No. 24-____

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

In re UNITED STATES OF AMERICA, et al.

UNITED STATES OF AMERICA, et al.,
Petitioners,

v.

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF OREGON,
Respondent,

and

KELSEY CASCADIA ROSE JULIANA, et al.
Real Parties in Interest.

On Petition for a Writ of Mandamus to the United States District Court
for the District of Oregon (No. 6:15-cv-1517)

PETITION FOR A WRIT OF MANDAMUS AND OPPOSED MOTION FOR A STAY OF PROCEEDINGS

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INTRODUCTION

The climate crisis is an urgent problem, and the Executive Branch is taking a wide range of steps to address it, across many agencies and in many different forms. *See generally* Exec. Order 14,008, *Tackling the Climate Crisis at Home and Abroad*, 86 Fed. Reg. 7619 (Jan. 27, 2021).[1] In this long-running case, however, Plaintiffs—a group of young people and a putative representative of future generations—seek sweeping relief from the Judicial Branch, not the political Branches, that would install the district court in a supervisory role over the federal government's response to climate change in its entirety. In a prior appeal, this Court held that Plaintiffs lack standing to sue because the unprecedented remedies they seek are beyond the judiciary's power. *Juliana v. United States*, 947 F.3d 1159, 1170-73 (9th Cir. 2020). Plaintiffs may challenge discrete government actions (or inaction), but their demand for changes to the government's overall response to climate change "must be made to the political branches or to the electorate at large" rather than in district court. *Id.* at 1175.

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[1] *See also, e.g.*, Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818; Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2021); *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*, 88 Fed. Reg. 1196 (Jan. 9, 2023); *Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review*, 86 Fed. Reg. 63110 (Nov. 15, 2021).

The Court thus concluded that the federal judiciary lacks jurisdiction over Plaintiffs' claims and directed the closure of the case by "remand[ing] this case to the district court with instructions to dismiss for lack of Article III standing." *Id.* Three years later, the district court decided that the case was not yet over and permitted Plaintiffs to file an amended complaint that purports to create Article III jurisdiction on the same flawed theory this Court rejected. The district court then largely denied the government's motion to dismiss the amended complaint. And although the court previously certified an immediate appeal from its denial of dispositive motions—leading to this Court's earlier mandate to dismiss—the district court refused to certify either its order permitting amendment or its order on the motion to dismiss, without explanation. The case is now headed to trial.

The Court should issue a writ of mandamus directing the district court to dismiss this case for lack of jurisdiction without leave to amend. The district court refused to recognize the limits of Article III jurisdiction and evaded the Court's mandate of dismissal. Indeed, citing this Court's decision, the district court acknowledged that "[s]ome may balk at [its] approach as errant or unmeasured." ECF No. 565 at 7 (attached as Exhibit 1) (citing *Juliana*, 947 F.3d at 1174). But this Court did not just "balk" at the district court's approach: the Court issued a mandate directing the district court to dismiss the case and an opinion holding that the district court lacked jurisdiction to manage the federal government's overall

response to the complex and multifaceted issue of climate change. The district court reasoned that the Court's decision did not foreclose an "innovative" experiment in declaratory relief of the district court's devising. But this Court held that the district court lacks Article III jurisdiction to award even declaratory relief as a remedy for Plaintiffs' claims, and the district court's attempted innovation was simply the application of a different label to the injunctive relief this Court already foreclosed.

The Court should hold that the district court violated the rule of mandate by granting leave to file the amended complaint. In the alternative, the Court should order the district court to dismiss the case without leave to amend either for lack of Article III standing or for failure to state claims for relief. The Court should also issue an administrative stay and then order a stay of proceedings pending this Court's consideration of this petition. Plaintiffs oppose a stay and mandamus.

STATEMENT OF JURISDICTION

This Court has authority to issue a writ of mandamus pursuant to 28 U.S.C. § 1651 and Rule 21 of the Federal Rules of Appellate Procedure.

STATEMENT OF THE ISSUES

1. Whether this Court should exercise its authority under the All Writs Act, 28 U.S.C. § 1651, to enforce its mandate and order the district court to dismiss this

action without leave to amend for lack of jurisdiction or, in the alternative, for failure to state a claim upon which relief can be granted.

2. Whether this Court should issue a stay of proceedings in district court pending resolution of this petition.

STATEMENT OF THE CASE

Plaintiffs brought this action more than eight years ago against President Obama and various components of the Executive Branch for allegedly violating their claimed constitutional right to a livable climate, which they asserted arises from the Fifth and Ninth Amendments of the Constitution, and a putative public-trust doctrine. *See generally* ECF Nos. 1, 7. In the years that followed, the parties vigorously contested these claims, resulting in more than 500 docket entries in district court and multiple mandamus and other actions in this Court and the Supreme Court. This Court directed that the litigation end in 2020, but the district court revived the case and said it will hold a trial.

1. Plaintiffs sued in August 2015 and filed a first amended complaint the following month. ECF Nos. 1, 7. That complaint asserted four claims for relief, alleging that the government's response to climate change violated Plaintiffs' Fifth Amendment rights to due process and equal protection, their unenumerated Ninth Amendment rights, and a putative federal public-trust doctrine. ECF No. 7 ¶¶ 277-310. Plaintiffs sought broad equitable relief, including asking the district court to

order the President and various components of the Executive Branch to "prepare and implement an enforceable national remedial plan to phase out fossil fuel emissions and draw down excess atmospheric CO_2." *Id.* at 94. The government responded with a motion to dismiss in November 2015, principally arguing that Plaintiffs lacked Article III standing and that they failed to state claims for relief. ECF No. 27.

The district court denied the government's motion to dismiss in November 2016. ECF No. 83. The court concluded that Plaintiffs adequately established Article III standing by alleging injuries from climate change and that the government's regulation of fossil fuels had contributed to those injuries. *Id.* at 25-26. The court reasoned that these injuries were judicially redressable because the court could order declaratory and injunctive relief requiring the government to cease "permitting, authorizing, and subsidizing fossil fuels," "move to swiftly phase out CO_2 emissions," "develop a national plan to restore Earth's energy balance, and implement that national plan so as to stabilize the climate system." *Id.* at 26-28 (quoting ECF No. 7 ¶ 12).

On the merits, the district court held that Plaintiffs had stated a claim that the government violated Plaintiffs' substantive due process right to a "climate system capable of sustaining life." *Id.* at 28-36. The court further held that Plaintiffs had stated a claim under a public-trust doctrine that, according to the court, imposes a

prohibition on "depriving a future legislature of the natural resources necessary to provide for the well-being and survival of its citizens." *Id.* at 102 (quoting amicus brief in support of Plaintiffs). Plaintiffs' claims under this public-trust rationale, the court concluded, are also "properly categorized as substantive due process claims." *Id.* at 116.

The district court declined to certify for interlocutory appeal under 28 U.S.C. § 1292(b) the order denying the motion to dismiss. ECF No. 172 at 4.

2. In June 2017, the government petitioned this Court for a writ of mandamus directing the district court to grant the government's motion to dismiss. The Court denied the petition without prejudice, underscoring the "very early stage" of the litigation. *In re United States*, 884 F.3d 830, 837-38 (9th Cir. 2018). The Court explained, however, that "[c]laims and remedies often are vastly narrowed as litigation proceeds," and that the Court had "no reason to assume this case will be any different." *Id*. The Court observed that the government could continue to "raise and litigate [its] legal objections" and "seek[] mandamus in the future." *Id*.

In May 2018, the government filed new dispositive motions in district court. It moved for judgment on the pleadings, arguing that Plaintiffs' claims should be dismissed in their entirety. ECF No. 195. That same day, the government filed for a protective order barring all discovery or, at a minimum, a stay of all discovery

pending resolution of its motion for judgment on the pleadings and its forthcoming motion for summary judgment. ECF No. 196. The government then moved for summary judgment, arguing that Plaintiffs lacked standing; failed to comply with the Administrative Procedure Act ("APA"), 5 U.S.C. § 702; and failed to state claims as a matter of law. ECF No. 207.

Meanwhile, Plaintiffs and the district court proceeded toward trial. Plaintiffs served extensive discovery, and the magistrate judge issued (and the district court summarily affirmed) an order denying a protective order or stay. ECF No. 212, 300. The district court expressed its intent to proceed with trial expeditiously. ECF No. 243 at 16:2-4 (Aiken, J.) ("[A]s we have talked about in this case before, we are not delaying trial at this point. We are moving forward."). The court indicated its expectation that the trial would last for approximately ten weeks. ECF No. 191 at 7:22-8:7 (Coffin, M.J.) (estimating "five weeks per side in essence").

In July 2018, with trial approaching and the government's dispositive motions still pending, the government petitioned this Court and, later, the Supreme Court for orders directing dismissal of the case or, in the alternative, a stay. Both courts denied the requested relief without prejudice as premature. *United States v. U.S. Dist. Ct.*, 139 S. Ct. 1 (2018) (mem.); *In re United States*, 895 F.3d 1101, 1105 (9th Cir. 2018). But the Supreme Court observed that the "breadth of [Plaintiffs'] claims" was "striking" and that "the justiciability of those claims

present[ed] substantial grounds for difference of opinion." 139 S. Ct. at 1. The Supreme Court indicated that the district court should "take these concerns into account in assessing the burdens of discovery and trial, as well as the desirability of a prompt ruling on the Government's pending dispositive motions." *Id.*

3. By the middle of October 2018, with trial only two weeks away, the district court had not yet resolved the government's dispositive motions. *See* ECF No. 352. Having exhausted all avenues for obtaining relief in district court, the government once again petitioned this Court for a writ of mandamus on October 12, 2018. *See In re United States*, No. 18-72776 (9th Cir.).

Three days later, on October 15, 2018, the district court issued an opinion largely denying the government's dispositive motions. ECF No. 369 at 1-62. The district court dismissed the President from the action "without prejudice," leaving open the possibility that the President could be joined later as needed, and granted summary judgment to the government on Plaintiffs' Ninth Amendment claim. *Id.* at 18, 56. The court otherwise denied the dispositive motions. It rejected the government's argument that Plaintiffs had to assert their claims under the APA and that Plaintiffs had failed to establish standing at the summary-judgment stage. *Id.* at 25, 29-45. The court reiterated its earlier holdings on the government's merits arguments. *Id.* at 25-29, 45-49. Addressing Plaintiffs' equal-protection claim for the first time, the court permitted the claim to proceed for "further development of

the factual record." *Id.* at 58-59. The court once again declined to certify its order for interlocutory appeal. *Id.* at 59-61.

The government again sought emergency relief from both this Court and the Supreme Court. The Supreme Court denied the government's stay application without prejudice because "adequate relief may be available in the United States Court of Appeals for the Ninth Circuit." *In re United States*, 139 S. Ct. 452, 453 (2018) (mem.). The Supreme Court highlighted its earlier observations about the breadth of Plaintiffs' claims, recounted the standard for interlocutory appeal, and noted that this Court's earlier denials of mandamus were premised on reasons that were largely "no longer pertinent." *Id.* This Court, in turn, issued an order in one of the mandamus proceedings that "invited the district court to revisit certification, noting the Supreme Court's justiciability concerns." *Juliana*, 947 F.3d at 1166.

The district court then certified its orders denying the government's dispositive motions, ECF No. 444 at 1-6, and stayed the proceedings, ECF No. 445, 453. The government then petitioned this Court for permission to appeal, and the Court accepted the appeal in December 2018. *Juliana v. United States*, 949 F.3d 1125, 1126 (9th Cir. 2018) (mem.).

4. In January 2020, this Court issued a published decision holding that Plaintiffs lacked Article III standing, reversing the certified orders, and remanding

to the district court with express instructions to dismiss. *Juliana*, 947 F.3d at 1175 (attached as Exhibit 4).

Beginning with Plaintiffs' request for a "declaration that the government is violating the Constitution," the Court concluded that "that relief alone is not substantially likely to mitigate [Plaintiffs'] asserted concrete injuries." *Id.* at 1170. The Court thus held that Plaintiffs' request for declaratory relief failed for lack of redressability, as the Court had just explained: "To establish Article III redressability, [Plaintiffs] must show that the relief they seek is . . . substantially likely to redress their injuries." *Id.*

Plaintiffs also requested an injunction requiring the government "to cease permitting, authorizing, and subsidizing fossil fuel use" and "to prepare a plan subject to judicial approval to draw down harmful emissions." *Id.* The Court was "skeptical" that the injunction Plaintiffs sought was substantially likely to address their injuries because, according to Plaintiffs' own experts, an injunction would not "suffice to stop catastrophic climate change or even ameliorate their injuries." *Id.* Setting aside these concerns, the Court ultimately held that Plaintiffs lacked standing because they could not "establish[] that the specific relief they seek is within the power of an Article III court." *Id.* at 1171. Plaintiffs sought "the adoption of a comprehensive scheme to decrease fossil fuel emissions and combat climate change," but it was "beyond the power of an Article III court to order,

design, supervise, or implement the [P]laintiffs' requested remedial plan." *Id.* Plaintiffs' own experts "ma[d]e plain" that "any effective plan would necessarily require a host of complex policy decisions entrusted, for better or worse, to the wisdom and discretion of the executive and legislative branches." *Id.* As the Court explained, "some questions—even those existential in nature—are the province of the political branches." *Id.* at 1173.

Because Plaintiffs could not establish redressability, the Court reversed and remanded to the district court "with instructions to dismiss for lack of Article III standing." *Id.* at 1175. Judge Staton dissented. *Id.* at 1175-91 (Staton, J., dissenting).

The Court denied Plaintiffs' petition for rehearing en banc in February 2021. *Juliana v. United States*, 986 F.3d 1295 (9th Cir. 2021) (mem.). Plaintiffs moved to stay the mandate pending a petition for a writ of certiorari in the Supreme Court but ultimately they did not file a petition and withdrew the motion to stay the mandate. The Court issued its mandate in March 2021 and remanded the case to the district court for dismissal. Ct. App. No. 18-36082, ECF No. 204 ("The judgment of this Court, entered January 17, 2020, takes effect this date.").

5. Back in district court, Plaintiffs asked permission to start the litigation over again from the beginning. Four days after this Court issued its mandate, which effectuated the Court's judgment "remand[ing] this case to the district court with

instructions to dismiss for lack of Article III standing," 947 F.3d at 1175, Plaintiffs filed a motion seeking leave to amend their complaint for a second time. ECF No. 462. Plaintiffs did not seek to "updat[e] facts," "add[] new claims for relief," or "challeng[e] conduct" of different defendants; rather, Plaintiffs sought to amend their allegations with respect to remedies in order to "cure any deficiency regarding Article III standing." *Id.* at 2, 9. Plaintiffs argued that adjustments to the first amended complaint would place their new pleading outside the scope of this Court's mandate. *Id.* at 13-19; *see also* ECF No. 462-3 at 2-5, 13-14 (summarizing amendments). The government opposed, explaining that granting leave to amend would violate this Court's mandate and that Plaintiffs' proposed amendment would be futile. ECF No. 468 at 7-17.

Two years passed without further action from the district court on Plaintiffs' motion for leave to amend. During that time, the government took significant steps to address climate change—through presidential actions, legislation, and regulatory policies implemented by agencies across the government (*see, e.g.*, p. 1 & n.1)—beyond the record of actions taken when Plaintiffs filed this suit in 2015 and when the district court set this case for trial in 2018.

In June 2023, the district court granted Plaintiffs leave to file a second amended complaint. ECF No. 540 (attached as Exhibit 3). The district court concluded that this Court's mandate did not preclude amendment and that

Plaintiffs' amended complaint cured any Article III defect. Plaintiffs then filed a second amended complaint reiterating their claims and requests for declaratory and injunctive relief. ECF No. 542 (attached as Exhibit 2). Plaintiffs moved the district court to set a pretrial conference, requesting "a scheduling order setting trial in this matter to commence on an expedited basis, no later than Spring 2024." ECF No. 543 at 3. The government moved to dismiss the second amended complaint, to stay the litigation, and to certify both the order granting leave to amend and any order denying the motion to dismiss for interlocutory appeal. ECF Nos. 547, 551, 552. In December 2023, while these motions were pending, Plaintiffs served requests for admission on the Environmental Protection Agency (EPA).

6. On December 29, 2023, the district court largely denied the government's motion to dismiss and denied the government's requests for a stay and for certification. Exhibit 1 at 2, 48-49.

The district court first rejected the government's argument that this Court's mandate required dismissal. *Id.* at 18-21. Turning to standing, the district court favorably considered Plaintiffs' request for an injunction and explained why injunctive relief could suffice to support Article III jurisdiction. *Id.* at 23-28. But the district court observed that the injunction Plaintiffs seek in their second amended complaint "still treads on ground" over which this Court "cautioned" the district court "not to step." *Id.* at 28. Although not outright concluding that this

Court's decision barred injunctive relief, the district court held that an injunction seeking to "prod a negotiated change of behavior" was not "necessary" or "perhaps premature" at "this point in the case." *Id.* The court thus purported to dismiss the complaint insofar as it seeks injunctive relief. *Id.* at 28, 49.

In contrast, the district court held that Plaintiffs had adequately alleged Article III standing to pursue a declaratory judgment. *Id.* at 28-34. The district court concluded that declaring a violation of Plaintiffs' constitutional rights and of the public-trust doctrine "may be enough to bring about relief by changed conduct." *Id.* at 31. A declaratory judgment, the court explained, would emerge from a bifurcated trial, split into a liability phase and a remedy phase. *Id.* at 33. During the liability phase, the court would hear evidence on the government's alleged violations and then "specify legal obligations." *Id.* During the remedy phase, the court would supervise the government's adoption of policies that would satisfy these "legal obligations" and keep the case "under [the court's] ongoing jurisdiction so that the parties can challenge aspects of the remedy implementation." *Id.* The court invoked special masters as one "model of supervision" and favorably discussed consent decrees as a solution to what it termed "long-lasting government violations." *Id.*

The court then addressed the merits of Plaintiffs' four claims. The court first held that Plaintiffs stated a cognizable substantive due-process claim under the

Fifth Amendment by asserting a supposed fundamental right to a climate system that can sustain human life, subject to strict scrutiny. *Id.* at 40-41. The government argued that Plaintiffs' due process claim improperly challenged alleged government inaction (i.e., failing to prevent harm from third parties), but the court held that an exception to this general rule applied because Plaintiffs alleged that the government knowingly helped create the harms of climate change. *Id.* at 44. The court also concluded that Plaintiffs stated a cognizable claim that the government violated its duty to protect a life-sustaining climate system as a public trust, rejecting the argument that public-trust claims are creatures of state law and may not be asserted against the federal government. *Id.* at 46-48.

The district court dismissed Plaintiffs' two remaining claims that the government had violated the Ninth Amendment and the equal-protection clause. *Id.* at 44-46. Lastly, the district court denied without explanation the government's request to certify for interlocutory review its order denying the motion to dismiss and its prior order granting leave to amend. *Id.* at 48-49. The court also denied the government's motion to stay the litigation and granted plaintiffs' request for a pretrial conference. *Id.* at 49. The government then moved for a stay pending the filing of this petition. ECF No. 571.

The court held a status conference on January 19, 2024, to discuss next steps in the litigation, including "setting a trial date." Exhibit 5 at 3:24. Plaintiffs

asserted that the "heart of the case is the same," notwithstanding "some new allegations in the complaint." *Id.* at 13:16-18. On the other hand, Plaintiffs contended that "a lot of updating needs to be done" through additional discovery and proposed that the parties supplement their expert reports by April 30. *Id.* at 8:18-20, 13:23. Plaintiffs also requested that the Court set trial for December 2. *Id.* at 5:8-10. Plaintiffs anticipated that presentation of their affirmative case would require approximately 20 days, which would require four weeks without accounting for the government's case. *Id.* at 9:7-11. The district court deferred issuing a scheduling order until after the government files an answer to the second amended complaint, which is due on February 27, 2024. ECF No. 573.

STANDARD OF REVIEW

"[A] writ of mandamus is an extraordinary remedy, to be reserved for extraordinary situations." *Gulfstream Aerospace Corp. v. Mayacamas Corp.*, 485 U.S. 271, 289 (1988). Mandamus is traditionally used "to confine the court against which mandamus is sought to a lawful exercise of its prescribed jurisdiction." *Cheney v. U.S. Dist. Ct.*, 542 U.S. 367, 381 (2004) (brackets and internal quotation marks omitted). Mandamus relief may appropriately be granted to correct not only errors fitting the "technical definition of jurisdiction," but also errors that "amount to a judicial usurpation of power" or a "clear abuse of discretion." *Id.* For example,

mandamus has been used "to restrain a lower court when its actions would threaten the separation of powers." *Id.*

This Court generally considers a petition for a writ of mandamus by applying five "*Bauman* factors": (1) whether the petitioner has another "adequate way to obtain the relief sought," (2) whether the petitioner "will suffer damage or prejudice that cannot be corrected on appeal," (3) whether "the district court clearly erred as a matter of law," (4) whether the error "is often repeated or shows the district court's persistent disregard for the federal rules," and (5) whether "there are new and important issues at stake." *In re U.S. Dep't of Educ.*, 25 F.4th 692, 697-98 (9th Cir. 2022) (citing *Bauman v. U.S. Dist. Ct.*, 557 F.2d 650, 654-55 (9th Cir. 1977)).[2] Not every *Bauman* factor is relevant in every case, and the writ may issue even if some of the factors point in different directions. *Christensen v. U.S. Dist. Ct.*, 844 F.2d 694, 697 (9th Cir. 1988). But "satisfaction of the third factor, that the district court made a clear error of law, is almost always a necessary predicate for the granting of the writ." *In re U.S. Dep't of Educ.*, 25 F.4th at 698.

[2] The Supreme Court has identified "three conditions [that] must be satisfied" before a court may issue the writ: (1) the petitioner must have "no other adequate means to attain the [desired] relief," (2) the petitioner's right to relief must be "clear and indisputable," and (3) the court must be satisfied that mandamus relief is "appropriate under the circumstances." *Cheney*, 542 U.S. at 380-81. These requirements overlap substantially with this Court's *Bauman* factors and are satisfied here for the same reasons.

When "a lower court obstructs the mandate of an appellate court, mandamus is the appropriate remedy." *Vizcaino v. U.S. Dist. Ct.*, 173 F.3d 713, 719 (9th Cir. 1999). Thus, "*Bauman* does not apply when mandamus is sought on the ground that the district court failed to follow the appellate court's mandate." *Id.*; *see also Pit River Tribe v. U.S. Forest Serv.*, 615 F.3d 1069, 1079 (9th Cir. 2010).

REASONS FOR GRANTING THE WRIT

I. The Court should order the district court to dismiss this case.

A writ of mandamus directing the district court to dismiss this case without leave to amend is the only adequate means for the government to obtain relief from the district court's clear and repeated failures to acknowledge its jurisdictional limits and this Court's express instruction. An extraordinary remedy is necessary to address the district court's extraordinary decisions.[3]

A. The district court violated this Court's mandate.

1. The mandate required dismissal.

This Court expressly ordered the district court to dismiss this case: "[W]e reverse the certified orders of the district court and remand with instructions to dismiss for lack of Article III standing." *Juliana*, 947 F.3d at 1175. The district

[3] In the alternative, the Court should issue a writ directing the district court to certify its orders granting leave to amend and denying dismissal for interlocutory appeal under 28 U.S.C. § 1292(b). The Court may also "invite[] the district court to revisit certification." *Juliana*, 947 F.3d at 1166.

court thus violated the mandate rule by permitting Plaintiffs to proceed on the second amended complaint after this Court held that the federal courts lack Article III jurisdiction in this matter.

"The rule of mandate requires a lower court to act on the mandate of an appellate court, without variance or examination, only execution." *United States v. Garcia-Beltran*, 443 F.3d 1126, 1130 (9th Cir. 2006); *see also In re Sanford Fork & Tool Co.*, 160 U.S. 247, 255 (1895) (lower court "cannot vary [the mandate] or examine it for any other purpose than execution"); *Rogers v. Consol. Rock Prods. Co.*, 114 F.2d 108, 111 (9th Cir. 1940) ("After a decision by this court, the only step that the District Court could take was to obey the mandate of this tribunal." (internal quotation marks omitted)). The district court is "unquestionably obligated" to execute the terms of the mandate. *S.F. Herring Ass'n v. Dep't of the Interior*, 946 F.3d 564, 574 (9th Cir. 2019). The mandate is thus "controlling as to all matters within its compass." *Firth v. United States*, 554 F.2d 990, 993 (9th Cir. 1977).

The rule of mandate is "similar to, but broader than, the law of the case doctrine." *United States v. Cote*, 51 F.3d 178, 181 (9th Cir. 1995). Although "both doctrines serve an interest in consistency, finality, and efficiency, the mandate rule also serves an interest in preserving the hierarchical structure of the court system." *United States v. Thrasher*, 483 F.3d 977, 982 (9th Cir. 2007). Where "the scope of

the remand is clear," the district court's power is "limited" by the scope of the Court's remand. *Hall v. City of Los Angeles*, 697 F.3d 1059, 1067 (9th Cir. 2012). The mandate rule thus "constitutes a basic feature of the rule of law in an appellate scheme," *S.F. Herring Ass'n*, 946 F.3d at 574, and "[v]iolation of the rule of mandate is a jurisdictional error," *Hall*, 697 F.3d at 1067.

Here, this Court instructed the district court "to dismiss for lack of Article III standing" after concluding that redressing Plaintiffs' asserted injuries is "beyond [the Court's] constitutional power." *Juliana*, 947 F.3d at 1165, 1175. The district court's task on remand was clear: dismiss the case. The Court did not contemplate further proceedings in its decision. The Court did not leave room for the district court to parse its holding or further examine questions of Article III standing. Notably, the Court did not remand for "proceedings consistent with this opinion," the customary formulation in cases where the district court is not barred from taking steps beyond execution of the mandate. *See, e.g.*, *Brown v. Duringer Law Grp. PLC*, 86 F.4th 1251, 1255 (9th Cir. 2023); *Hall v. Smosh Dot Com, Inc.*, 72 F.4th 983, 991 (9th Cir. 2023); *All. for Wild Rockies v. Petrick*, 68 F.4th 475, 498 (9th Cir. 2023). The Court left no room for the district court to perpetuate this suit; the Court simply ordered dismissal.

The precise scope of the Court's mandate follows from the conclusive nature of the Court's decision. In the then-operative complaint, Plaintiffs sought a

declaration that the government violated their constitutional rights and the public-trust doctrine and that the Energy Policy Act is unconstitutional. ECF No. 7 at 94. They also sought an injunction ordering the government to "prepare and implement an enforceable national remedial plan to phase out fossil fuel emissions and draw down excess atmospheric CO_2 so as to stabilize the climate system and protect the vital resources on which Plaintiffs now and in the future will depend." *Id.* The Court considered Plaintiffs' claims and these requests for relief in full, including "remedial declaratory *and* injunctive relief." *Juliana*, 947 F.3d at 1159 (emphasis added). And the Court concluded that "it is beyond the power of an Article III court to order, design, supervise, or implement" Plaintiffs' remedial plan for the "adoption of a comprehensive scheme to decrease fossil fuel emissions and combat climate change." *Id.* at 1171-72. The relief Plaintiffs seek for their sweeping claims is therefore not "within the power of an Article III court." *Id.* at 1171. Any remedy that would "require the judiciary to pass judgment on the sufficiency of the government's response" to a court order on Plaintiffs' claims "necessarily would entail a broad range of policymaking" that is the province of the political Branches. *Id.* Federal courts simply lack the power to "supervise[] or enforce[]" a declaratory or injunctive remedy addressing Plaintiffs' claims. *Id.* No further proceedings in district court could alter these fundamental limits of Article III jurisdiction.

Because this Court conclusively resolved the jurisdictional issue, the district court's only task was to execute the mandate. But rather than dismissing the case, the district court permitted Plaintiffs to file an amended complaint that was nearly identical to the complaint this Court already considered. Plaintiffs did not "updat[e] facts," "add[] new claims for relief," or "challeng[e] conduct" of different defendants. ECF 462 at 2, 9. Instead, they reformulated their request to seek materially indistinguishable relief: a declaration that the United States' national energy system violated their constitutional rights and the public trust doctrine and that the Energy Policy Act is unconstitutional; and an "appropriate injunction restraining [the government] from carrying out policies, practices, and affirmative actions that render the national energy system unconstitutional in a manner that harms Plaintiffs." Exhibit 2 at 143. As Plaintiffs explained in their motion for leave to amend, the sole intent of their new pleading was to provide the district court with a basis for finding Article III standing and "finally move to a full evidentiary proceeding in the liability phase." ECF No. 462 at 2.

Plaintiffs argued that the second amended complaint would "amend[] their allegations to demonstrate that declaratory judgment alone would be substantially likely to provide partial redress," ECF No. 462 at 9, but this Court squarely held—in clear, unambiguous language—that a declaratory judgment cannot provide redress. Plaintiffs' motion for leave to amend (and the second amended complaint

they proposed) exclusively raised issues within the "compass" of this Court's mandate, *Firth*, 554 F.2d at 993, because a declaration "is unlikely by itself to remediate their alleged injuries absent further court action," *Juliana*, 947 F.3d at 1170.

The Court should issue a writ of mandamus to correct the district court's error. *See Vizcaino*, 173 F.3d at 719. Permitting the district court's apparent "disregard of appellate mandates would severely jeopardize the supervisory role of the courts of appeals within the federal judicial system." *Id.* (internal quotation marks omitted). And "litigants who have proceeded to judgment in higher courts"—like the government here—"should not be required to go through that entire process again to obtain execution of the judgment." *Id.* (internal quotation marks omitted).

2. The mandate foreclosed amendment.

The district court offered two principal reasons for disregarding this Court's mandate and permitting Plaintiffs to proceed on the second amended complaint. *See* Exhibit 1 at 18-21; Exhibit 3 at 9-11. First, the district court reasoned that the Court's mandate did not expressly preclude amendment as a formal matter. Second, the district court concluded that Plaintiffs' amendment included allegations related to "intervening recent precedent" that this Court had not considered. Exhibit 1 at 20. The district court clearly erred on both fronts.

a. The district court correctly noted that the rule of mandate "leaves to the district court any issue not expressly or impliedly disposed of on appeal," *Firth*, 554 F.2d at 993, and that a district court may permit additional pleadings on remand absent a mandate to the contrary, *see S.F. Herring Ass'n*, 946 F.3d at 574. But the district court clearly erred in concluding that this Court's mandate permitted further amendment, where this Court held that the relief Plaintiffs seek is beyond the judicial power. The district court reasoned that the Court's mandate did not "expressly state that plaintiffs could not amend to replead their case," Exhibit 3 at 11, but even if instructing "dismiss[al] for lack of Article III standing" was not clear enough, determining the scope of the mandate is not a formalist exercise requiring specific words to be uttered. The district court must "distinguish matters that have been decided on appeal . . . from matters that have not." *United States v. Kellington*, 217 F.3d 1084, 1093 (9th Cir. 2000).

Indeed, what matters when applying the rule of mandate is the "spirit of the mandate, taking into account the appellate court's opinion and the circumstances it embraces." *Creech v. Tewalt*, 84 F.4th 777, 787 (9th Cir. 2023) (internal quotation marks omitted); *see also, e.g.*, *Quern v. Jordan*, 440 U.S. 332, 347 n.18 (1979) (examining whether post-mandate conduct of lower court was consistent "with either the spirit or the express terms of [the Court's] decision"); *United States v. Paul*, 561 F.3d 970, 973 (9th Cir. 2009) (concluding a district court violated "both

the spirit and express instructions of [the Court's] mandate"); *Kellington*, 217 F.3d at 1092-93 (explaining that a district court may deviate from the mandate only if doing so is "not counter to the spirit of the circuit court's decision").

Here, as explained above (pp. 20-22), this Court conclusively decided the question of Article III redressability on appeal and did not countenance further proceedings on remand. The "spirit of the mandate" thus did not permit Plaintiffs' filing of the second amended complaint. The district court appeared to recognize that the mandate foreclosed Plaintiffs' attempt to reform their request for injunctive relief, explaining that the injunction described in the second amended complaint "still treads on ground" over which this Court "cautioned" the district court "not to step." Exhibit 1 at 28. Yet the district court held that Plaintiffs' efforts to rehabilitate their request for declaratory relief fell beyond the scope of the mandate because those issues were "not decided by [this Court] in the interlocutory appeal." Exhibit 3 at 11; *see also id.* at 12-13 (asserting that the Court "did not decide whether Plaintiffs' requested declaratory relief failed or satisfied the redressability requirement for standing").

The district court flatly mischaracterized this Court's opinion, which expressly considered Plaintiffs' request for declaratory relief in holding that the federal courts lack the power to redress Plaintiffs' injuries. *Juliana*, 947 F.3d at 1170. "To establish Article III redressability," the Court explained, Plaintiffs "must

show that the relief they seek" is "substantially likely to redress their injuries." *Id.* But Plaintiffs' requested "declaration that the government is violating the Constitution . . . alone is not substantially likely to mitigate [Plaintiffs'] asserted concrete injuries." *Id.* This Court was clear that Plaintiffs' requested declaratory judgment is not sufficient to establish standing.

The second amended complaint seeks declaratory relief indistinguishable from the declaratory relief sought in the first amended complaint. *Compare* ECF No. 7 at 94 (Prayer for Relief ¶¶ 1, 3, 5) (seeking a declaration that the government has violated Plaintiffs' constitutional rights (¶ 1) and the public-trust doctrine (¶ 5), and that the Energy Policy Act is unconstitutional (¶ 3)), *with* Exhibit 2 at 143 (Prayer for Relief ¶¶ 1, 2, 3) (same). The district court cited purportedly new "factual allegations directly linking how a declaratory judgment alone will redress plaintiffs' individual ongoing injuries," Exhibit 3 at 13, but the cited allegations about redressability are conclusory assertions that "a declaratory judgment to resolve this actual constitutional case and controversy" will "significantly increase the likelihood that [Plaintiffs] would obtain relief to safeguard [their] life, liberty, property, and equal protection of the law" because the government "will correct the unconstitutional policies and practices of the national energy system" and the "worsening of [Plaintiffs'] injuries at the hands of [the] government will end." Exhibit 2 ¶ 19-A.c; *see also id.* ¶¶ 22-A.c, 30-A.c, 34-A.c, 39-A.c, 43-A.c, 46-A.c,

49-A.c, 52-A.c, 56-A.c, 59-A.c, 62-A.c, 64-A.c, 67-A.c, 70-A.c, 72-A.c, 76-A.c, 80-A.c, 85-A.c, 88-A.c, 90-A.c (all same). There is no reasonable argument that the Court would have reached a different decision if the earlier complaint had recited these conclusory allegations, as the Court's analysis was based on the nature of the relief sought rather than a parsing of the complaint. The mandate thus controls.

Beyond these new allegations, the district court purported to differentiate the declaratory relief sought in Plaintiffs' second amended complaint by laying out how it would perform an "innovative judicial role" during the remedy phase of the trial. Exhibit 1 at 33. As explained further below (pp. 35-37), the district court's "declaratory judgment" would involve ongoing judicial oversight of the government's creation and implementation of a plan to address climate change. But this Court already held that those exact same functions—when previously presented under the label of an injunctive remedy—fall outside the judicial power. *Juliana*, 947 F.3d at 1170. Accordingly, the district court's plan does not establish redressability for the same reasons explained in this Court's earlier decision. But for purposes of the mandate rule, the most salient problem is that the justiciability of Plaintiffs' renewed request for declaratory relief falls within the "compass" of this Court's mandate. *Firth*, 554 F.2d at 993. This Court is not required to expressly prohibit district courts from revisiting issues that fall within the spirit of

its mandate, and this Court already held that a request for declaratory relief cannot establish that Plaintiffs' claims are redressable. That holding did not rest on how Plaintiffs worded their allegations.

b. The district court also cited a purported intervening change in the law affecting Article III standing to seek declaratory relief. Although there are exceptions to the mandate rule for "an intervening change in controlling authority," *In re Molasky*, 843 F.3d 1179, 1184 n.5 (9th Cir. 2016), there has been no intervening change in the law of standing to seek declaratory relief.

The district court rested its assertion of intervening authority primarily on the Supreme Court's decision in *Uzuegbunam v. Preczewski*, 141 S. Ct. 792 (2021), which the district court characterized as "recent authority affirming that partial declaratory relief satisfies redressability for purposes of Article III standing." Exhibit 3 at 14. That characterization is incorrect. *Uzuegbunam*, a case about nominal damages, has nothing to say about this Court's analysis of judicial power in *Juliana*, and the holding of *Uzuegbunam* does not address declaratory judgments or equitable relief generally. In *Uzuegbunam*, the Supreme Court addressed whether nominal damages would provide First Amendment plaintiffs redress for wholly past injuries. 141 S. Ct. at 800-01. In its discussion of nominal damages, the Supreme Court referenced their "declaratory function." *Id.* at 798. But *Uzuegbunam* remained a damages case, and the Supreme Court did not purport

to work any change in the law with respect to declaratory judgments, much less abrogate this Court's decision in *Juliana*. *Id.* at 797-800.

* * *

At bottom, this Court ordered dismissal because Plaintiffs' claims are not redressable, and Plaintiffs' second amended complaint falls within the scope of that order. This Court's binding decision in this case is more than a minor obstacle that Plaintiffs can bypass with a few added lines in their complaint asserting that declaratory relief will afford redress. Because the district court violated the mandate and refused to certify an immediate appeal, a writ of mandamus is the only means to ensure that the district court complies with this Court's holding that Plaintiffs' claims are beyond the judicial power to redress.

3. This Court may recall and modify its mandate.

This Court may also properly construe this petition for a writ of mandamus as a motion to recall and modify the mandate in the earlier appeal. A writ of mandamus is the typical means for a court of appeals to "compel an inferior court to follow an appellate mandate." *Vizcaino*, 173 F.3d at 719. But the courts of appeals also "are recognized to have an inherent power to recall their mandates." *Calderon v. Thompson*, 523 U.S. 538, 549 (1998). This power "is one of last resort" to be exercised "only in extraordinary circumstances" and "held in reserve against grave, unforeseen contingencies." *Id.*; *see also, e.g.*, *United States v. King*,

419 F.3d 1035, 1035-36 (9th Cir. 2005) (order). Because the district court's disregard of this Court's jurisdictional ruling presents extraordinary circumstances, the Court may construe this petition for a writ of mandamus as a request to recall and modify the Court's mandate to make clear that this Court's decision foreclosed Plaintiffs' efforts to reopen this litigation with amended pleadings.

B. Plaintiffs lack Article III standing.

The writ of mandamus should issue for the additional reason that, beyond violating this Court's mandate, the district court's holding that Plaintiffs have Article III standing is irreconcilable with this Court's earlier decision and longstanding precedent from both this Court and the Supreme Court. To demonstrate standing, a plaintiff must show "(1) a concrete and particularized injury that (2) is caused by the challenged conduct and (3) is likely redressable by a favorable judicial decision." *Juliana*, 947 F.3d at 1168. In the previous appeal, this Court held that Plaintiffs failed to establish redressability because the request for declaratory relief was (1) "not substantially likely to mitigate the plaintiffs' asserted concrete injuries" and (2) the injunctive relief Plaintiffs sought was not otherwise "within the power of an Article III court." *Id.* at 1171.

The district court correctly recognized that this Court's decision was binding as to Plaintiffs' request for injunctive relief, noting that the injunction set forth in the second amended complaint "still treads on ground" covered by this Court's

decision. Exhibit 1 at 28. But the district court held that Plaintiffs' renewed request for declaratory relief cured the jurisdictional defects in the first amended complaint. Specifically, the second amended complaint seeks a declaration that the United States' national energy system and the Energy Policy Act violate Plaintiffs' due process rights to a stable climate system and that the national energy system violates an asserted public-trust doctrine. Exhibit 2 at 143. Setting aside that this declaration would not be meaningfully distinct from the declaration sought in the first amended complaint, as explained above (pp. 26-28), Plaintiffs' requested declaration cannot satisfy either prong of redressability. 947 F.3d at 1170-73.[4]

1. Under the binding precedent of this Court's earlier decision, a declaratory judgment alone is unlikely to meaningfully address the complex phenomenon of global climate change, much less redress Plaintiffs' alleged injuries, and the district court clearly erred in holding otherwise. As this Court put it: "a declaration that the government is violating the Constitution" is "not substantially likely to mitigate [Plaintiffs'] asserted concrete injuries." *Juliana*, 947 F.3d at 1170. A "declaration, although undoubtedly likely to benefit the plaintiffs psychologically, is unlikely by itself to remediate their alleged injuries absent further court action." *Id.*

[4] In the government's view, Plaintiffs also have not satisfied Article III's injury-in-fact and causation requirements. The government recognizes that this Court's earlier decision forecloses those contentions at this stage, *see Juliana*, 947 F.3d at 1168-69, but it preserves those arguments in the event of further review.

Where a plaintiff seeks relief under the Declaratory Judgment Act, 28 U.S.C. § 2201, redressability normally rests on the potential for the sort of "further court action" this Court described. *Juliana*, 947 F.3d at 1170. That is because an Article III dispute must "be real and substantial and admit of specific relief through a decree of a conclusive character, as distinguished from an opinion advising what the law would be upon a hypothetical state of facts." *MedImmune, Inc. v. Genentech, Inc.*, 549 U.S. 118, 126-27 (2007) (internal quotation marks omitted). Permitting courts to declare the lawfulness of government actions in the abstract "would threaten to grant unelected judges a general authority to conduct oversight of decisions of the elected branches of Government." *California v. Texas*, 141 S. Ct. 2104, 2116 (2021). "What saves proper declaratory judgments from a redressability problem . . . is that they have preclusive effect on a traditional lawsuit that is imminent." *Haaland v. Brackeen*, 599 U.S. 255, 293 (2023) (internal quotation omitted); *see, e.g.*, *San Diego Cnty. Credit Union v. Citizens Equity First Credit Union*, 65 F.4th 1012 (9th Cir. 2023) (use of declaratory judgment in subsequent trademark dispute).

Yet here, the declaration Plaintiffs seek would not have preclusive effect on any imminent lawsuit or in itself compel the government to take any action, nor could a declaration of rights serve as the basis for a future action for relief from any conduct declared unlawful, as both this Court and the district court already

have held that Plaintiffs may not obtain injunctive relief. *Juliana*, 947 F.3d at 1173; Exhibit 1 at 28; *see also M.S. v. Brown*, 902 F.3d 1076, 1083 (9th Cir. 2018) ("[T]here is no redressability if a federal court lacks the power to issue such relief."). Moreover, a declaratory judgment would be limited to the handful of Plaintiffs in this case. A declaratory judgment would have no preclusive or other effect with respect to the hundreds of millions of other people in the country. It thus is manifest, both under Article III and equitable principles that govern both declaratory and injunctive relief, that a court could not order the sort of sweeping government-wide relief calling for a restructuring of the Nation's energy system at the behest of a small group of litigants. *See* 5 U.S.C. § 702.

All that remains is a request for a declaration that the government is violating these particular Plaintiffs' rights in the abstract, unmoored from any particular action or dispute and not properly enforceable through the judicial process. *Cf. California*, 141 S. Ct. at 2116 ("[T]hat is the very kind of relief that cannot alone supply jurisdiction otherwise absent."). These circumstances distinguish this case from the authorities on which the district court relied. *See, e.g.*, *Uzuegbunam*, 141 S. Ct. at 802 (action for nominal damages for a particular First Amendment violation); *Utah v. Evans*, 536 U.S. 452, 463 (2002) (action seeking both injunctive and declaratory relief); *Franklin v. Massachusetts*, 505

U.S. 788, 803 (1992) (action seeking a declaration as to particular government action, directed at the responsible agency official).

The district court nonetheless concluded that Plaintiffs' requested declaration would satisfy Article III redressability because a "declaration that defendants are violating plaintiffs' constitutional rights may be enough to bring about relief by changed conduct." Exhibit 1 at 31. But this Court has already held that the possibility that relief in this case might "goad" the government to take additional action is insufficient to establish redressability. *Juliana*, 947 F.3d at 1175; *see Brackeen*, 599 U.S. at 294 ("'[R]edressability requires that the court be able to afford relief *through the exercise of its power*, not through the persuasive or even awe-inspiring effect of [its] opinion.' . . . Otherwise, redressability would be satisfied whenever a decision might persuade actors who are not before a court—contrary to Article III's strict prohibition on 'issuing advisory opinions.'" (citations omitted)). And that is especially so because, again, any declaratory judgment would be limited to the handful of Plaintiffs here. Indeed, this Court held that even an injunction against the government would be unlikely to afford Plaintiffs redress, given the nature and scope of climate change, *Juliana*, 947 F.3d at 1170-71, and in addition to Article III obstacles, principles governing equitable relief would foreclose any such sweeping, nationwide injunction against numerous federal agencies based on the claims of a set of individuals.

2. The district court also erred in concluding that the court could afford redress through a form of relief—supervising the government's energy policies writ large—that is not "within the power of an Article III court." *Juliana*, 947 F.3d at 1171. It is "beyond the power of an Article III court to order, design, supervise, or implement the plaintiffs' requested remedial plan." *Id.* at 1172-73. Yet in explaining why the courts can afford "declaratory" relief in this matter, the district court outlined a plan to assume precisely the kind of supervisory role that this Court already held to be impermissible.

The district court stated that the trial it foresees will be bifurcated into liability and remedy phases. Exhibit 1 at 33. During the liability phase, the court would undertake to identify "the constitutional benchmark" and "defin[e] plaintiffs' basic rights and defendant's consequent obligations." *Id.* The court would then issue a declaratory judgment "specif[ying] legal obligations." *Id.* During the subsequent remedy phase, the district court would play an "innovative" role that would involve "supervis[ing] the parties in crafting a plan" that would contain "measures that [the government] decide[s] are appropriate to bring the agencies into constitutional compliance," *id.*, without respect to the limits on the authority Congress has vested in them or the public processes these agencies are required to follow. The court will then exercise "ongoing jurisdiction" to assess the government's compliance over an uncertain and undefined scope and period of

time—apparently until "policies and practices of the national energy system" meet the court's unspecified standard for sufficiency—akin to supervising a consent decree, and perhaps with the aid of a special master. *Id.*

The district court suggested that exercising these supervisory powers after awarding a declaratory judgment cures the Article III problem. *Id.* To the contrary, the court's assumption of such a role would greatly exacerbate that problem. And the district court's self-described "innovation" is simply to segue from a declaratory judgment *into* an injunction. An order prescribing conduct and compelling compliance on penalty of sanction is plainly injunctive, regardless of what label the district court applies, *see, e.g.*, *Turtle Island Restoration Network v. U.S. Dep't of Com.*, 672 F.3d 1160, 1165 (9th Cir. 2012), and the powers that the district court describes—supervising government defendants, directing particular policies and practices, enforcing compliance, exercising jurisdiction indefinitely—are inherently injunctive. Any judicial action to require compliance with the legal "obligations" specified in a declaratory judgment with respect to Plaintiffs here would plainly be "beyond the power of an Article III court to order." *Juliana*, 947 F.3d at 1172-73.

In any event, this Court already rejected the exact same argument from Plaintiffs that "the district court need not itself make policy decisions, because if their general request for a remedial plan is granted, the political branches can

decide what policies will best 'phase out fossil fuel emissions and draw down excess atmospheric CO_2.'" *Juliana*, 947 F.3d at 1172. Even if the district court left these supposed details of such a sweeping plan to the government to work out, this Court explained, Plaintiffs' remedy "would subsequently require the judiciary to pass judgment on the sufficiency of the government's response," which "would entail a broad range of policymaking" involving both the Executive Branch and Congress. *Id.* at 1171. The Court recognized that "the political branches might conclude . . . that economic or defense considerations called for continuation of the very programs challenged in this suit, or a less robust approach," and that the federal courts cannot substitute their judgments on these complex issues. *Id.* at 1172. Further, "given the complexity and long-lasting nature of global climate change, the court would be required to supervise the government's compliance with any suggested plan for many decades." *Id.* at 1172. Those functions exceed the judicial power.

Thus, the district court clearly erred in finding redressability through a plan that would appoint the court as the superintendent of the Executive Branch's climate policy for an indefinite term, a judicial assumption of the powers of the President in excess of the powers conferred by Article III. To reach this conclusion, the Court need not (and should not) "discount the gravity of th[e] asserted environmental effects" or the "greater risks of harm" from "continuing

greenhouse gas emissions," but simply recognize that the Court "may act only where [it is] granted power to do so by the Constitution." *Wash. Env't Council v. Bellon*, 732 F.3d 1131, 1142 (9th Cir. 2013). The Constitution allocates the government's comprehensive policy response to climate change to the political branches, which have taken a wide range of steps to address the urgent crisis of climate change even as this litigation unfolded (p. 1 & n.1).

C. Plaintiffs fail to state claims upon which relief can be granted.

In the alternative, the Court should issue a writ of mandamus ordering dismissal because Plaintiffs' second amended complaint clearly fails to state a claim upon which relief can be granted. Fed. R. Civ. P. 12(b)(6). Absent mandamus review, the district court would proceed to trial on novel constitutional and public-trust claims of significant national importance that the Supreme Court has noted are "striking" in their "breadth." *United States v. U.S. Dist. Ct.*, 139 S. Ct. at 1; *see also In re United States*, 139 S. Ct. at 453. Because Plaintiffs' claims lack a foundation in federal law, the extraordinary remedy of mandamus is warranted to correct the district court's legal error before the court holds a trial on public policy that should take place in a congressional committee room and not a federal courthouse. *Cf. Cheney*, 542 U.S. at 381 (mandamus is appropriate to correct errors that "amount to a judicial usurpation of power").

The government presented these arguments in its earlier interlocutory appeal in this case, but the Court had no occasion to address the merits once it ordered dismissal for lack of jurisdiction. Now that the district court has reasserted jurisdiction, Plaintiffs' novel constitutional and public-trust claims once again warrant this Court's immediate review. But the district court summarily declined to certify an interlocutory appeal, notwithstanding its earlier certification of orders addressing the same issues. Exhibit 1 at 49. Thus, even if Plaintiffs had standing—and they do not—the Court should exercise its mandamus powers to order dismissal for failure to state a claim. *See Juliana*, 947 F.3d at 1166.

1. Plaintiffs fail to state a due process claim.

Plaintiffs claim that the government has violated a due process right to a "stable climate system," which they locate in the Fifth Amendment's guarantee of rights to life, liberty, and property. Exhibit 2 at ¶¶ 277-89. This claim fails as a matter of law for two independent reasons.

a. The Supreme Court has instructed courts to exercise great care when asked to recognize a new right under the Due Process Clause. *Washington v. Glucksberg*, 521 U.S. 702, 720 (1997). No court has recognized a substantive due process right to a stable climate system under the Fifth Amendment.

To the contrary, federal courts have declined to recognize a constitutional right to a healthful environment in other contexts. *See, e.g.*, *Guertin v. Michigan*,

912 F.3d 907, 921-22 (6th Cir. 2019) (noting that the "Constitution does not guarantee a right to live in a contaminant-free, healthy environment"); *Nat'l Sea Clammers Ass'n v. City of New York*, 616 F.2d 1222, 1237-38 (3d Cir. 1980) (finding it "established in this circuit and elsewhere that there is no constitutional right to a pollution-free environment"), *vacated on other grounds sub nom. Middlesex Cnty. Sewerage Auth. v. Nat'l Sea Clammers Ass'n*, 453 U.S. 1 (1981); *Ely v. Velde*, 451 F.2d 1130, 1139 (4th Cir. 1971) (noting that arguments "in support of a constitutional protection for the environment" have not "been accorded judicial sanction"); *Clean Air Council v. United States*, 362 F. Supp. 3d 237, 250-53 (E.D. Pa. 2019) (collecting cases).

The district court erred in concluding that the Fifth Amendment guarantees an individual and personal "right to a climate system that can sustain human life." Exhibit 1 at 39. The court observed that history and tradition do not set the "outer bounds" of the judicial inquiry, *id.*, but the court did not identify an alternative basis for recognizing a new right under the Constitution beyond the court's understanding that the "right to life" includes "the right to be free from knowing government destruction of the[] ability to breathe, to drink, or to live." *Id.* at 40. The only authority the district court cited on Plaintiffs' asserted right is a dissenting opinion from a state court. *Id.* (citing *Aji P. v. State*, 497 P.3d 350, 351 (Wash. 2021) (Gonzalez, C.J., dissenting)).

b. The district court also erred in recognizing a due process right to particular climate conditions because the Fifth Amendment's Due Process Clause does not impose on the government an affirmative duty to protect or guarantee particular levels of safety and security. *See DeShaney v. Winnebago Cnty. Dep't of Soc. Servs.*, 489 U.S. 189, 194-95 (1989). The Court recognizes two exceptions to this general no-duty rule: "(1) when a 'special relationship' exists between the plaintiff and the state (the special-relationship exception); and (2) when the state affirmatively places the plaintiff in danger by acting with 'deliberate indifference' to a 'known or obvious danger' (the state-created danger exception)." *Patel v. Kent Sch. Dist.*, 648 F.3d 965, 971 (9th Cir. 2011) (citations omitted) (addressing the Due Process Clause of the Fourteenth Amendment). Plaintiffs rely on the state-created danger exception, which holds that "a state actor can be held liable for failing to protect a person's interest in his personal security or bodily integrity when the state actor affirmatively and with deliberate indifference placed that person in danger." *Pauluk v. Savage*, 836 F.3d 1117, 1122 (9th Cir. 2016).

The district court clearly erred in concluding that Plaintiffs adequately pleaded a claim of state-created danger. Exhibit 1 at 41-44. Plaintiffs broadly allege that the government "plac[ed] Plaintiffs in a position of climate danger" and "continued to act with deliberate indifference to the known danger [the government] helped create and enhance." Exhibit 2 ¶ 285; *see also id.* ¶¶ 280-84.

But this Court has recognized state-created dangers only where a government official created "an obvious, immediate, and 'particularized danger' to a specific person known to that official." *Pauluk*, 836 F.3d at 1129-30 (Murguia, J., concurring in part and dissenting in part); *see also id.* at 1130 (collecting cases). Here, Plaintiffs instead allege broad and generalized harms from the degradation of the global climate system, not immediate and particularized dangers, and Plaintiffs do not identify a specific government actor that knowingly placed them in such a danger. *Id*. Rather, the second amended complaint focuses on largely unspecified government actions taken by multiple agencies over a course of decades, far afield from the individual decisions that this Court has found to constitute state-created danger. *See id.* Further, Plaintiffs' allegations concern actions that the government has taken with respect to the public at large rather than Plaintiffs in particular. *See* Exhibit 2 ¶¶ 279-89. Finding a state-created danger in these circumstances would result in an exception that swallows the no-duty rule.

2. Plaintiffs fail to state a public-trust claim.

Plaintiffs claim that the government also violated an asserted public-trust doctrine. That doctrine originated in English common law, *see District of Columbia v. Air Fla., Inc.*, 750 F.2d 1077, 1081-82 (D.C. Cir. 1984), and it provides that the "sovereign owns all of its navigable waterways and the lands lying beneath them as trustee of a public trust for the benefit of the people," *Nat'l*

Audubon Soc'y v. Superior Ct., 658 P.2d 709, 718 (Cal. 1983) (internal quotation and citation omitted). Plaintiffs allege that the federal government holds in trust the Nation's "atmosphere, waters, oceans, and biosphere" and violated its duty to protect the "overarching public trust resource" of the Nation's "life-sustaining climate system." Exhibit 2 ¶ 308; *see also id.* ¶¶ 309-10. This claim fails as a matter of law for two independent reasons.

a. There is no federal public-trust doctrine. The doctrine has been recognized in certain circumstances as a matter of state law, with no basis in the U.S. Constitution. *See, e.g.*, *PPL Mont., LLC v. Montana*, 565 U.S. 576, 603-04 (2012) ("[T]he public trust doctrine remains a matter of state law" and its "contours . . . do not depend upon the Constitution[.]"); *Idaho v. Couer d'Alene Tribe*, 521 U.S. 261, 283-85 (1997); *Phillips Petroleum Co. v. Mississippi*, 484 U.S. 469, 475 (1988).[5] This Court has recognized as much, *see United States v. 32.42 Acres of Land*, 683 F.3d 1030, 1038 (9th Cir. 2012), and the D.C. Circuit rejected a claim on the same theory advanced by Plaintiffs, litigated by some of the same attorneys litigating

[5] The district court concluded that the Supreme Court's statements about the relationship between the public-trust doctrine and the Constitution were dicta and did not foreclose the recognition of a federal public trust. ECF No. 83 at 43-45. But even assuming that analysis is correct, this Court does not "treat considered dicta from the Supreme Court lightly" and will "accord it appropriate deference." *United States v. Montero-Camargo*, 208 F.3d 1122, 1134 n.17 (9th Cir. 2000).

this case. *Alec L. v. McCarthy*, 561 F. App'x 7 (D.C. Cir. June 5, 2014) (mem.) (per curiam).

Indeed, a federal public-trust doctrine constraining the federal government's power over public lands would be inconsistent with the Constitution's Property Clause. U.S. Const. art. IV, § 3, cl. 2 ("Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States[.]"); *see also Kleppe v. New Mexico*, 426 U.S. 529, 539 (1976) (holding that "[t]he power over the public land thus entrusted to Congress is without limitations"). Plaintiffs purport to locate a federal public-trust doctrine in the Ninth and Tenth Amendments. Exhibit 2 ¶ 308. But the Ninth Amendment "has never been recognized as independently securing any constitutional right," *Strandberg v. City of Helena*, 791 F.2d 744, 748 (9th Cir. 1986), and the Tenth Amendment only reserves to the states those powers not expressly granted to Congress, *New York v. United States*, 505 U.S. 144, 156-57 (1992).

b. Plaintiffs also cannot state a claim for a public-trust duty to protect a "life-sustaining climate system" broadly encompassing the "atmosphere, waters, oceans, and biosphere." Exhibit 2 ¶ 308. Public-trust cases generally involve state ownership of particular, identifiable natural resources, typically submerged and submersible lands, tidelands, and waterways. *See, e.g.*, *PPL Montana*, 565 U.S.

576, 603-04 (riverbeds); *Stop the Beach Renourishment, Inc. v. Fla. Dep't of Env't Prot.*, 560 U.S. 702, 707-08 (2010) (submerged lands); *Phillips Petroleum Co.*, 484 U.S. at 476-77 (tidelands); *Summa Corp. v. California ex rel. State Lands Comm'n*, 466 U.S. 198, 205-06 (1984) (tidelands); *United States v. Mission Rock Co.*, 189 U.S. 391, 406-07 (1903) (tidelands); *Ill. Cent. R.R. v. Illinois*, 146 U.S. 387, 453-60 (1892) (submerged lands). State courts have sometimes expanded state public-trust doctrines further, but Plaintiffs do not assert claims under state law. And in any event, a climate system is not susceptible to ownership as a public trust subject to the jurisdiction of any particular government. Plaintiffs nevertheless seek to hold the federal government responsible for maintaining the global climate system as a public trust. Exhibit 2 ¶ 308.

The district court erred in concluding that Plaintiffs adequately alleged a violation of public-trust duties with respect to the climate system. ECF No. 83 at 40; Exhibit 1 at 47. The district court notably declined to consider Plaintiffs' claims as they were pleaded, instead concluding that Plaintiffs had stated a claim for "violations of the public trust doctrine in connection with the territorial sea." Exhibit 1 at 47 (citing ECF No. 83 at 40-42). In limiting its analysis to the territorial sea—and declining to address whether the atmosphere is a public-trust asset, *see, e.g.*, ECF No. 83 at 40 n.10—the district court failed to address Plaintiffs' actual claim: that the global climate system is burdened by a federal

public trust. At a minimum, the district court clearly erred in failing to dismiss this claim insofar as it asserts a trust over resources beyond the territorial sea.[6]

D. Mandamus is warranted.

The extraordinary remedy of mandamus is warranted here. Mandamus generally is governed by the five *Bauman* factors (p. 17-18), but the Court may issue the writ to enforce its own mandate without consideration of these factors. *Vizcaino*, 173 F.3d at 719 ("*Bauman* does not apply when mandamus is sought on the ground that the district court failed to follow the appellate court's mandate."). In any event, all five factors are present here and support granting the writ.

1. The government does not have another "adequate way to obtain the relief sought." *In re U.S. Dep't of Educ.*, 25 F.4th at 698. Earlier in this litigation, the government petitioned both this Court and the Supreme Court for relief as the district court denied the government's dispositive motions, declined to certify interlocutory appeal, and moved quickly toward a trial expected to last a number of weeks. *See* Exhibit 5 at 9:7-11. These petitions were denied as either premature—

[6] The district court also erred in declining to dismiss this case for Plaintiffs' failure to bring their cause of action under the APA, which channels challenges to agency actions into a carefully organized framework, 5 U.S.C. § 706, and does not permit a court to conduct a "broad programmatic" review of agency policy. *Norton v. S. Utah Wilderness All.*, 542 U.S. 55, 62, 64 (2004). This Court in the earlier appeal concluded that Plaintiffs' claims "may proceed independently of the review procedures mandated by the APA." *Juliana*, 947 F.3d at 1159. The government recognizes that this Court's decision binds a future panel, but preserves that argument in the event of further review.

in light of dispositive-motion practice in district court or other avenues for relief from discovery and trial—or moot. *See United States v. U.S. Dist. Ct.*, 139 S. Ct. at 1; *In re United States*, 139 S. Ct. at 453; *In re United States*, 895 F.3d 1101 (9th Cir. 2018); *In re United States*, 884 F.3d 830 (9th Cir. 2018). Eventually, after the government exhausted all avenues for relief in district court, this Court "invited the district court to revisit certification, noting the Supreme Court's justiciability concerns," and the district court "reluctantly certified" an appeal and stayed its proceedings. *Juliana*, F.3d at 1166.

Following this Court's decision finding no Article III jurisdiction, the district court granted leave to amend and returned the case to its earlier posture. The government once again moved to dismiss the (now second) amended complaint, sought a stay of litigation, and asked the district court to certify both its order that granted leave to amend and any order that denied the motion to dismiss. ECF No. 547, 551, 552. The district court largely denied the government's requests—without explaining its decision not to certify an interlocutory appeal—and held a status conference to discuss setting a trial date. Exhibit 3; ECF No. 572. Short of mandamus, there is no realistic means of obtaining relief from the trial the district court is intent on holding. During the previous rounds of litigation, the government moved for judgment on the pleadings and summary judgment after the court denied its motion to dismiss, but these further dispositive motions were also

denied. There is no reason to think the court will handle further dispositive motions any differently; the record establishes that further efforts at seeking relief in district court will be futile.

2. The government "will suffer damage or prejudice that cannot be corrected on appeal." *In re U.S. Dep't of Educ.*, 25 F.4th at 698. Absent mandamus relief, the government will be required to comply with additional discovery requests and proceed to trial on Plaintiffs' sweeping claims. The Justice Department has already devoted more than 21,000 attorney and paralegal hours to this litigation and spent millions of taxpayer dollars on expert fees, travel expenses, and other non-attorney fees. *See* Declaration of Guillermo A. Montero ¶¶ 2-3, filed in *In re United States*, No. 18A410 (U.S. Oct. 18, 2018) (attached as Exhibit 6); Supplemental Declaration of Guillermo A. Montero, ECF No. 571-1 ¶ 3 (attached as Exhibit 7). If trial had commenced in October 2018, the parties expected to present up to 72 witnesses, including 29 expert witnesses, testifying to a diverse range of topics described in more than 1,100 pages of expert reports. Exhibit 6 ¶ 5. To conduct a ten-week trial of that complexity, the government expected to commit an additional 7,300 hours of professional time and millions of additional taxpayer dollars. *Id.* ¶¶ 6-7.

The government must expend resources to defend litigation in the normal course and does not seek extraordinary relief from the appellate courts simply

because it disagrees with a district court's resolution of dispositive motions. But this case presents the extraordinary circumstance where a court plans to hold a multi-week trial on issues of significant public import that will require enormous expenditures of government time and resources—all in a case where this Court already has held that the district court lacks jurisdiction because even at the end of such a trial, there would be no workable remedy that could be ordered or enforced. Those harms cannot be corrected on appeal from a final judgment. And more fundamentally, the court would hold a trial at the behest of a handful of Plaintiffs on issue of broad public importance and governmental actions, contemplating presentation of legal and factual positions in a court rather than through the agency process Congress had mandated in order to provide for broad public participation and consideration of varying perspectives.

3. The district court "clearly erred as a matter of law." *In re U.S. Dep't of Educ.*, 25 F.4th at 698. As explained at length above (pp. 19-38), the district court clearly erred both by violating this Court's mandate and by holding that Plaintiffs had adequately pleaded Article III standing on grounds this Court had already rejected. A district court clearly errs when this Court "has already directly addressed the question at issue" and reached a different conclusion. *Id.* Separately, the district court clearly erred by denying the government's motion to dismiss Plaintiffs' due process and public-trust claims (pp. 38-46).

4. The district court's error "is often repeated or shows the district court's persistent disregard for the federal rules." *In re U.S. Dep't of Educ.*, 25 F.4th at 698. The district court has wrongly held on multiple occasions that Plaintiffs have Article III standing, most recently after this Court expressly held that Plaintiffs do not have standing. ECF Nos. 83, 369; Exhibits 1, 3. The district court certified its earlier orders for interlocutory review only after the Supreme Court and this Court urged that result. Yet after this Court ordered dismissal, the district court put the case back on track for trial, the exact same place the case was when this Court took up the interlocutory appeal—as if this Court had never ruled.

In declining to dismiss the second amended complaint, the district court at times seemed to acknowledge that its decision to proceed with trial was inconsistent with this Court's decision. "*Some* may balk at the [c]ourt's approach as errant or unmeasured," the district court wrote, citing a passage of *this Court's* opinion explaining that not every problem can be resolved by the federal judiciary. Exhibit 1 at 7 (emphasis added). But "future generations may look back to this hour and say that the judiciary failed to measure up at all," the district court explained, in an apparent criticism of this Court's decision. *Id.* The district court's actions and words suggest that it is set on advancing its expansive view of the judiciary's role regardless of this Court's mandate and the limits of Article III.

5. There are "new and important issues at stake." *In re U.S. Dep't of Educ.*, 25 F.4th at 698. Plaintiffs allege sweeping claims raising novel constitutional theories and seeking unprecedented relief from agencies across the Executive Branch. As the Supreme Court has observed, Plaintiffs' claims are "striking" in their "breadth." *United States v. U.S. Dist. Ct.*, 139 S. Ct. at 1. Both the district court and this Court previously concluded that these claims present "a controlling question of law" for which there was a "substantial ground for difference of opinion." 28 U.S.C. § 1292(b); *see also Juliana*, 947 F.3d at 1165-66. Moreover, climate change is unquestionably an "important issue," as is Plaintiffs' request that the district court superintend the government's response to climate change over decades. If Plaintiffs were to prevail, the district court envisions an "innovative" remedy phase involving indefinite, continuing jurisdiction over the federal government's entire suite of actions in response to an enormously important and complex problem affecting the entire world. Exhibit 1 at 33-34.

II. The Court should stay proceedings in district court pending resolution of this petition.

The government also asks this Court to invoke its authority under the All Writs Act, 28 U.S.C. § 1651, to order a stay of all proceedings in the district court while the Court considers this petition. *See also* 9th Cir. General Order 6.8(a) (motions panel "may also issue a stay or injunction pending further consideration

of the application").[7] A stay is "an exercise of judicial discretion . . . to be guided by sound legal principles," *Nken v. Holder*, 556 U.S. 418, 433-34 (2009) (internal quotation marks omitted), that have been distilled into four factors: (1) the applicant's likely success on the merits; (2) irreparable injury to the applicant absent a stay; (3) substantial injury to the other parties; and (4) the public interest. *Hilton v. Braunskill*, 481 U.S. 770, 776 (1987). Each of these factors favors a stay.

For the reasons explained above (pp. 19-46), the government has a strong likelihood of success in obtaining a writ of mandamus. And absent a stay, the government will suffer irreparable injury in the form of intrusive discovery and a trial conducted by a district court without jurisdiction. As explained above (pp. 48-50), although the burdens of discovery and trial ordinarily do not warrant mandamus relief, this case presents extraordinary circumstances that will result in harm to the government that other litigants would not suffer in the normal course.

Foremost, this Court already has concluded that Plaintiffs lack standing to bring this case and the district court lacks jurisdiction to entertain these claims against the government. The district court plans to hold a lengthy trial premised on its intention to supervise the Executive Branch's entire climate policy through the

[7] The government has asked the district court for a stay pending resolution of this petition, although that is not an express prerequisite to filing a petition for a writ of mandamus under Federal Rule of Appellate Procedure 21. *Cf.* Fed. R. App. P. 8(a)(1).

judicial process. Such a trial would nullify this Court's decision in the interlocutory appeal, deprive the United States of the benefit of the judgment it secured in that appeal, and harm the government by subjecting numerous agencies and their officials to the compulsory process of a district court operating outside the confines of its jurisdiction as defined by this Court. *See Cheney*, 542 U.S. at 380.

On the other side of the ledger, a stay of proceedings during the pendency of this petition is not likely to appreciably injure the other parties. This case has been pending since 2015, and the time required to resolve this petition pales in comparison to the two years that elapsed between Plaintiffs' motion for leave to amend their complaint and the district court's decision granting leave to amend.

Lastly, the public interest favors a stay. Absent relief, the Executive Branch and its agencies will be subject to discovery and required to divert substantial resources away from their essential function of "faithfully execut[ing]" the law. U.S. Const. art. II, § 3. The unprecedented scope and nature of the claims set for trial will inevitably harm the government in its "energetic performance of its constitutional duties." *Cheney*, 542 U.S. at 382.

Given the district court's determination to move forward with discovery and a trial, the government respectfully requests an administrative stay while the Court considers the government's stay request and an expedited ruling on the request for

a stay. *See* Order, *United States v. U.S. Dist. Ct.*, No. 18-73014 (9th Cir. Nov. 8, 2018).

CONCLUSION

For the foregoing reasons, the petition should be granted, and the district court should be directed to dismiss the case without leave to amend. This Court also should grant a stay of all proceedings in the district court while it considers this petition and grant an administrative stay pending resolution of the request for a stay.

Respectfully submitted,

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February 2, 2024
DJ 90-1-4-14528

STATEMENT OF RELATED CASES

There are five related cases within the meaning of Circuit Rule 28-2.6:

- *In re United States*, 884 F.3d 830 (9th Cir. 2018) (No. 17-71692) (mandamus petition seeking relief from denial of motion to dismiss first amended complaint, denied without prejudice on March 7, 2018).

- *In re United States*, 895 F.3d 1101 (9th Cir. 2018) (No. 18-71928) (mandamus petition seeking relief from earlier proceedings, denied without prejudice on July 20, 2018).

- *In re United States*, No. 18-72776 (mandamus petition seeking relief from earlier proceedings, denied as moot November 2, 2018).

- *In re United States*, No. 18-73014 (mandamus petition seeking relief from earlier proceedings, denied as moot on December 26, 2018).

- *Juliana v. United States*, 947 F.3d 1159 (9th Cir. 2020) (No. 18-36082) (interlocutory appeal from orders related to dismissal, judgment on the pleadings, and summary judgment; case remanded with instructions to dismiss).

CERTIFICATE OF SERVICE

I hereby certify that I electronically filed the foregoing with the Clerk of the Court for the United States Court of Appeals for the Ninth Circuit by using the appellate ACMS system on February 2, 2024.

I further certify that a notice of the filing of the foregoing (including a complete copy of the foregoing) will be filed in underlying proceeding in the United States District Court for the District of Oregon in compliance with Federal Rule of Appellate Procedure 21, and that all parties to the proceeding will be served with that notice through the district court's CM/ECF system. In addition, a courtesy copy of the foregoing has been provided via e-mail to the following counsel for Plaintiffs:

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UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

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This brief contains 13,000 **words,** including _____ words manually counted in any visual images, and excluding the items exempted by FRAP 32(f). The brief's type size and typeface comply with FRAP 32(a)(5) and (6).

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Signature /s/ Daniel Halainen **Date** February 2, 2024

*(use "*s/[typed name]*" to sign electronically-filed documents)*

No. 24-____

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

In re UNITED STATES OF AMERICA, et al.

UNITED STATES OF AMERICA, et al.,
Petitioners,

v.

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF OREGON,
Respondent,

and

KELSEY CASCADIA ROSE JULIANA, et al.
Real Parties in Interest.

On Petition for a Writ of Mandamus to the United States District Court
for the District of Oregon (No. 6:15-cv-1517)

EXHIBITS TO PETITION FOR A WRIT OF MANDAMUS AND MOTION FOR A STAY OF PROCEEDINGS

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INDEX OF EXHIBITS

1. District court's opinion and order denying in part motion to dismiss and denying motions to certify and to stay, ECF No. 565 (Dec. 29, 2023)

2. Plaintiffs' second amended complaint, ECF No. 542 (June 8, 2023)

3. District court's opinion and order granting leave to amend, ECF No. 540 (June 1, 2023)

4. Ninth Circuit decision, No. 18-36082 (Jan. 17, 2020)

5. Reporter's transcript of January 19, 2024, status conference, to be docketed at ECF No. 572 (Jan. 22, 2024)

6. Declaration of Guillermo A. Montero, filed in *In re United States*, No. 18A410 (U.S. Oct. 18, 2018)

7. Supplemental Declaration of Guillermo A. Montero, ECF No. 571-1 (Jan. 18, 2024)

Exhibit 1

District court's opinion and order denying in part motion to dismiss and denying motions to certify and to stay, ECF No. 565 (Dec. 29, 2023)

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

EUGENE DIVISION

KELSEY CASCADIA ROSE JULIANA, *et al.*,

Plaintiffs,

v.

THE UNITED STATES OF AMERICA, *et al.*,

Defendants.

Civ. No. 6:15-cv-01517-AA

OPINION AND ORDER

AIKEN, District Judge:

In 2015, twenty-one plaintiffs—a group of young people, including "future generations"—brought this civil rights action against the federal government, alleging injury from the devastation of climate change and contending that the Constitution guarantees the right to a stable climate system that can sustain human life. Through the years of litigating this case, plaintiffs maintain that their

government, by subsidizing fossil fuel extraction and consumption, is responsible for destroying the climate system on which all life, liberty, and property depends, violating plaintiffs' fundamental rights under the Due Process Clause of the Constitution and the historical public trust doctrine. On June 1, 2023, the Court granted plaintiffs' motion to file a second amended complaint.

Now before the Court is defendants' motion to dismiss the second amended complaint. ECF No. 547. For the reasons explained, the Court DENIES defendants' motion to dismiss, ECF No. 547; DENIES defendants' motion for an order certifying its prior order, ECF No. 540, for interlocutory appeal, ECF No. 551; and DENIES defendants' motion to stay litigation, ECF No. 552. The Court GRANTS plaintiffs' motion to set a pretrial conference, ECF No. 543.

INTRODUCTION

The parties do not disagree that the climate crisis threatens our ability to survive on planet Earth. This catastrophe is *the* great emergency of our time and compels urgent action.[1] As this lawsuit demonstrates, young people—too young to vote and effect change through the political process—are exercising the institutional procedure available to plead with their government to change course. While facts

[1] *See* David Wallace-Wells, The Uninhabitable Earth: Life After Warming (2019); Andrew Freedman & Jason Samenow, *Humidity and Heat Extremes Are on the Verge of Exceeding Limits of Human Survivability, Study Finds*, Washington Post (May 8, 2020) (reporting study warning that highly populated regions of the world will be rendered uninhabitable sooner than previously thought for parts of the year); Nafeez Ahmed, *New Report Suggests 'High Likelihood of Human Civilization Coming to an End' Starting in 2050*, VICE (June 3, 2019).

remain to be proved, lawsuits like this highlight young people's despair with the drawn-out pace of the unhurried, inchmeal, bureaucratic response to our most dire emergency. Top elected officials have declared that the climate emergency spells out "code red for humanity."[2] Burning fossil fuels changes the climate more than any other human activity.[3] The government does not deny that it has promoted fossil fuel combustion through subsidies; tax exemptions; permits for fossil fuel development projects; leases on federal lands and offshore areas; permits for imports and exports; and permits for energy facilities.[4] Despite many climate change suits around the country, in 2023, the United States witnessed record-breaking levels of oil and gas production.[5] And recent calculations conservatively estimate that the United States

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[2] President Joseph Biden, Remarks on "Actions to Tackle the Climate Crisis" at Brayton Point Power Station, Somerset, Massachusetts (July 20, 2022), https://www.whitehouse.gov/briefing-room/speeches-remarks/2022/07/20/remarks-by-president-biden-on-actions-to-tackle-the-climate-crisis/ [https://perma.cc/LU2U-CTFM].

[3] Environmental Protection Agency, Sec. Environmental Topics, Climate Change, *Causes of Climate Change*, (last updated April 25, 2023), https://www.epa.gov/climatechange-science/causes-climate-change [https://perma.cc/UGU4-B6EF].

[4] *Juliana v. United States*, 947 F.3d 1159, 1167 (9th Cir. 2020) ("The government affirmatively promotes fossil fuel use in a host of ways, including beneficial tax provisions, permits for imports and exports, subsidies for domestic and overseas projects, and leases for fuel extraction on federal land.").

[5] *Energy Poverty Prevention and Accountability Act of 2023: Hearing on H.R.6474 and H.R.6481 before the H. Nat. Resources Subcomm. on Energy and Min. Resources, 118th Cong.* (statement of J. Mijin Cha, Assistant Professor, Univ. of Cal.) (citing Oliver Milman, "*US Oil and Gas Production Set to Break Record in 2023 despite UN Climate Goals*," The Guardian, November 27, 2023, sec. Environment, https://www.theguardian.com/environment/2023/nov/27/us-oil-gas-record-fossil-fuels-cop28-united-nations [https://perma.cc/VJ4C-KZGH]).

provides the oil and gas industry $20,000,000,000.00 annually in an array of subsidies.[6]

Defendants maintain that, because tackling the climate crisis is complex, and no single remedy may *entirely* redress plaintiffs' harms caused by climate change, the judiciary is constrained by the Constitution from offering any redress at all. *See* defs.' mot. to dismiss ("Mot.") at 11-13. Defendants contend that the issue of climate change is political in its nature, and that redress of plaintiffs' alleged injuries must be sought from Congress. *Id*. at 28. That unnecessarily narrow view overlooks one clear and constitutional path to shielding future generations from impacts of the onslaught of environmental disaster: that it is the responsibility of the judiciary to declare the law that the government may not deprive the People of their Constitutional guarantee of the God-given right to life. U.S. CONST. art III; U.S. CONST. amend. V; *Marbury v. Madison*, 5 U.S. (1 Cranch) 137, 170 (1803).

Plaintiffs' allegations are that collective resolve at every level and in every branch of government is critical to reducing fossil fuel emissions and vital to combating climate change. That curbing climate change requires an all-hands-on-deck approach does not oust the Court from its province or discharge it of its duty under the Constitution to say what the law is. *Marbury* 5 U.S. at 170.[7] Combatting

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[6] *Id.* (Statement of J. Mijin Cha) (citing Environmental and Energy Study Institute, Fact Sheet, *"Proposals to Reduce Fossil Fuel Subsidies (2021),"* (July 23, 2021) https://www.eesi.org/papers/view/fact-sheet-proposals-to-reduce-fossil-fuel-subsidies-2021 [https://perma.cc/SD8B-7P6B].

[7] *See also* Edith M. Lederer, *UN Chief: World Must Prevent Runaway Climate Change by 2020*, Associated Press News (Sept. 10, 2018) (describing massive

climate change may require all to act in accord, but that does not mean that the courts must "throw up [our] hands" in defeat. *See Juliana v. United States*, 947 F.3d 1159, 1175 (9th Cir. 2020) (Staton, J., dissenting).

The legislative and executive branches of government wield constitutional powers entrusted to those branches by the People through the democratic process. *See* U.S. CONST. art. I and art. II. So too, as part of a coequal branch of government, the Court cannot shrink from its role to decide on the rights of the individuals duly presenting their case and controversy. *Marbury*, 5 U.S. at 170. Indeed, courts at home and abroad are capably grappling with climate change lawsuits seeking redress against both government and private actors on a range of legal theories, many novel.[8] In Montana, Judge Kathy Seeley presided over the first climate change trial in the United States, piercing through expert testimony and scientific evidence to provide factual findings and conclusions of law, ruling that the state's failure to consider climate change when approving fossil fuel projects was unconstitutional. *See Held v. Montana*, Findings of Fact, Conclusions of Law, and Order, Civil Action CDV-2020-307 (Mont. First Jud. D. Ct. Lewis and Clark County, Aug. 14, 2023).

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decarbonization effort necessary to avoid climate "tipping points."), https://apnews.com/article/floods-united-nations-antonio-guterres-us-news-climate-71ab1abf44c14605bf2dda29d6b5ebcc [https://perma.cc/84E6-D24C].

[8] The Sabin Center for Climate Change Law of Columbia University has assembled for public access the "Climate Change Litigation Database" containing summaries and court dockets for climate change lawsuits brought in the United States and abroad. *Climate Change Litigation Databases,* Colum. L. Sch.: Sabin Ctr. For Climate Change L., https://climatecasechart.com/ [https://perma.cc/B89Z-YN4M].

The judiciary is capable and duty-bound to provide redress for the irreparable harm government fossil fuel promotion has caused. Legal scholar and professor Mary Christina Wood contends that the all-encompassing breadth of ongoing "irreparable harm" sets the climate emergency apart from any other crisis, in terms of the human interests at stake.[9] As Professor Wood eloquently states: "Because no crisis is as ominous, imminent, and far reaching, the climate emergency must be considered *sui generis*," that is, "in a class of its own."[10] The legal approach must "rise to the emergency rather than repeat a failed past paradigm."[11] In the context of Australian youth's challenge to government approval of a coal mine, Justice Bromberg wrote that failure to curb climate change is "what might fairly be described as the greatest inter-generational injustice ever inflicted by one generation of humans upon the next."[12]

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9 Mary C. Wood, *"On the Eve of Destruction": Courts Confronting the Climate Emergency*, 97 Ind. L.J. 239, 249 (2022) (hereinafter "Wood, *Eve of Destruction*").

10 *Id.*

11 *Id.*

12 *Sharma v. Minister for the Env't* [2021] FCA 560 1, 90 (27 May 2021) (Austl.). The court stated:

> "It is difficult to characterise in a single phrase the devastation that the plausible evidence presented in this proceeding forecasts for the Children. As Australian adults know their country, Australia will be lost and the World as we know it gone as well. The physical environment will be harsher, far more extreme and devastatingly brutal when angry. As for the human experience—quality of life, opportunities to partake in nature's treasures, the capacity to grow and prosper—all will be greatly diminished. Lives will be cut short. Trauma will be far more common and good health harder to hold and maintain. None of this will be the fault of nature itself. It will largely be inflicted by the inaction of this generation of adults, in what might fairly be described as the greatest

Some may balk at the Court's approach as errant or unmeasured,[13] but more likely than not, future generations may look back to this hour and say that the judiciary failed to measure up at all. In any case over which trial courts have jurisdiction, where the plaintiffs have stated a legal claim, it is the proper and peculiar province of the courts to impartially find facts, faithfully interpret and apply the law, and render reasoned judgment.[14] Such is the case here.

BACKGROUND

I. Plaintiffs' Lawsuit

In 2015, plaintiffs filed this civil rights lawsuit that journalists later coined "The Biggest Case on the Planet."[15] At the start of this case, the twenty-one plaintiffs were between the ages of eight and nineteen. They brought suit along with "future generations" through their guardian, Dr. James Hansen. Plaintiffs named as

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> inter-generational injustice ever inflicted by one generation of humans upon the next."

Id.

[13] *Juliana v. United States*, 947 F.3d 1159, 1174 (9th Cir. 2020) ("Not every problem posing a threat—even a clear and present danger—to the American Experiment can be solved by federal judges. As Judge Cardozo once aptly warned, a judicial commission does not confer the power of 'a knight errant, roaming at will in pursuit of his own ideal of beauty or of goodness'; rather, we are bound 'to exercise a discretion informed by tradition, methodized by analogy, disciplined by system.'") (quoting Benjamin N. Cardozo, The Nature of the Judicial Process 141 (1921)).

[14] *See* The Federalist No. 78 (Alexander Hamilton).

[15] Laura Parker, *"Biggest Case on the Planet" Pits Kids v. Climate Change*, Nat'l Geographic (Nov. 9, 2018), https://www.nationalgeographic.com/science/article/kids-sue-us-government-climate-change [https://perma.cc/2J7J-74C2].

defendants all federal agencies that plaintiffs alleged were responsible for the U.S. energy policy, including the Department of Agriculture, Department of Transportation, Environmental Protection Agency, Department of Interior, the State Department, Council on Environmental Quality, Department of Defense, and Department of Commerce. Compl., ECF No. 1; First Am. Compl. ("FAC"), ECF No. 7.

Plaintiffs compiled an abundance of factual evidence to support their claim that the government has known about the dangers posed by fossil fuel production, and, despite that knowledge, chose to promote production and consumption of coal, oil, and gas at increasing levels over decades. The record is extensive. The evidence, as the Ninth Circuit stated, "leaves little basis for denying that climate change is occurring at an increasingly rapid pace . . . and stems from fossil fuel combustion." *Juliana*, 947 F.3d at 1166.

From the beginning, plaintiffs alleged that, as early as the year 1899, scientists understood that CO_2 concentration in the atmosphere caused heat retention, global heating, and climate change. FAC ¶ 131. Plaintiffs stated that for over fifty years, the United States of America has known that CO_2 pollution from burning fossil fuels was causing global warming and dangerous climate change, and that continuing to burn fossil fuels would destabilize the climate system on which present and future generations of our nation depend for survival. *Id.* ¶¶ 132-35. Recounting over a dozen signpost junctures, plaintiffs provide letters, memoranda, and reports to the political branches from scientific experts and government agencies cautioning about the

danger of carbon pollution and warning that a lack of action would be felt for decades. *Id.* ¶¶ 136-50.

Defendants moved to dismiss the complaint under Federal Rule of Civil Procedure 12(b)(1) and 12(b)(6) for lack of standing; failure to state a cognizable constitutional claim; and failure to state a claim on a public trust theory. ECF No. 27. The Court denied that motion in November 2016. *See* Nov. 10, 2016 Op. & Order, ECF No. 83. Defendants also moved for judgment on the pleadings and summary judgment. ECF Nos. 195, 207. For the most part, the Court denied those motions.

When the Court denied defendants' motions to certify its dispositive orders for interlocutory appeal, defendants petitioned the Supreme Court for a writ of mandamus, ECF No. 390-1, and to stay proceedings, ECF No. 391-1, both which were denied. Defendants asked the district court to reconsider certifying its orders for interlocutory appeal, and, that time, the Ninth Circuit invited the district court to do so. *See* Nov. 21, 2018 Order, ECF Nos. 444, 445. Defendants then sought permission to appeal, which the Ninth Circuit granted. Filed Ord., *Juliana v. United States*, No. 18-36082 (9th Cir. Dec. 26, 2018).

On January 17, 2020, a divided panel of the Ninth Circuit issued a decision reversing the district court's certified orders and remanding the case with instructions to dismiss for lack of Article III standing. *Juliana*, 947 F.3d at 1175. Writing for the majority, Judge Hurwitz, joined by Judge Murguia, began with the basics: "To have standing under Article III, a plaintiff must have (1) a concrete and

particularized injury that (2) is caused by . . . challenged conduct and (3) is likely redressable by a favorable judicial decision." *Id.* at 1168.

Agreeing with the district court, Judge Hurwitz found that "[a]t least some plaintiffs" had claimed "particularized injuries," since climate change threatened to harm certain plaintiffs in "concrete and personal" ways if left unchecked. *Id.* The appellate court described the dire circumstances faced by one plaintiff who had had to evacuate his coastal home because of climate change. *Id.* And some plaintiffs had also established causation because there was "at least a genuine factual dispute as to whether" U.S. climate policy was a "substantial factor" in exacerbating plaintiffs' climate change-related injuries. *Id.* at 1169. Thus, plaintiffs' standing turned on redressability: "whether the plaintiffs' claimed injuries [were] redressable by an Article III court." *Id.*

Plaintiffs claimed defendants had violated their constitutional right to a climate system capable of sustaining life, and to redress that violation, sought injunctive relief, including an order directing defendants to "prepare and implement an enforceable national remedial plan to phase out fossil fuel emissions and draw down excess atmospheric CO_2 to stabilize the climate system." FAC at 94 ¶¶ 2, 6, 7.

"Reluctantly," the panel found such relief "beyond [the district court's] constitutional power." *Juliana*, 947 F.3d at 1165. To establish redressability, the appellate court explained, plaintiffs must have identified relief that was both "(1) substantially likely to redress their injuries" and "(2) within the district court's power to award." *Id.* at 1170. On the first prong, the panel found that plaintiffs' own experts

had stated that only a comprehensive, government-led plan to reduce U.S. greenhouse gas emissions could mitigate "the global consequences of climate change" and thereby bring plaintiffs' total redress. *Id.* Turning to the second prong, the panel found that supervising such a plan "would necessarily require" judges to make "a host of complex policy decisions." *Id.* at 1171.

Plaintiffs told the appellate court that even partial relief would suffice to redress their injuries, and that the district court "need not itself make policy decisions," because if plaintiffs' request for a remedial plan were granted, the political branches "could decide what policies" would be best to "draw down excess atmospheric CO_2." *Id.* at 1172. But the panel determined that, "even under such a scenario," the district court would need to pass judgment on the sufficiency of the government's response to the order. In the Ninth Circuit's view, a district court could not engage in passing judgment on the sufficiency of the government's response to a court order, because it "necessarily would entail a broad range of policymaking." *Id.*

The panel continued: "[A] constitutional directive or legal standard[ ] must guide the court's exercise of equitable power," and, on the other hand, "limited and precise" legal rules simply could not resolve the range of policy-related questions plaintiffs' claims raised. *Id.* at 1173. The appellate court determined that no remedy subject to limited and precise definition could redress plaintiffs' injuries and therefore issuing such relief was not within the district court's power. *Id.*

Judge Josephine L. Staton dissented. "Plaintiffs bring suit," she lamented, "to enforce the most basic structural principle embedded in our system of ordered liberty:

that the Constitution does not condone the Nation's willful destruction." *Id*. at 1175. In Judge Staton's view, the district court had the power to award plaintiffs' relief unless plaintiffs' claims ran afoul of the political question doctrine. *See id*. at 1184-85. Since plaintiffs' claims did not pose political questions, she continued, they should have proceeded. *Id*. at 1185-86. "[O]ur history is no stranger to widespread, programmatic changes . . . ushered in by the judiciary[]," Judge Staton concluded, and the "slow churn" of institutional-reform litigation "should not dissuade us here." *Id*. at 1188-89. At end of the day, the narrower understanding prevailed: that Article III courts cannot order injunctive relief unless constrained by more "limited and precise" legal standards, discernable in the Constitution, and that plaintiffs must make their case to the political branches. *Id*. at 1175. The Ninth Circuit "reverse[d] the certified orders of the district court and remand[ed]" the case "with instructions to dismiss for lack of Article III standing." *Id*.

Plaintiffs moved to file an amended complaint, removing from their prayer for relief the injunction that the Ninth Circuit had found objectionable. ECF No. 462. The Court granted it because (1) the Ninth Circuit did not foreclose the possibility of amendment when it mandated dismissal; (2) plaintiffs had notified the Court of a Supreme Court case providing a new and more expansive interpretation of declaratory judgments; and (3) plaintiffs' proposed complaint narrowed the scope of the injunctive relief it had initially requested. *See Juliana v. United States*, No. 6:15-CV-01517-AA, 2023 WL 3750334 (D. Or. June 1, 2023).

II. Plaintiffs File a Second Amended Complaint

In plaintiffs' second amended complaint, they maintain earlier factual allegations, contending that defendants implemented no recommendation provided to them via scientific reports warning of catastrophic climate change. Second Am. Compl. ("SAC") ¶ 153. Plaintiffs contend that, if defendants had not disregarded the evidence, "CO_2 emissions today would be reduced by 35% from 1987 levels." *Id.* Instead, since 1991, plaintiffs state that defendants have allowed CO_2 emissions from fossil fuel combustion to increase. *Id.* Plaintiffs provide tables setting forth data from government sources showing that fossil fuel production, fossil fuel energy consumption, and fossil fuel emissions have climbed substantially since 1965, and that by 2011, fossil fuel combustion in the U.S. accounted for 94% of CO_2 emissions. *Id.* ¶¶ 155-58. By 2012, data plaintiffs provide shows that the U.S. was the largest producer of natural gas, and the second largest producer of coal and energy production. *Id.* ¶ 160. By 2014, according to the United States Energy Information Administration, the U.S. had become the largest producer of total petroleum in the world. *Id.* ¶ 161.

Plaintiffs assert that defendants knew the harmful effect of their actions would significantly endanger many, like plaintiffs, with damage persisting for millennia. *Id.* ¶¶ 1, 161. Despite that knowledge, plaintiffs allege defendants continued their policies and practices of promoting the exploitation of fossil fuels and that defendants acted with deliberate indifference to the peril they knowingly created. *Id.*

Plaintiffs' inventory cataloguing the regulatory permits, export permits, and approvals for leasing, drilling, and mining on public lands is substantial. The

accounting of exploitation for fossil fuel extraction, coal tracts, and oil and gas leases is staggering. *Id.* ¶¶ 164-70. Plaintiffs comprehensively inventory the affirmative governmental promotion of fossil fuel combustion over decades. *Id.* ¶¶ 171-78.

Plaintiffs also include allegations drawing from scientific evidence documenting the tangible impacts of climate change. Evidence describes rising sea levels, severe droughts, hurricanes, wildfires, extreme heat, flash flooding, unprecedented ocean acidification, and rapid depletion of sea ice. *Id.* ¶¶ 213-41. Such events alter our air quality, water availability, water quality, crop yields, animal agriculture, and housing security. *Id.* Plaintiffs' allegations about what the future holds if climate change is unabated are harrowing. *Id.* ¶¶ 242-55.

As the legal basis for their claims, plaintiffs maintain that defendants have violated the Due Process Clause and Equal Protection Clause of the Fifth Amendment; the "unenumerated rights preserved for the people by the Ninth Amendment"; and the public trust doctrine. FAC at 84, 88, 91, 92; SAC at 133, 137, 140, 141 (bringing same claims for relief).

Plaintiffs seek declaratory relief under the Declaratory Judgment Act, 28 U.S.C. § 2201. SAC ¶ 14. Requested relief includes a declaration that the United States national energy system that creates the harmful conditions described above has violated and continues to violate the Fifth Amendment of the U.S. Constitution and plaintiffs' constitutional rights to substantive due process and equal protection of the law. *Id.* at 143 ¶ 1. Further, plaintiffs seek a declaration that defendants violated public trust rights and a declaration that the Energy Policy Act, Section 201

is unconstitutional. *Id.* at 143 ¶¶ 2-3.[16] Plaintiffs request injunctive relief only if necessary and "as appropriate." *Id.* at 143 ¶ 4.

III. The Government Files a Motion to Dismiss

Defendants move to dismiss under Federal Rule of Civil Procedure 12(b)(1) and 12(b)(6), asserting that plaintiffs lack standing; that plaintiffs cannot bring claims in the absence of a statutory right of action; that plaintiffs ask the Court to exercise authority that exceeds the scope of its power under Article III of the Constitution; and that all of plaintiffs' claims fail on the merits. Defendants also assert that, if the Court denies their motion, it should again certify its decision for interlocutory appeal.

LEGAL STANDARDS

I. Motion to Dismiss – FEDERAL RULE OF CIVIL PROCEDURE 12(b)(1)

A court reviews a motion to dismiss a complaint for lack of Article III standing under Rule 12(b)(1). *Naruto v. Slater*, 888 F.3d 418, 425 n.7 (9th Cir. 2018) (quoting *Maya v. Centex Corp.*, 658 F.3d 1060, 1067 (9th Cir. 2011)). If the jurisdictional attack is facial, courts determine whether the allegations contained in the complaint are sufficient on their face to invoke federal jurisdiction, accepting all material allegations in the complaint as true and construing them in favor of the party asserting jurisdiction. *See Warth v. Seldin*, 422 U.S. 490, 501 (1975). Once a party has moved to dismiss for lack of subject matter jurisdiction under Rule 12(b)(1), the

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[16] As noted earlier, plaintiffs had initially sought injunctive relief, including an order directing defendants to "prepare and implement an enforceable national remedial plan to phase out fossil fuel emissions and draw down excess atmospheric CO_2 to stabilize the climate system." FAC at 94 ¶¶ 2, 6, 7.

party invoking federal jurisdiction bears the burden of establishing the elements of standing. *Lujan v. Defs. of Wildlife*, 504 U.S. 555, 561 (1992). "[A] party must establish an Article III case or controversy before [a court can] exert subject matter jurisdiction." *Matter of E. Coast Foods, Inc.*, 66 F.4th 1214, 1218 (9th Cir. 2023). To satisfy the "irreducible constitutional minimum" of Article III standing, a plaintiff must establish (1) an injury in fact (2) that is fairly traceable to the challenged conduct and show that a court can provide (3) a remedy likely to redress that injury. *Spokeo, Inc. v. Robins*, 578 U.S. 330, 338 (2016).

II. Motion to Dismiss – FEDERAL RULE OF CIVIL PROCEDURE 12(b)(6)

To survive a motion to dismiss, a complaint must contain sufficient factual matter, accepted as true, to state a "claim to relief that is plausible on its face." *Bell Atl. Corp. v. Twombly*, 550 U.S. 544, 555, 570 (2007). A claim has facial plausibility when the plaintiff pleads factual content that allows the court to draw the reasonable inference that the defendant is liable for the misconduct alleged. *Id.* at 556. The plausibility standard is not akin to a "probability requirement," but it asks for more than a sheer possibility that a defendant has acted unlawfully. *Id.* The tenet that a court must accept as true all allegations contained in a complaint is inapplicable to legal conclusions. *Ashcroft v. Iqbal*, 556 U.S. 662, 678 (2009). Threadbare recitals of the elements of a cause of action, supported by mere conclusory statements, do not suffice. *Id.* (citing *Twombly*, 550 U.S. at 555). "Where the well-pleaded facts do not permit the court to infer more than the mere possibility of misconduct, the complaint

has alleged—but it has not show[n]—that the pleader is entitled to relief." *Iqbal*, 556 U.S. at 679 (quoting FED. R. CIV. P. 8(a)(2)).

DISCUSSION

Over the eight years litigating this case, plaintiffs have presented evidence spanning over 50 years describing defendants' contribution to climate change through both inaction and affirmative promotion of fossil fuel use. The Court recalls plaintiffs' evidence included a letter by a top aide to President Nixon's domestic policy adviser emphasizing the effect of rising sea levels in 1969: "Goodbye New York. Goodbye Washington, for that matter."[17] In 1986, a Senate subcommittee observed that "there is a very real possibility that man—through ignorance or indifference, or both—is irreversibly altering the ability of our atmosphere to perform basic life support functions for the planet."[18] Those are but two documents out of hundreds highlighting the lengthy nature of government knowledge of the dangers of fossil fuel combustion. By and large, defendants have not disputed the factual premises of plaintiffs' claims. *Juliana,* 947 F.3d at 1167 (so stating). However, plaintiffs have not legally established that evidence. In reviewing defendants' motion to dismiss, the Court notes that, though it has held evidentiary hearings and painstakingly reviewed

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[17] Memorandum from Daniel P. Moynihan, Assistant to the President for Domestic Pol'y, to John Ehrlichman, Assistant to the President for Domestic Affs. (Sept. 17, 1969), [https://perma.cc/G92P-AKLJ].

[18] *Ozone Depletion, the Greenhouse Effect, and Climate Change: Hearing Before the Subcomm. on Env't Pollution of the Comm. on Env't & Pub. Works*, 99th Cong. 2 (1986) (opening statement of Sen. John H. Chafee, Chairman, Subcomm. on Env't Pollution).

thousands of pages of declarations and exhibits, today, its task is solely to decide whether plaintiffs have standing to bring suit and state a claim upon which relief may be granted. FED. R. CIV. P. 12(b)(1), (6).

As an initial matter, defendants assert that the Court must consider whether the rule of mandate, as a jurisdictional rule, requires the Court to dismiss the second amended complaint. Mot. at 10. Next, defendants maintain that plaintiffs have failed to bring a justiciable case and that the Court must dismiss plaintiffs' claims under Rule 12(b)(1) for lack of subject matter jurisdiction. *Id*. at 10-16. Finally, defendants urge the Court to find that plaintiffs' claims fail on the merits and that plaintiffs should have brought this action under the Administrative Procedure Act ("APA") but failed to do so. *Id*. at 32.

I. Mandate of the Court of Appeals for the Ninth Circuit

Defendants state that the Ninth Circuit was clear when it remanded the case to the Court with instructions to dismiss. *Id*. at 11. Defendants argue that, when the scope of the remand is clear, a district court cannot vary or examine the mandate of an appellate court "for any other purpose than execution." *Id*. at 10 (citing *In re Sanford Fork & Tool Co*., 160 U.S. 247, 255 (1895)). Defendants contend that, rather than examine whether plaintiffs' amended pleadings establish redressability to satisfy the requirement of standing, the Court should reconsider the Ninth Circuit's mandate and dismiss the second amended complaint. *Id*. at 11. Because it is jurisdictional error to contravene a rule of mandate, the Court duly reconsiders the mandate of the Ninth Circuit and does not take the matter lightly.

"A district court that has received the mandate of an appellate court cannot vary or examine that mandate for any purpose other than executing it." *Hall v. City of Los Angeles*, 697 F.3d 1059, 1067 (9th Cir. 2012). "Violation of the rule of mandate is a jurisdictional error." *Id.* at 1067. "But while the mandate of an appellate court forecloses the lower court from reconsidering matters determined in the appellate court, it leaves to the district court any issue not expressly or impliedly disposed of on appeal." *S.F. Herring Ass'n v. Dep't of the Interior*, 946 F.3d 564, 574 (9th Cir. 2019) (quoting *Nguyen v. United States*, 792 F.2d 1500, 1502 (9th Cir. 1986)). In determining which matters fall within the compass of a mandate, "[d]istrict courts must implement both the letter and the spirit of the mandate, taking into account the appellate court's opinion and the circumstances it embraces." *Vizcaino v. U.S. Dist. Ct. for W. Dist. of Wash.*, 173 F.3d 713, 719 (9th Cir. 1999) (as amended) (quoting *Delgrosso v. Spang & Co.*, 903 F.2d 234, 240 (3d Cir. 1990)).

"Absent a mandate which explicitly directs to the contrary, a district court upon remand can permit the plaintiff to file additional pleadings . . . " *S.F. Herring,* 946 F.3d at 574 (quoting *Nguyen*, 792 F.2d at 1502); *see also Sierra Club v. Penfold*, 857 F.2d 1307, 1312 (9th Cir. 1988). When the mandate in the prior appeal does not expressly address the possibility of amendment and does not indicate a clear intent to deny amendment seeking to raise new issues not decided, that mandate does not purport "to shut the courthouse doors." *S.F. Herring,* 946 F.3d at 574.

In *S.F. Herring,* the Ninth Circuit discussed its mandate in a prior appeal, which vacated the district court's order entering summary judgment in the

defendants' favor and directed the district court to dismiss the complaint. *See S.F. Herring Ass'n v. U.S. Dep't of Interior*, 683 F. App'x 579, 581 (9th Cir. 2017) (vacating judgment and remanding case with instructions to dismiss for lack of subject matter jurisdiction). On remand, the district court allowed the plaintiff to file a second amended complaint. In the later appeal, the Ninth Circuit determined that the district court correctly found that the earlier mandate to dismiss did not prevent the plaintiff from seeking leave to re-plead. *S.F. Herring*, 946 F.3d at 574. The appellate court reasoned that in instructing the district court to dismiss, the mandate was silent on whether dismissal should be with or without leave to amend, and the mandate therefore did not preclude the district court from allowing plaintiff to file amended pleadings. *Id.* at 572-574.

When this Court granted plaintiffs' motion for leave to amend, it "consider[ed] plaintiffs' new factual allegations under the Declaratory Judgment Act and plaintiffs' amended request for relief, in light of intervening recent precedent, to be a new issue that, while discussed, was not decided by the Ninth Circuit in the interlocutory appeal." *Juliana v. United States*, No. 6:15-CV-01517-AA, 2023 WL 3750334, at *5 (D. Or. June 1, 2023). The Court once again finds that the Ninth Circuit's mandate did not address whether amendment, if permitted, would cure the deficiency it identified in plaintiffs' complaint.

The Ninth Circuit also did not instruct the Court to dismiss without leave to amend. Accordingly, its mandate to dismiss did not foreclose that opportunity, and the Court, on reconsideration, finds that in permitting plaintiffs to proceed with their

second amended complaint, the rule of mandate is not contravened. *S.F. Herring*, 946 F.3d at 574; *see also Creech v. Tewalt*, 84 F.4th 777, 783 (9th Cir. 2023) (where appellate court remanded and stated that plaintiff should have leave to amend, district court did not violate rule of mandate by dismissing *without* leave to amend, because appellate court did not expressly foreclose that option).

II. Standing

The Ninth Circuit determined that plaintiffs had established an injury in fact, traceable to defendants—the first two elements of constitutional standing. *Juliana* 947 F.3d at 1168-70. For completeness in its standing analysis, this Court adopts the Ninth Circuit's determination. Defendants reserve the right to "oppose" the Ninth Circuit's ruling. Mot. at 12.

Defendants contend that plaintiffs have not satisfied the third element of standing, because they failed to demonstrate that their injuries are "redressable" and that they are entitled to injunctive or declaratory relief. Defendants maintain that plaintiffs' requested relief fails, because plaintiffs cannot show that the relief they seek is (1) substantially likely to redress their injuries or (2) within the Court's power to award. *Id*. at 4-5, 12; *see also Spokeo,* 578 U.S. at 338.

A plaintiff must support each element of the standing test "with the manner and degree of evidence required at the successive stages of the litigation." *Lujan*, 504 U.S. at 561 (1992). Accordingly, at the motion-to-dismiss stage, "general allegations" suffice to establish standing because those allegations are presumed to "embrace those specific facts that are necessary to support the claim." *Id*. A plaintiff need not

show a favorable decision is "certain" to redress his injury but must show a substantial likelihood it will do so. *Washington Env't Council v. Bellon*, 732 F.3d 1131, 1146 (9th Cir. 2013). The injury need not be completely redressable; it is sufficient that the injury be partially redressed. *Meese v. Keene*, 481 U.S. 465, 476 (1987) ("enjoining the application of the words political propaganda to the films would at least partially redress the reputational injury of which appellee complains.").

As for plaintiffs' request for declaratory relief, the Ninth Circuit determined that a declaration would be "unlikely by itself to remediate [plaintiffs'] alleged injuries." *Juliana* 947 F.3d at 1170. For injunctive relief, the Ninth Circuit was "skeptical," but assumed without deciding that plaintiffs might be able to show that their injuries could be redressed by an order in their favor. *Id.* at 1171. That said, the appellate court based its ruling on the second redressability prong, stating that an injunction was "beyond the power of an Article III court to order, design, supervise, or implement." *Id.* Plaintiffs' second amended complaint scales down the requested injunctive relief, seeking "an injunction restraining [d]efendants from carrying out policies, practices, and affirmative actions that render the national energy system unconstitutional in a manner that harms [p]laintiffs," and only "if deemed necessary, just and proper." SAC at 143 ¶ 4.

Accordingly, for plaintiffs' claim for both injunctive relief and declaratory relief, the Court will evaluate whether each form of relief is (1) substantially likely to redress their injuries and (2) within the Court's power to award. *Spokeo,* 578 U.S. at 338.

A. Injunctive Relief

1. Substantial Likelihood of Redress

Defendants assert that an order enjoining defendants' fossil fuel activities will not stop catastrophic climate change or even partially ameliorate plaintiffs' injuries, and therefore, any such injunction is not substantially likely to redress plaintiffs' injuries and satisfy standing. Mot. at 12.

Whether a court order will halt *all* climate change by restraining defendants from carrying out fossil fuel activities is the wrong inquiry for at least two reasons. First, redressability does not require certainty, it requires only a substantial likelihood that the Court could provide meaningful relief. *Spokeo,* 578 U.S. at 338. Second, the possibility that some other individual or entity might cause the same injury does not defeat standing—the question is whether the injury *caused by the defendant* can be redressed.

Defendants have not disputed plaintiffs' factual allegations that they produce a quarter of all emissions on Earth. *Juliana*, 947 F.3d at 169. Based on plaintiffs' alleged facts, an order to defendants to refrain from certain fossil fuel activities which are causing plaintiffs' injuries would redress those injuries. On the spectrum of likely to unlikely, a favorable court order is much closer to likely, *i.e.,* substantially likely, to redress plaintiffs' harm.

"Substantially likely" is a *legal* characterization, not an evidence based, scientific number. Quantifying a threshold datapoint at which plaintiffs' harm would be remedied would involve rigorous, disciplined fact-finding, and inevitably would

raise a host of questions: What part of plaintiffs' injuries stem from causes beyond defendants' control? Even if emissions increase elsewhere, will the extent of plaintiffs' injuries be less if they obtain the relief they seek in this lawsuit? When would we reach this "point of no return" that plaintiffs' evidence describes, and do defendants have it within their power to avert reaching it, even without cooperation from third parties? All these questions are inextricably bound up in an evidentiary inquiry, and none of them can be answered at the motion-to-dismiss stage. At this junction, the Court finds that plaintiffs have shown that a favorable decision from this Court would be substantially likely to redress plaintiffs' injuries. Defendants' motion to dismiss is denied as to this issue.

2. The Court's Power to Provide Redress

Defendants assert that the Ninth Circuit determined that the injunction plaintiffs sought in their first amended complaint would "necessarily require a host of complex policy decisions entrusted . . . to the wisdom and discretion of the executive and legislative branches," *Juliana*, 947 F.3d at 1171, decisions "which must be made by the People's elected representatives." *Id.* at 1172. Defendants maintain that, even with amendment, plaintiffs' requested injunctive relief is unavailable, because it would "enjoin the executive branch from exercising discretionary authority" granted to it by statute, and would enjoin Congress from exercising power expressly granted to it by the Constitution. Mot. at 13 (citing the Property Clause, U.S. CONST. art. IV, § 3, cl. 2). In defendants' view, the requested injunction remains beyond a district court's power to award. *Id.*

While crafting and implementing injunctions in cases involving longstanding agency shortcomings may require rigorous, adversarial fact-finding to penetrate questions of science, there is nothing exceptional about a federal court issuing injunctions against federal agencies. *See e.g.*, *Nw. Env't Def. Ctr. v. United States Army Corps of Engineers*, No. 3:18-CV-00437-HZ, 2021 WL 3924046 (D. Or. Sept. 1, 2021) (injunction requiring U.S. Army Corps of Engineers to implement drawdown, spill, and specific fish management actions at its facilities; establishing an expert panel to craft implementation plans; and requiring status reports from agency).

Other federal district courts have similarly ordered agency action, and appellate courts have affirmed that granting this type of injunctive relief falls within the "broad equitable powers" of district courts. *Cobell VI*, 240 F.3d 1081, 1108 (D.C. Cir. 2001); *Gautreaux v. Romney*, 457 F.2d 124, 132 (7th Cir. 1972). Courts may also issue injunctions even when "ordering what is in effect nationwide relief." *Bresgal v. Brock*, 843 F.2d 1163, 1171 (9th Cir. 1987).

Without any explicit statutory command to the contrary, no court has held that these powers *categorically* fail on separation-of-powers grounds. *See* Samuel Buckberry Joyce, *Climate Injunctions: The Power of Courts to Award Structural Relief Against Federal Agencies*, 42 Stan. Env'tl. L.J. 241, 268-281, May 2023 (compiling cases featuring structural injunctions against the federal government).

Familiar instances of large-scale institutional litigation in modern American history include cases that ordered busing to desegregate schools;[19] the treaty rights cases that assured a fair share of fish for American Indian treaty fishers;[20] cases instituting prison condition reform;[21] and cases relating to land use and low-income housing.[22] Legal scholars have cited those cases and explained that injunctions in those cases "aimed to break down, scrutinize, and reform institutional dynamics and practices that caused the government to repeatedly violate fundamental rights of citizens to bring about enduring constitutional and civil rights compliance."[23]

In their first amended complaint, plaintiffs' requested remedy was an injunction requiring the government not only to "cease permitting, authorizing, and subsidizing" fossil fuel use, but also to "prepare a remedial plan subject to judicial approval to draw down harmful emissions." *Juliana*, 947 F.3d at 1170.

When it determined that plaintiffs' requested relief was beyond the power of an Article III court to order, the Ninth Circuit did not offer any explicit guidance on

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19 *See, e.g.*, *Brown v. Bd. of Educ. of Topeka*, 347 U.S. 483 (1954); *Swann v. Charlotte- Mecklenburg Bd. of Educ.*, 402 U.S. 1 (1971); *Milliken v. Bradley*, 418 U.S. 717 (1974); *Green v. Cnty. Sch. Bd. of New Kent Cnty.*, 391 U.S. 430 (1968).

20 *See, e.g.*, *United States v. Washington*, 520 F.2d 676 (9th Cir. 1975); *Washington v. Washington State Com. Passenger Fishing Vessel Ass'n*, 443 U.S. 658 (1979).

21 *See, e.g.*, *Brown v. Plata*, 563 U.S. 493 (2011); *Hudson v. McMillian*, 503 U.S. 1 (1992); *Hutto v. Finney*, 437 U.S. 678 (1978).

22 *See Hills v. Gautreaux*, 425 U.S. 284, 298 (1976).

23 Wood, *Eve of Destruction*, at 262.

how to distinguish other structural injunction cases, where the district court has power to order specific, injunctive relief, from this case, where the relief necessary to redress plaintiffs' injuries is held to be too broad.

Plaintiffs have scaled back the specific directives they at first sought in the injunction in their first amended complaint. At this point in the litigation, where the facts alleged are accepted as true, the Court can only identify one distinction between the injunction plaintiffs' request and the injunctions issued in the structural reform cases described above. In other reform cases, those plaintiffs' obtained injunctions against a single agency for a discreet violation of law. In this case, plaintiffs seek relief on constitutional grounds and historical trust principles against a host of governmental defendants.

The Court appreciates that, under existing precedent, an injunction of the scope plaintiffs first requested, and the "scaled down" request plaintiffs make now, against every named defendant in this suit, would be more expansive than any case of which the Court is aware.

On the other hand, requiring plaintiffs to bring piecemeal statutory actions against individual agencies perpetuates a status quo unlikely to bring about the all-out course correction necessary to avoid the impending crisis. Requiring plaintiffs to file individual suits premised on discreet agency shortcomings may be a viable path to achieving protections for the environment. However, a court order directing the agencies to work together, outside their silos to oversee resolution of a complex,

multiagency problem may prove especially constructive where a practical solution has eluded the entire government for decades.

Such an order has not proven to be necessary—and is perhaps premature—at this point in the case. Plaintiffs' amended request for injunction, though narrower, still treads on ground over which Ninth Circuit cautioned the Court not to step. If the reform plaintiffs seek is to prod a negotiated change of behavior, it is unnecessary to seek injunctive relief at this point to do so. Defendants' motion to dismiss plaintiffs' claim for injunctive relief is granted.

B. Declaratory Relief

Plaintiffs' second amended complaint seeks a declaration that "the national energy system" violates the Constitution and the public trust doctrine. SAC at 143, ¶¶ 1-3. Defendants contend that plaintiffs' claim for declaratory relief must be dismissed, asserting that the declaration is not materially distinct from the declaration plaintiffs sought in their first amended complaint. And defendants argue that plaintiffs cannot satisfy the two prongs for redressability, because an "unbounded declaration" alone will not redress plaintiffs' injuries, and declaring an "energy system" unconstitutional would "functionally declare unconstitutional unspecified laws, regulations, and policies," and such a declaration is therefore not within the power of a federal court. Mot. at 14.

1. Substantial Likelihood of Redress

Under the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.*, courts can grant declaratory relief in the first instance and later consider if further relief is

warranted. "In a case of actual controversy within its jurisdiction, [ ] any court of the United States, upon the filing of an appropriate pleading, may declare the rights and other legal relations of any interested party seeking such declaration, whether or not further relief is or could be sought. Any such declaration shall have the force and effect of a final judgment or decree and shall be reviewable as such." 28 U.S.C. § 2201. "Further necessary or proper relief based on a declaratory judgment or decree may be granted, after reasonable notice and hearing, against any adverse party whose rights have been determined by such judgment." 28 U.S.C. § 2202.

The Supreme Court has long recognized that declaratory judgment actions can provide redressability, even where relief obtained is a declaratory judgment alone. *See generally Franklin v. Massachusetts*, 505 U.S. 788, 803 (1992) *and Utah v. Evans*, 536 U.S. 452 (2002). In *Franklin* and *Evans*, states objected to the technique used by the Census Bureau to count people and those states sued government officials.

In *Franklin v. Massachusetts*, the Supreme Court stated that "[f]or purposes of establishing standing," it did not need to decide whether injunctive relief was appropriate where "the injury alleged is likely to be redressed by declaratory relief," and the court could "assume it is substantially likely that the President and other executive and congressional officials would abide by an authoritative interpretation of the census statute and constitutional provision by the District Court." 505 U.S. at 803. In *Utah v. Evans*, the Supreme Court referenced *Franklin*, explaining that, in terms of its "standing" precedent, declaratory relief affects a change in legal status, and the practical consequence of that change would "amount to a significant increase

in the likelihood that the plaintiff would obtain relief that directly redresses the injury suffered." 536 U.S. 452 (2002).

Other cases recognize the role of declaratory relief in resolving Constitutional cases. *See, e.g.*, *Evers v. Dwyer*, 358 U.S. 202, 202-04 (1958) (ongoing governmental enforcement of segregation laws created actual controversy for declaratory judgment); *Powell v. McCormack*, 395 U.S. 486, 499 (1969) ("A court may grant declaratory relief even though it chooses not to issue an injunction or mandamus.").

Finally, the Supreme Court held that, for the purpose of Article III standing, nominal damages—a form of declaratory relief—provide the necessary redress for a completed violation of a legal right, even where the underlying unlawful conduct had ceased. *Uzuegbunam*, 592 U.S. 279, ---, 141 S. Ct. 792, 802. *Uzuegbunam* illustrates that when a plaintiff shows a completed violation of a legal right, as plaintiffs have shown here, standing survives, even when relief is nominal, trivial, or partial. As Justice Thomas stated, in the context of nominal damages, "True, a single dollar often cannot provide full redress, but the ability to effectuate a partial remedy satisfies the redressability requirement. 592 U.S. at --- ,141 S. Ct. at 801 (quoting *Church of Scientology of Cal. v. United States*, 506 U.S. 9, 13 (1992).

To satisfy redressability under Article III, plaintiffs need not allege that a declaration alone would solve their every ill. To plead a justiciable case, a court need only evaluate "whether the facts alleged, under all the circumstances, show that there is a substantial controversy, between parties having adverse legal interests, of sufficient immediacy and reality to warrant the issuance of a declaratory judgment."

MedImmune, Inc. v. Genentech, Inc., 549 U.S. 118, 127 (2007) (quoting *Md. Cas. Co. v. Pac. Coal & Oil Co.*, 312 U.S. 270, 273 (1941)).

There is nothing in § 2201 preventing a court from granting declaratory relief even if it is the only relief awarded. Section 2201 provides that declaratory relief may be granted "whether or not further relief is or could be sought." *Id.* Under the statute, the relief plaintiffs seek fits like a glove where plaintiffs' request declaratory relief independently of other forms of relief, such as an injunction. *See Steffel v. Thompson*, 415 U.S. 452, 475, (1974) (stating in a different context that "regardless of whether injunctive relief may be appropriate, federal declaratory relief is not precluded."). A declaration that defendants are violating plaintiffs' constitutional rights may be enough to bring about relief by changed conduct.

2. The Court's Power to Provide Redress

As expressed in *Marbury v. Madison*: "It is emphatically the province and duty of the judicial department to say what the law is." 5 U.S. at 177. Over the course of American history, courts have corrected longstanding, systemic wrongs of political branches that encroach on the fundamental rights of citizens.

The judiciary has the unique and singular duty to both declare constitutional rights and prevent political acts that would curb or violate those rights. *Id.* at 167. It is a foundational doctrine that when government conduct harms American citizens, the judiciary is constitutionally required to perform its independent role and determine whether the challenged conduct, not exclusively committed to any branch by the Constitution, is unconstitutional. *Id.* at 176-78.

The Act gives "federal courts competence to make a declaration of rights." *Pub. Affairs Associates v. Rickover*, 369 U.S. 111, 112 (1962). The Supreme Court has found it "consistent with the statute . . . to vest district courts with discretion in the first instance, because facts bearing on the usefulness of the declaratory judgment remedy, and the fitness of the case for resolution, are peculiarly within their grasp." *MedImmune,* 549 U.S. at 136.

A declaratory judgment need not be "unbound" as defendants assert but may precisely describe and quantify the government's obligations. For example, in the landmark treaty fishing cases, courts declared the tribes right to take up to 50 percent of the harvestable quantities of fish. *United States v. Washington*, 520 F.2d 676, 687 (9th Cir. 1975).

Declaratory judgments are thus firmly sited within the core competences of the courts in a way that structural injunctions are not. Declaratory judgments ask courts to declare actions lawful or unlawful, applying legal standards to a set of facts. Unlike structural injunctions, which envision an on-going dialogue between the court and the parties, the declaratory relief model facilitates a dialogue between the parties. Following a court's declaration of rights, which serves as the baseline below which a defendant may not fall, the various stakeholders are left to handle the details.[24]

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[24] *See generally* Emily Chiang, *Reviving the Declaratory Judgment: A New Path to Structural Reform*, 63 Buff. L. Rev. 549 (May 2015) (discussing models of structural reform and encouraging public interest lawyers to consider declaratory relief as an effective and uniquely suited tool for structural reform in the modern age).

From the beginning, the Court has envisioned that the government defendants would be interested in collectively developing a remedial plan of their own making—not of the Court's making—containing measures that they decide are appropriate to bring the agencies into constitutional compliance.

Following a declaratory judgment outlining the constitutional benchmark, a fact-finding stage often requires scientific analysis (a proficiency in which defendants are well-equipped) along with production of data defendants most likely already possess. To avoid complex remedial issues from clouding the foundational task of defining plaintiffs' basic rights and defendants' consequent obligations, the Court would bifurcate the case into a "liability" stage and a "remedy" stage.

The liability stage may allow the Court to specify legal obligations in a declaratory judgment, while the remedy stage demands a more innovative judicial role to supervise the parties in crafting a plan. During the remedy stage, the Court could invoke the usual standards of deference to the agency, while the case remains open under its ongoing jurisdiction so that parties can challenge aspects of the remedy implementation without bringing a new lawsuit.

One model of supervision involves the appointment of a special master to handle complex factual issues, make determinations on recurring issues, and make recommendations to the court. Consent decrees are used in many contexts of long-lasting government violations. Professor Wood points out one notable example in the environmental context that arose from a treaty fishing case, *United States v. Oregon*,

handled by Judge Belloni, U.S. District Court of Oregon.[25] The litigation "culminated in a consent decree" and the Columbia River Fish Management Plan ("CRFMP") became "a model of judicial administration that gained nationwide acclaim."[26]

The CRFMP established a system of co-management between nine sovereigns (states, tribes, and the federal government) managing treaty fisheries in the Columbia River Basin. *See United States v. Oregon*, 699 F. Supp. at 1469 (describing and approving Columbia River Fish Management Plan). The CRFMP set forth detailed management criteria for each fishery, established technical and policy committees, and created a dispute resolution process that involved the court only as a last resort. Professor Wood argues that by "allowing the sovereign parties to identify points of agreement and work out the details of a remedy using their own administrative and scientific expertise, the consent decree process can create an enduring remedy structure to fit complex institutional and biological circumstances."[27]

Defendants have not shown that plaintiffs' claim for declaratory relief falls outside the scope of the Court's authority, where "facts bearing on the usefulness of the declaratory judgment remedy, and the fitness of the case for resolution, are peculiarly within [its] grasp." *MedImmune,* 549 U.S. at 136. Accordingly, defendants' motion to dismiss is denied as to this issue.

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25 Wood, *Eve of Destruction*, at 264 (citing *United States v. Oregon*, 699 F. Supp. 1456, 1469 (D. Or. 1988) (describing and approving the CRFMP)).

26 *Id.*

27 *Id.*

III. Political Question Doctrine

Defendants maintain that plaintiffs' claims present political questions over which the Court lacks jurisdiction. Mot. at 12-19. In defendants' view, plaintiffs ask the Court to "review and assess the entirety of Congress's and the Executive Branch's programs and regulatory decisions relating to climate change and then to pass on the comprehensive constitutionality of all of those policies, programs, and inaction in the aggregate." *Id.* at 17. Defendants assert that no federal court "has ever purported to use the judicial [p]ower to perform such a sweeping policy review." *Id.*

Defendants appear to misunderstand the function of the Court acting within its prescribed authority to declare what the law is—it is not the Court which will perform "a sweeping policy review," it is *defendants*.

There is no need for the Court to step outside its prescribed role to decide this case. At its heart, this lawsuit asks the Court to determine whether defendants have violated plaintiffs' constitutional rights. That question is squarely within the purview of the judiciary. *See INS v. Chadha*, 462 U.S. 919, 941 (1983) (the judiciary is bound to determine whether the political branches have "chosen a constitutionally permissible means of implementing [their] power"); *Jewel v. Nat'l Sec. Agency,* 673 F.3d 902, 912 (9th Cir. 2011) (although lawsuit challenging federal agencies' surveillance practices "strikes at the heart of a major public policy controversy," claims were justiciable because they were "straightforward claims of statutory and constitutional rights, not political questions.").

The Court previously analyzed whether plaintiffs' claims presented a political question under *Baker v. Carr*, 369 U.S. 186 (1962) and adopts that analysis here. *See Juliana v. United States*, 217 F. Supp. 3d 1224, 1235-42 (D. Or. 2016) *rev'd and remanded on other grounds*, 947 F.3d 1159 (9th Cir. 2020). The Ninth Circuit explicitly stated that it did not find that plaintiffs had presented a political question. *Juliana*, 947 F.3d at 1174 n.9 ("Contrary to the dissent, we do not find this to be a political question, although that doctrine's factors often overlap with redressability concerns").

Here the Constitution entrusts defendants with the power to oversee departments and agencies in the executive branch in their administration of the broad range of laws committed to their implementation. Mot. at 18. Speculation about the remedial stage does not support dismissal. *Baker*, 369 U.S. at 198 ("Beyond noting that we have no cause at this stage to doubt the District Court will be able to fashion relief if violations of constitutional rights are found, it is improper now to consider what remedy would be most appropriate if appellants prevail at trial."). Because the Court finds that under *Baker*, the political question doctrine does not impede plaintiffs' claims, defendants' motion to dismiss is denied on this issue.

IV. First Claim for Relief – Due Process Clause of the Fifth Amendment

Plaintiffs allege that the Due Process Clause of the Fifth Amendment recognizes and preserves the fundamental right of citizens to be free from government actions that harm "life, liberty, and property." SAC ¶ 278. Plaintiffs maintain that these "inherent and inalienable rights" reflect the basic societal contract of the

Constitution to protect citizens and "posterity"—future generations—from government infringement upon basic freedoms and basic rights. *Id*. Plaintiffs state that defendants' affirmative aggregate acts have been and are infringing on plaintiffs' liberties, by knowingly creating a destabilized climate system that is causing irreversible harm.

Defendants challenge plaintiffs' due process claims on two grounds. First, they assert any challenge to defendants' affirmative actions (*i.e.*, leasing land, issuing permits) cannot proceed because plaintiffs have failed to identify infringement of a fundamental right or discrimination against a suspect class of persons.

Second, they argue plaintiffs cannot challenge defendants' inaction (*i.e.*, failure to prevent third parties from emitting CO_2 at dangerous levels). Defendants maintain that the Constitution "does not impose an affirmative duty to protect individuals, and plaintiffs have failed to allege a cognizable claim under the "state-created danger" exception to that rule. Mot. at 21.

Defendants state that the Supreme Court has repeatedly instructed courts considering novel due process claims to "exercise the utmost care whenever . . . asked to break new ground in this field, . . . lest the liberty protected by the Due Process Clause be subtly transformed" into judicial policy preferences. *Id*. at 19-20 (quoting *Washington v. Glucksberg*, 521 U.S. 702, 720 (1997)). Defendants maintain that plaintiffs' request to recognize an implied fundamental right to a stable climate system, SAC ¶ 304, "contradicts that directive, because such a purported right is without basis in the Nation's history or tradition." Mot. at 20.

A. Affirmative Government Action and Due Process

The Due Process Clause of the Fifth Amendment to the United States Constitution bars the federal government from depriving a person of "life, liberty, or property" without due process of law. U.S. CONST. amend. V.

When a plaintiff challenges affirmative government action under the Due Process Clause, the threshold inquiry is the applicable level of judicial scrutiny. *Witt v. Dep't of the Air Force*, 527 F.3d 806, 813 (9th Cir. 2008). The default level of scrutiny is rational basis, which requires a reviewing court to uphold the challenged governmental action so long as it "implements a rational means of achieving a legitimate governmental end[.]" *Kim v. United States*, 121 F.3d 1269, 1273 (9th Cir. 1997) (quotation marks omitted). When the government infringes on a "fundamental right," however, a reviewing court applies strict scrutiny. *Witt*, 527 F.3d at 817. Substantive due process "forbids the government to infringe certain fundamental liberty interests at all, no matter what process is provided, unless the infringement is narrowly tailored to serve a compelling state interest." *Reno v. Flores*, 507 U.S. 292, 302, (1993).

It appears undisputed by plaintiffs, and in any event is clear to this Court, that defendants' affirmative actions would survive rational basis review. Resolution of this part of the motion to dismiss therefore hinges on whether plaintiffs have alleged infringement of a fundamental right.

Fundamental liberty rights include both rights enumerated elsewhere in the Constitution and rights and liberties which are either (1) "deeply rooted in this

Nation's history and tradition" or (2) "fundamental to our scheme of ordered liberty[.]" *McDonald v. City of Chicago*, 561 U.S. 742, 767 (2010) (internal citations, quotations, and emphasis omitted). Seemingly "new" fundamental rights are not out of bounds. When the Supreme Court broke new legal ground by recognizing a constitutional right to same-sex marriage, Justice Kennedy wrote that

> The nature of injustice is that we may not always see it in our own times. The generations that wrote and ratified the Bill of Rights ... did not presume to know the extent of freedom in all its dimensions, and so they entrusted to future generations a charter protecting the right of all persons to enjoy liberty as we learn its meaning. When new insight reveals discord between the Constitutions central protections and a received legal stricture, a claim to liberty must be addressed.

Obergefell v. Hodges, 576 U.S. 644, 664 (2015). Thus, "[t]he identification and protection of fundamental rights is an enduring part of the judicial duty to interpret the Constitution . . . [that] has not been reduced to any formula." *Id.* at 663-64 (citation and quotation marks omitted). In determining whether a right is fundamental, courts must exercise "reasoned judgment," keeping in mind that "[h]istory and tradition guide and discipline this inquiry but do not set its outer boundaries." *Id.* at 664. The genius of the Constitution is that its text allows "future generations [to] protect . . . the right of all persons to enjoy liberty as we learn its meaning." *Id.*

Exercising "reasoned judgment," *id.*, the Court finds that the right to a climate system that can sustain human life is fundamental to a free and ordered society.

Defendants contend plaintiffs are asserting a right to be free from pollution or climate change, and that courts have consistently rejected attempts to define such

rights as fundamental. Mot. at 20. Defendants mischaracterize the right plaintiffs assert. Plaintiffs do not object to the government's role in producing any pollution or in causing any climate change; they assert the government has caused pollution and climate change on a catastrophic level, and that if the government's actions continue unchecked, they will permanently and irreversibly damage plaintiffs' property, their economic livelihood, their recreational opportunities, their health, and ultimately their (and their children's) ability to live.

In this opinion, this Court simply holds that where a complaint alleges governmental action is affirmatively and substantially damaging the climate system in a way that will cause human deaths, shorten human lifespans, damage property, threaten human food sources, and dramatically alter the planets ecosystem, it states a claim for a due process violation. To hold otherwise would be to say that the Constitution affords no protection against a government's knowing decision to poison the air its citizens breathe or the water its citizens drink.

How can the judiciary uphold the Constitution's guarantee that the government shall not deprive its citizens of life without due process, while also upholding government "actions that could leave [future generations] a world with an environment on the brink of ruin and no mechanism to assert their rights." *Aji P. v. State*, 198 Wash. 2d 1025, 497 P.3d 350, 351 (2021) (Gonzalez, C.J.) (dissenting). We cannot vow to uphold the Constitution's protection of a God-given right to life, and at the same time, exercise "judicial restraint" by telling plaintiffs that "life" cannot possibly include the right to be free from knowing government destruction of their

ability to breathe, to drink, or to live. "It cannot be presumed that any clause in the [C]onstitution is intended to be without effect." *Marbury*, 5 U.S. at 174. Plaintiffs have adequately alleged infringement of a fundamental right and defendants' motion to dismiss is denied on this issue.

B. Government Inaction Under the Due Process Clause

Plaintiffs allege that "[a]cting with full appreciation of the consequences of their acts, defendants knowingly caused, and continue to cause, dangerous interference with our atmosphere and climate system." SAC ¶ 280. They allege this danger stems, "in substantial part, [from] [d]efendants' historic and continuing permitting, authorizing, and subsidizing of fossil fuel extraction, production, transportation, and utilization." *Id.* ¶ 279. Plaintiffs allege defendants acted "with full appreciation" of the consequences of their acts. *Id.* ¶¶ 278–79. Plaintiffs challenge defendants' failure to limit third-party CO_2 emissions under the danger creation exception stated in *DeShaney v. Winnebago Cnty. Dep't of Soc. Servs.*, 489 U.S. 189 (1989).

The Due Process Clause imposes no duty on the government to protect persons from harm inflicted by third parties that would violate due process if inflicted by the government. *Id.* at 196; *accord Patel v. Kent Sch. Dist.*, 648 F.3d 965, 971 (9th Cir. 2011). As a general matter:

> [The Due Process Clause] is phrased as a limitation on the State's power to act, not as a guarantee of certain minimal levels of safety and security. It forbids the State itself to deprive individuals of life, liberty, or property without "due process of law," but its language cannot fairly be extended to impose an affirmative obligation on the State to ensure that those interests do not come to harm through other means.

DeShaney, 489 U.S. at 194-95. The Ninth Circuit recognizes two narrow exceptions to the no-duty-to-protect rule from *DeShaney*: (1) the "special-relationship" exception, which applies to individuals involuntarily placed in state custody; and (2) the state-created danger exception. *Murguia v. Langdon*, 61 F.4th 1096, 1106 (9th Cir. 2023).

In the Ninth Circuit, a plaintiff challenging government inaction on a danger creation theory must first show the "state actor create[d] or expose[d] an individual to a danger which he or she would not have otherwise faced." *Kennedy v. City of Ridgefield*, 439 F.3d 1055, 1061 (9th Cir. 2006). The state action must place the plaintiff "in a worse position than that in which he would have been had the state not acted at all." *Pauluk v. Savage*, 836 F.3d 1117, 1125 (9th Cir. 2016) (quotation marks omitted and alterations normalized).

Second, the plaintiff must show the "state actor . . . recognize[d]" the unreasonable risks to the plaintiff and "actually intend[ed] to expose the plaintiff to such risks without regard to the consequences to the plaintiff." *Campbell v. Wash. Dep't of Soc. & Health Servs.*, 671 F.3d 837, 846 (9th Cir. 2011) (brackets and quotation marks omitted). The defendant must have acted with "[d]eliberate indifference," which "requires a culpable mental state more than gross negligence." *Pauluk*, 836 F.3d at 1125 (quotation marks omitted).

Defendants assert that applying the *DeShaney* exception to the circumstances of this case would cause the exception to swallow the rule, arguing that "[e]very instance" in which the Ninth Circuit has "permitted a state-created danger theory to proceed has [also] involved an act by a government official that created an obvious,

immediate, and particularized danger to a specific person known to that official." Mot. at 22; *Pauluk*, 836 F.3d at 1129-30 (Murguia, J., concurring in part and dissenting in part) (internal quotation marks omitted). Defendants assert that plaintiffs fail to identify immediate harm to their personal security or bodily integrity and identify no government actions or actors that put them in danger—only general degradation of the climate, without the immediate, direct, physical, and personal harms at issue in the above referenced cases. Mot. at 20.

Plaintiffs' allegations include "[harm to] plaintiffs' dignity, including their capacity to provide for their basic human needs, safely raise families, practice their religious and spiritual beliefs, maintain their bodily integrity, and lead lives with access to clean air, water, shelter, and food." SAC ¶ 283. In the face of these risks, plaintiffs allege defendants "have had longstanding, actual knowledge of the serious risks of harm and have failed to take necessary steps to address and ameliorate the known, serious risk to which they have exposed [p]laintiffs." *Id.* ¶ 285.

Accepting the allegations of the complaint as true, plaintiffs have adequately alleged a danger creation claim. Defendants' arguments do not reflect that *DeShaney* imposes rigorous proof requirements. A plaintiff asserting a danger-creation due process claim must show (1) the government's acts created the danger to the plaintiff; (2) the government knew its acts caused that danger; and (3) the government with deliberate indifference failed to act to prevent the alleged harm. These stringent standards are sufficient safeguards against the flood of litigation concerns raised by defendants.

At the motion-to-dismiss stage, the Court accepts the factual allegations in the complaint as true. Plaintiffs have alleged that defendants helped create the current climate crisis, that defendants acted with full knowledge of the consequences of their actions, and that defendants have failed to correct or mitigate the harms they helped create in deliberate indifference to the injuries caused by climate change. Plaintiffs may therefore proceed with their substantive due process challenge to defendants' failure to adequately regulate CO_2 emissions and defendants' motion to dismiss is denied as to this issue.

V. Second Claim for Relief: Equal Protection Under the Fifth Amendment

Plaintiffs allege that both unborn members of "future generations" and minor children who cannot vote are a suspect classification. SAC ¶¶ 290-301. Plaintiffs state that, for purposes of this action, they should be treated as protected classes because many harmful effects caused by the acts of defendants will occur again. *Id.* ¶ 297. Plaintiffs maintain that the Court should determine they must be treated as protected classes, and federal laws and actions that disproportionately discriminate against and endanger them must be invalidated. *Id.*

Defendants assert that "[n]one of the government actions that [p]laintiffs complain of classify or affect youth or posterity any differently than they affect other persons." Mot. at 29. While plaintiffs' allegations are to the contrary, asserting that future generations will be decidedly more effected by climate change, defendants assert that their actions furthering fossil fuel combustion survive rational basis

review, because plaintiffs cannot allege that there is no conceivable set of facts that could provide a rational basis for defendants' actions. *Id.*

Both the Supreme Court and the Ninth Circuit have held that age is not a suspect class. *City of Dallas v. Stanglin*, 490 U.S. 19, 25 (1989); *United States v. Flores-Villar*, 536 F.3d 990, 998 (9th Cir. 2008). *Stanglin* and *Flores-Villar* both applied rational basis review to governmental action that discriminated against teenagers of a similar age to plaintiffs here. In both cases, that discrimination was found to be permissible if it had a rational basis.

Even if plaintiffs' suspect-class argument were not foreclosed by precedent, the Court would not be persuaded to break new ground in this area. *See Cunningham v. Beavers*, 858 F.2d 269, 273 (5th Cir. 1988) ("No cases have ever held, and we decline to hold, that children are a suspect class.").

Accordingly, defendants' motion to dismiss plaintiffs' equal protection claim based on plaintiffs' constituting a suspect class is granted.

VI. Third Claim for Relief: Unenumerated Rights Under the Ninth Amendment

Plaintiffs' third claim for relief, which is pleaded as a freestanding claim under the Ninth Amendment, alleges that the Nation's founders intended that the federal government would have both the authority and the responsibility to be a steward of our country's essential natural resources. SAC ¶ 303. This stewardship, plaintiffs assert, is clear from the delegation of powers to manage lands and the conveyed authority to address major challenges facing our nation. *Id.* Plaintiffs allege that among the "implicit liberties protected from government intrusion by the Ninth

Amendment" is the right to be "sustained by our country's vital natural systems, including our climate system." *Id.*

Defendants assert that the Ninth Amendment has never been recognized as independently securing any constitutional right, and that this claim must be dismissed. Mot. at 21; *Strandberg v. City of Helena*, 791 F.2d 744, 748 (9th Cir. 1986).

Defendants are correct. Plaintiffs' Ninth Amendment claim is not viable. *Id.* Defendants' motion to dismiss plaintiffs' third claim for relief is granted.

VII. Fourth Claim for Relief: Rights Under Public Trust Doctrine

Plaintiffs' public trust claim arises from the particular application of the public trust doctrine to essential natural resources. The complaint alleges that the overarching public trust resource is our country's life-sustaining climate system, which encompasses our atmosphere, waters, oceans, and biosphere. SAC ¶ 308. Plaintiffs assert that defendants must take affirmative steps to protect those trust resources. *Id.* As sovereign trustees, plaintiffs contend that defendants have a duty to refrain from "substantial impairment" of these essential natural resources. *Id.* ¶ 309. The affirmative aggregate acts of defendants, in plaintiffs' view, in fossil fuel production and consumption have "unconstitutionally caused, and continue to cause, substantial impairment to the essential public trust resources." *Id.*

Plaintiffs allege that defendants have failed in their duty of care to safeguard plaintiffs' interest as the present and future beneficiaries of the public trust, and that such an abdication of duty abrogates the ability of succeeding members of the

Executive Branch and Congress to provide for the survival and welfare of our citizens and to promote the endurance of our nation. *Id*.

Defendants assert that plaintiffs' fourth claim for relief, asserting public trust claims, should be dismissed for two independent reasons. Mot. at 24. First, any public trust doctrine is a creature of state law that applies narrowly and exclusively to particular types of state-owned property not at issue here. *Id*; U.S. CONST. art. IV, § 3, cl. 2 ("The Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States."). Defendants contend there is no basis for plaintiffs' public trust claim against the federal government under federal law. Second, the "climate system" or atmosphere is not within any conceivable federal public trust. *Id*.

The Court has expended innumerable hours in research and analysis of plaintiffs' public trust claim and, in prior orders, determined that plaintiffs have alleged violations of the public trust doctrine in connection with the territorial sea. *See Juliana v. United States*, 217 F. Supp. 3d 1224, 1255 (D. Or. 2016), *rev'd and remanded on other grounds,* 947 F.3d 1159 (9th Cir. 2020). Because the Ninth Circuit did not reach the merits of plaintiffs' claims, the Court incorporates its analysis and legal conclusions, as stated in *Juliana*, 217 F. Supp at 1255-61 (finding that plaintiffs' alleged injuries relate to the effects of ocean acidification and rising ocean temperatures, thus pleadings adequately alleged harm to public trust assets; the public trust doctrine applies to the federal government; the federal government, like the states, holds public assets, including the territorial seas, in trust for the people;

environmental statutes have not displaced the venerable public trust doctrine; and plaintiffs' claims rest "directly on the Due Process Clause of the Fifth Amendment and are enforceable against the federal government.").

Accordingly, the Court finds that plaintiffs have stated a claim under a purported public trust doctrine. Defendants' motion to dismiss plaintiffs' fourth claim for relief is denied.

VIII. Action Under Administrative Procedure Act

Defendants argue that plaintiffs needed to bring their claims under the Administrative Procedure Act ("APA") and failed to do so. Mot. at 32.

The Court finds that the APA does not govern plaintiffs' claims, and that, as a result, plaintiffs' failure to state a claim under the APA is not a ground for dismissing this action. The Ninth Circuit found that "[w]hatever the merits of the plaintiffs' claims, they may proceed independently of the review procedures mandated by the APA." *Juliana*, 947 F.3d at 1167-68. Defendants' motion to dismiss is denied as to this issue. Defendants reserve their right to disagree with the Ninth Circuit's determination on this point but concede that the Ninth Circuit's decision governs, and respectfully preserve their arguments on the applicability of the APA for potential further review.

CONCLUSION

Other courts across the United States have noted that "[w]ith each year, the impacts of climate change amplify and the chances to mitigate dwindle." *Matter of Hawai'i Elec. Light Co., Inc.*, 152 Haw. 352, 359 (2023). The judicial branch of

government can no longer "abdicat[e] responsibility to apply the rule of law." *Id*. at 365 (Wilson, J., concurring). For the reasons explained, Defendants' motion to dismiss the second amended complaint, ECF No. 547, is GRANTED in part and DENIED in part. The Court also DENIES defendants' request to certify for interlocutory review this opinion and order; DENIES defendants' motion for an order certifying its prior order, ECF No. 540, for interlocutory appeal, ECF No. 551; and DENIES defendants' motion to stay litigation, ECF No. 552. The Court GRANTS plaintiffs' motion to set a pretrial conference, ECF No. 543, and ORDERS the parties to confer and contact the Court to schedule a telephonic status conference to discuss next steps in this case.

It is so ORDERED on this day, December 29, 2023.

Ann L. Aiken

/s/Ann L. Aiken
UNITED STATES DISTRICT JUDGE

Exhibit 2

Plaintiffs' second amended complaint, ECF No. 542 (June 8, 2023)

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UNITED STATES DISTRICT COURT

DISTRICT OF OREGON – EUGENE DIVISION

KELSEY CASCADIA ROSE JULIANA; **XIUHTEZCATL TONATIUH M.**, through his Guardian Tamara Roske-Martinez; **ALEXANDER LOZNAK**; **JACOB LEBEL**; **ZEALAND B.**, through his Guardian Kimberly Pash-Bell; **AVERY M.**, through her Guardian Holly McRae; **SAHARA V.**, through her Guardian Toña Aguilar; **KIRAN ISAAC OOMMEN**; **TIA MARIE HATTON**; **ISAAC V.**, through his Guardian Pamela Vergun; **MIKO V.**, through her Guardian Pamela Vergun; **HAZEL V.**, through her Guardian Margo Van Ummersen; **SOPHIE K.**, through her Guardian Dr. James Hansen; **JAIME B.**, through her Guardian Jamescita Peshlakai; **JOURNEY Z.**, through his Guardian Erika Schneider; **VIC B.**, through his Guardian Daisy Calderon; **NATHANIEL B.**, through his Guardian Sharon Baring; **AJI P.**, through his Guardian Helaina Piper; **LEVI D.**, through his Guardian Leigh-Ann Draheim; **JAYDEN F.**, through her Guardian Cherri Foytlin; **NICHOLAS V.**, through his Guardian Marie Venner; and **FUTURE GENERATIONS**, through their Guardian Dr. James Hansen;

Plaintiffs,

Case No.: 6:15-cv-01517-AA

SECOND AMENDED COMPLAINT FOR DECLARATORY AND INJUNCTIVE RELIEF

Constitutional Rights; Declaratory Judgment Action (28 U.S.C. §§ 1331, 2201, 2202)

vs.

The UNITED STATES OF AMERICA; **The OFFICE OF THE PRESIDENT OF THE UNITED STATES**; **BRENDA MALLORY**, in her official capacity as Director of Council on Environmental Quality; **SHALANDA YOUNG**, in her official capacity as Director of the Office of Management and Budget; **ARATI PRABHAKAR**, in her official capacity as Director of the Office of Science and Technology Policy; **The UNITED STATES DEPARTMENT OF ENERGY**; **JENNIFER GRANHOLM**, in her official capacity as Secretary of Energy; **The UNITED STATES DEPARTMENT OF THE INTERIOR**; **DEB HAALAND**, in her official capacity as Secretary of Interior; **The UNITED STATES DEPARTMENT OF TRANSPORTATION**; **PETE BUTTIGIEG**, in his official capacity as Secretary of Transportation; **The UNITED STATES DEPARTMENT OF AGRICULTURE**; **THOMAS J. VILSACK**, in his official capacity as Secretary of Agriculture; **The UNITED STATES DEPARTMENT OF COMMERCE**; **GINA RAIMONDO**, in her official capacity as Secretary of Commerce; **The UNITED STATES DEPARTMENT OF DEFENSE**; **LLOYD AUSTIN**, in his official capacity as Secretary of Defense; **The UNITED STATES DEPARTMENT OF STATE**; **ANTONY BLINKEN**, in his official capacity as Secretary of State; **The UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**; **MICHAEL REGAN**, in his official capacity as Administrator of the EPA;

Defendants.

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INTRODUCTION

1. For over fifty years, the United States of America[1] has known that carbon dioxide ("CO_2") pollution from burning fossil fuels was causing global warming and dangerous climate change, and that continuing to burn fossil fuels would destabilize the climate system on which present and future generations of our nation depend for their wellbeing and survival. Defendants also knew the harmful impacts of their actions would significantly endanger Plaintiffs, with the damage persisting for millennia. Despite this knowledge, Defendants continued their policies and practices of allowing the exploitation of fossil fuels. Specifically, Department of Energy has approved the export of liquefied natural gas ("LNG") from the Jordan Cove LNG terminal in Coos Bay, Oregon. This export terminal will be the largest projected source of CO_2 emissions in Oregon, and will significantly increase the harm that Defendants' actions are causing to Plaintiffs. Defendants have long-standing knowledge of the cumulative danger that their national energy system, and the aggregate actions taken thereunder, are causing Plaintiffs. The Jordan Cove project enhances the cumulative danger caused by Defendants' affirmative aggregate actions.

2. In a 1965 White House Report on "Restoring the Quality of Our Environment," for example, the President's Science Advisory Committee stated: "The land, water, air and living things of the United States are a heritage of the whole nation. They need to be protected for the benefit of all Americans, both now and in the future. The continued strength and welfare of our nation depend on the quantity and quality of our resources and on the quality of the environment in which our people live."

[1] Throughout this Complaint, the terms "United States" or "Federal Government" refer to Defendant United States of America. Alternatively, "U.S." refers to the country, not the Defendant.

3. The United States Environmental Protection Agency ("EPA") in 1990 and the Congressional Office of Technology Assessment in 1991 prepared plans to significantly reduce our nation's CO_2 emissions, stop global warming, and stabilize the climate system for the benefit of present and future generations. Both the EPA's 1990 Plan, "Policy Options for Stabilizing Global Climate," and the OTA's 1991 Plan, "Changing By Degrees: Steps to Reduce Greenhouse Gases," were prepared at the request of, and submitted to, Congress. Despite the imminent dangers identified in both the EPA's 1990 Plan and the OTA's 1991 Plan, Defendants never implemented either plan.

4. Since 1990, Defendants have known that CO_2 levels in the atmosphere must be stabilized at or below 350 parts per million ("ppm") in order to protect our nation's climate system and that a swift transition away from fossil fuels was necessary. Twenty-five years later, today's best science confirms that 350 ppm is the maximum safe level of atmospheric CO_2 required to restore a stable climate system.

5. Defendants have for decades ignored experts they commissioned to evaluate the danger to our Nation, as well as their own plans for stopping the dangerous destabilization of the climate system. Specifically, Defendants have known of the unusually dangerous risks of harm to human life, liberty, and property that would be caused by continued fossil fuel burning. Instead, Defendants have willfully ignored this impending harm. By their exercise of sovereign authority over our country's atmosphere and fossil fuel resources, they permitted, encouraged, and otherwise enabled continued exploitation, production, and combustion of fossil fuels, and so, by and through their aggregate actions and omissions, Defendants deliberately allowed atmospheric CO_2 concentrations to escalate to levels unprecedented in human history, resulting in a dangerous destabilizing climate system for our country and these Plaintiffs.

6. The 1965 Report and the 1990 and 1991 Plans are only examples of the extensive knowledge Defendants have had about the dangers they caused to present and future generations, including Plaintiffs. Since 1965, numerous other studies and reports also have informed Defendants of the significant harms that would be caused if Defendants did not reduce reliance on carbon-intense energy from fossil fuels and rapidly transition to carbon-free energy. These studies and reports concluded that continued fossil fuel dependency would drive the atmospheric concentration of CO_2 to dangerous levels that would destabilize the climate system.

7. Yet, rather than implement a rational course of effective action to phase out carbon pollution, Defendants have continued to permit, authorize, and subsidize fossil fuel extraction, development, consumption and exportation – activities producing enormous quantities of CO_2 emissions that have substantially caused or substantially contributed to the increase in the atmospheric concentration of CO_2. Through its policies and practices, the Federal Government bears a higher degree of responsibility than any other individual, entity, or country for exposing Plaintiffs to the present dangerous atmospheric CO_2 concentration. In fact, the United States is responsible for more than a quarter of global historic cumulative CO_2 emissions.

8. The present level of CO_2 and its warming, both realized and latent, are already in the zone of danger. Defendants have acted with deliberate indifference to the peril they knowingly created. As a result, Defendants have infringed on Plaintiffs' fundamental constitutional rights to life, liberty, and property. Defendants' acts also discriminate against these young citizens, who will disproportionately experience the destabilized climate system in our country.

9. By and through natural gas imports and exports, the Federal Government and the Department of Energy are further enhancing the dangerous climate situation, without due process

and in violation of Plaintiffs' right to equal protection. As noted above, the Jordan Cove LNG Terminal in Coos Bay, Oregon, is the sole LNG export terminal in the Northwest and Oregon's largest projected source of CO_2 emissions. The Department of Energy's approval of LNG exports from the Jordan Cove LNG Terminal heightens the danger to Plaintiffs that Defendants' actions in the aggregate have created. The result is an unconstitutional violation of Plaintiffs' fundamental rights.

10. Plaintiffs are especially vulnerable to the dangerous situation that Defendants have substantially caused. This Court is Plaintiffs' last resort to ensure their reasonable safety, and that of our Posterity, from the harm perpetrated by Defendants. There is an extremely limited amount of time to preserve a habitable climate system for our country; otherwise, the warming of our nation will become locked in or rendered increasingly severe. Recent scientific studies conclude that our country is now in a period of "carbon overshoot," with early consequences that are already threatening and that will, in the short term, rise to unbearable unless Defendants take immediate action to rapidly abate fossil fuel emissions and restore energy balance at a lower atmospheric CO_2 concentration.

11. The current policies, plans, and practices of the Federal Government will not achieve even a proportionate share of the fossil fuel emission reductions that must occur within this century. To the contrary, Defendants' policies, plans, and practices permit, authorize, and subsidize fossil fuel exploitation and consumption, and thus press our climate system further toward irretrievable impacts. A key recent instance is the government's approval of LNG exports from the Jordan Cove LNG Terminal. If Defendants continue to promote such development and further delay rapid, systematic annual emissions reductions, they will ensure a far less hospitable climate system, with far-reaching damage to our nation and Plaintiffs alike.

12. This Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and the government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' Fifth Amendment rights as described herein. Until the Court resolves this constitutional controversy, these young Plaintiffs will continue to be harmed and put at extreme risk by Defendants' energy system and Defendants will continue policies and practice, made up of many aggregate actions, to perpetuate an unconstitutional energy system, avoiding the constitutional check of Article III courts and undermining the separation of powers that the Framers intended. Without declaratory relief in the first instance, Defendants will be free to, and will, continue their policies and practices that make the nation's energy system in a manner that "may hasten an environmental apocalypse" and carry out "the Nation's willful destruction." Declaratory judgment will eliminate the current and substantial legal controversy and inform the parties of the unlawfulness or lawfulness of the government's conduct, especially as to whether Defendants' conduct causes a deprivation of rights secured by the Constitution. It has long been held that there is an expectation in our democracy that government officials will comply with a declaratory judgment. *Utah v. Evans*, 536 U.S. 452, 463-64 (2002). If the constitutional controversy is resolved in their favor by declaratory judgment, Plaintiffs intend to seek further relief as deemed appropriate and consistent with the separation of powers between the three branches of government. Plaintiffs come before this Court to defend and secure their fundamental rights under the Constitution, before it is too late.

JURISDICTION AND VENUE

13. This action is brought pursuant to the United States Constitution. It is authorized by Article III, Section 2, which extends the federal judicial power to all cases arising in equity

under the Constitution. An actual case and controversy exists between Plaintiffs and Defendants because Defendants have established and carried out a national energy system, through policies, practices and aggregate actions, that Plaintiffs claim cause a deprivation of their rights of equal protection, substantive due process, and public trust. An actual case and controversy exists because, while Plaintiffs claim Defendants' national energy system causes Plaintiffs' individual and particularized injuries that rise to a constitutional violation, Defendants deny that their national energy system is unconstitutional and that they are thereby causing a deprivation of Plaintiffs' rights secured by the Constitution. This controversy not only threatens Plaintiffs' lives and liberties, but threatens the very existence of our Republic until it is resolved by our Article III courts. The resolution of that controversy involves questions of scientific, historic, and other factual evidence. Plaintiffs have no adequate remedy at law to redress the harms herein, which are of a continuing nature and which, if left unresolved, will be irreversible.

14. This Court has jurisdiction pursuant to 28 U.S.C. § 1331 (federal question) as this action arises under the laws of the United States. This Court can grant declaratory relief in the first instance and later consider further necessary or proper relief, if warranted, pursuant to the Declaratory Judgment Act. 28 U.S.C. §§ 2201, *et seq.* Specifically, "[i]n a case of actual controversy within its jurisdiction, [ ] any court of the United States, upon the filing of an appropriate pleading, may declare the rights and other legal relations of any interested party seeking such declaration, whether or not further relief is or could be sought. Any such declaration shall have the force and effect of a final judgment or decree and shall be reviewable as such." 28 U.S.C. § 2201. "Further necessary or proper relief based on a declaratory judgment or decree may be granted, after reasonable notice and hearing, against any adverse party whose rights have been determined by such judgment." 28 U.S.C. § 2202. Only the Court has the

authority to declare a government system unconstitutional. No other branch of government can do that. Declaring the United States national energy system to be unconstitutional would resolve the controversy between the parties, thereby redressing a substantial cause of Youth Plaintiffs' constitutional injuries and minimizing and eliminating a source of their significant risk of sustaining worsening injuries.

15. Venue lies in this judicial district by virtue of 28 U.S.C. § 1391(e). The majority of Youth Plaintiffs (as hereinafter defined) reside in this judicial district, some Defendants have offices in this judicial district, and the events, omissions, and harms giving rise to the claims herein arise in substantial part in this judicial district. Pursuant to Local Rule 3-2, divisional venue lies in the Eugene Division because the largest number of Youth Plaintiffs reside in this division of the judicial district, and events, omissions, and harms giving rise to the claims herein arise in substantial part in this division of the judicial district.

PLAINTIFFS

16. Plaintiff **Kelsey Cascadia Rose Juliana** is a citizen of the U.S. and a resident of Eugene, Oregon. Kelsey is 19 years old and was born and raised in Oregon, the state where she hopes to work, grow food, recreate, have a family, and raise children. During the fall of 2014, Kelsey walked 1,600 miles from Nebraska to Washington D.C. in the Great March for Climate Action to raise awareness about the climate crisis. Kelsey is harmed by Defendants' actions and inactions regarding carbon pollution and the resulting climate destabilization and ocean acidification. Specifically, Defendants' actions have caused damage to and continue to threaten the resources on which she relies for her survival and wellbeing. Kelsey depends on the freshwaters of Oregon for drinking, hygiene, and recreation. She drinks the freshwater that flows from the McKenzie River and drinks from springs in the Oregon Cascades on hiking,

canoeing, and backpacking trips. Kelsey also depends upon the marine and estuarine waters of Oregon as a food source and a place of recreation and vacationing. Kelsey spends time along the Oregon coast in places like Yachats and Florence and enjoys playing on the beach, tidepooling, and observing unique marine animals. An important part of Kelsey's diet includes food that comes from the marine waters and freshwater rivers, including salmon, cod, tuna, clams, mussels, and crab. Kelsey also depends upon food grown in Oregon both by small farmers in the Willamette Valley and by her family in their garden.

17. The current and projected drought and lack of snow caused by Defendants are already harming all of the places Kelsey enjoys visiting, as well as her drinking water, and her food sources—including wild salmon. During the summer of 2015, record-setting heat and low water levels killed salmon in Oregon's rivers. In the coming decades, Kelsey will suffer even greater harm from the impacts of ocean acidification and rising sea levels on the marine life she eats for sustenance, and on the beaches, tidepools, and other places she visits along the Oregon coast.

18. In addition to coastal recreation, Kelsey enjoys snowshoeing, cross-country skiing, and snow camping. Warmer winters and declining snowpack make it harder for her to enjoy these winter activities. Kelsey also enjoys rafting, swimming in rivers, snorkeling on rivers, canoeing on lakes, hiking, rock-climbing, and backpacking in the warmer seasons. Increasing summer temperatures, and the resulting algal blooms in the lakes Kelsey visits harm her ability to enjoy these activities and prevent her from drinking the water. Intense wildfires, which also threaten Kelsey's ability to enjoy summer activities. Kelsey has had to abandon camping trips because of nearby wildfires.

19. Defendants have caused psychological and emotional harm to Kelsey as a result of her fear of a changing climate, her knowledge of the impacts that will occur in her lifetime, and her knowledge that Defendants are continuing to cause harms that threaten her life and wellbeing. As a result of the acts and omissions of Defendants, Kelsey believes that she will not be able to continue to do all of the things described in this Complaint for her life, health, and enjoyment, nor will she one day be able to share those experiences with her children.

19-A. Kelsey's individual injuries to her water and food sources, her personal security and safety, her mental wellbeing, her freedom to live, travel, recreate, safely raise children and pursue happiness in her home state of Oregon, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Kelsey's individual injuries each year. Kelsey is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Kelsey is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her water and food sources, her personal security and safety, her mental wellbeing, her freedom to live, travel, recreate, safely raise children, and pursue happiness in her home state of Oregon. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Kelsey. Another separate injury is the deprivation of Kelsey's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which Defendants know is

causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Kelsey's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Kelsey makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Kelsey and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Kelsey can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Kelsey will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the

likelihood that Kelsey would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Kelsey's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Kelsey's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

20. Plaintiff **Xiuhtezcatl Tonatiuh M.**, by and through his guardian and mother Tamara Roske-Martinez, is a 15-year-old citizen of the U.S. who lives in Boulder, Colorado. For nine years, Xiuhtezcatl has advocated for reductions in CO_2 emissions before local, state, federal, and international governmental bodies, including three speeches before the United Nations, and service on the Presidential Youth Council to advise the President of the United States. As the youth director for his organization Earth Guardians, Xiuhtezcatl uses music, dance, art, videos, speeches, testimony, and youth organizing to urge his governments to stop taking actions that promote fossil fuel exploitation and result in dangerous climate change.

21. Of Aztec descent, Xiuhtezcatl engages in sacred indigenous spiritual and cultural practices to honor and protect the Earth. Xiuhtezcatl has suffered harm to his spiritual and cultural practices from Defendants' actions. Climate change also harms Xiuhtezcatl's personal safety, property, and recreational interests through the resulting increased frequency and

intensity of wildfires, drought, declining snowpack, pine-beetle infested forests, and extreme flooding near his home in Colorado. Xiuhtezcatl's home, including the forests that he relies upon for his spiritual, physical, emotional, and mental wellbeing, will continue to die and burn as climate change worsens. Water will become increasingly scarce, adversely impacting every aspect of his life.

22. Xiuhtezcatl is also harmed by the adverse impacts to his air and water quality, and his health that result from the exploitation of fossil fuels in Colorado. Under authorizations by the Department of Energy, natural gas extracted through fracking in Colorado will be transported by pipeline to Oregon, liquefied at the Jordan Cove LNG Terminal in Coos Bay, and then shipped overseas for combustion. The LNG exports from Coos Bay, Oregon will harm Xiuhtezcatl because the export of natural gas enhances demand for natural gas extraction in Colorado and increases the atmospheric concentration of CO_2.

22-A. Xiuhtezcatl's individual injuries to his spiritual and cultural practices, his physical and mental health, his personal security and safety in his home and the forests and waters he relies upon for life sustenance and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Xiuhtezcatl's individual injuries each year. Xiuhtezcatl is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Xiuhtezcatl is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his spiritual and cultural practices, his physical and mental health, his personal security and safety in his home and the forests and waters he relies upon for life sustenance and happiness. The further

loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Xiuhtezcatl. Another separate injury is the deprivation of Xiuhtezcatl's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Xiuhtezcatl's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Xiuhtezcatl makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Xiuhtezcatl and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Xiuhtezcatl can prevent his irreversible injury. If the national energy system remains predominantly fossil

fuel-based, Xiuhtezcatl will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Xiuhtezcatl would obtain relief to safeguard his life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Xiuhtezcatl's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Xiuhtezcatl's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

23. Plaintiff **Alexander Loznak** is a citizen of the U.S. and lives in the unincorporated area of Kellogg, Oregon. He is 18 years old and graduated from Roseburg High School in June 2015. Alex is experiencing harm caused by Defendants. For example, Alex is

gravely concerned about how his life and his family's farm will continue to be affected by climate change.

24. Alex lives on his family's 570-acre farm, the Martha A. Maupin Century Farm ("Maupin Century Farm"), located along the Umpqua River. His great, great, great, great grandmother, Martha Poindexter Maupin, founded the farm in 1868 (she was one of the first women in Oregon to own a ranch) after arriving in the area by way of the Oregon Trail. The Maupin Century Farm is Alex's intellectual and spiritual base and a foundational piece of his life and heritage, and his identity and wellbeing depend on its preservation and protection. However, the drought conditions, unusually hot temperatures, and climate-induced migration of forest species are harming and will increasingly harm Alex's use and enjoyment of the Maupin Century Farm.

25. Alex's ability to fish on local rivers is harmed by drought and hot temperatures. The Pacific Connector Natural Gas Pipeline, which would connect to the Jordan Cove LNG Terminal at Coos Bay, would be located only about 30 miles from the Maupin Century Farm, in a forest where Alex recreates. The Pacific Connector Natural Gas Pipeline would cross bodies of water at 400 different locations in Oregon, including two places on the South Umpqua River where Alex recreates. Alex has walked along the pipeline route and has seen the old growth trees that will be logged and the special rivers that will be impacted in order to deliver natural gas to what would be the largest, most-polluting facility and power plant in Oregon, solely built to liquefy natural gas for export and ultimate combustion.

26. The Maupin Century Farm is also an important source of revenue and food for Alex and his family. On the Farm, Alex and his family grow plum trees and hazelnut trees, raise chickens and grass-fed cows, and have a large garden growing many of the fruits and vegetables

that his family consumes. The record-setting heat waves and drought in Oregon adversely impact both Alex's life and the Farm, especially their hazelnut orchard. The heat waves and drought harm Alex's ability to work outside on the Farm during the summer months.

27. The Maupin Century Farm is home to many different species of wildlife, including deer, bears, mountain lions, and birds, which Alex enjoys seeing. Alex and his family hunt deer, elk, and wild turkeys to provide food. Each of these species of wildlife is adversely impacted by climate change caused by Defendants. Other food sources for Alex, including crab and seafood, are negatively impacted by ocean acidification, warming, and sea level rise caused by Defendants.

28. The health and bodily integrity of his family and their Farm, which they rely on for food and as a source of income—as well as for their personal wellbeing—increasingly are harmed by climate change caused by Defendants. The Maupin Century Farm has been passed from generation to generation in Alex's family, and in many ways Alex's future depends on that family farm. He would like to reside at, raise children on, and retire to the Maupin Century Farm, but he is concerned about how it will be further damaged by climate change caused by Defendants. Wildfires, more common and more destructive due to warmer summers and drought conditions, are increasingly common in Southern Oregon. The area where Alex lives is frequently smoky due to nearby wildfires during the warmer months. Additionally, Alex is allergic to pollen and suffers worse in unseasonably warm years. He also suffers from asthma, which is worse in the increasingly smoky summer months. Alex's allergies and asthma will worsen as climate change caused by Defendants worsens.

29. For recreation, Alex enjoys activities in the snow in Oregon and also hiking in Northern Washington and Glacier National Park, where he has seen the glaciers receding due to

climate change caused by Defendants. Alex plans to return to Montana, and he also plans to travel to Alaska, and his recreational and aesthetic interests are harmed as the glaciers continue to disappear before he can visit them.

30. Alex has taken individual action to try to protect the climate system by driving an efficient hybrid car, by starting a Climate Change Club at Roseburg High School with the goal of installing solar panels on the school's roof, by starting the League of Umpqua Climate Youth ("LUCY"), and by lobbying his state legislators to pass comprehensive climate legislation.

30-A. Alex's individual injuries to his health, his food sources, his home, his personal security and safety, his ability to work outside for part of the year, his family farm heritage, his freedom to live, travel, and recreate where he wants in the United States, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Alex's individual injuries each year. Alex is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Alex is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his health, food sources, personal security and safety, ability to work, and protect his family farm. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Alex. Another separate injury is the deprivation of Alex's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to

prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Alex's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Alex makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Alex and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Alex can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Alex will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Alex would obtain relief to safeguard his life, liberty, property, and

equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Alex's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Alex's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

31. Plaintiff **Jacob Lebel** is an 18-year-old citizen of the U.S. residing in Roseburg, Oregon. In 2000, Jacob and his family immigrated to Oregon from Quebec, Canada, attracted by the state's pristine landscape and temperate weather. Since then, Jacob's family has established Rose Hill Farms, a diverse, organically managed farm, as well as a thriving local medical practice at White Oak Medical Clinic. Jacob grew up working on Rose Hill Farms, where he currently spends most of his time. Jacob intends to continue his use and enjoyment of Rose Hill Farms for these purposes and for his vocational career in the future. Jacob derives educational, inspirational, spiritual, and other benefits from his work at the Farm. Jacob is harmed and will continue to be harmed by Defendants' actions described herein and the climate change impacts to the Farm, including the deterioration of the Farm environment, rising temperatures, and a dwindling water supply.

32. In the summer, Rose Hill Farms depends on home-dug ponds to irrigate a large garden and three greenhouses, as well as several orchards of more than four hundred fruit and

nut trees. The recent long, dry summers, droughts, and heat waves reduced, and are currently reducing, the supply of water in the ponds, just as the water needs of the crops and trees have increased. As climate impacts continue to grow in severity, so will this water shortage. Furthermore, experts predict that large destructive wildfires, aggravated by record-low snowpacks and consistently drier and hotter conditions, will become increasingly common in Oregon. A wildfire would destroy the fourteen years of work that have gone into making the Rose Hill Farms. In addition to the farm structures, orchards, greenhouses, and pastures at risk from a fire, approximately 70 percent of the 350 acres of land owned by Jacob's family is mixed conifer forest which they manage sustainably and which represents an enormous investment. Already, Jacob and his family are required to invest resources to install an irrigation system in order to contend with the increasing drought conditions as a result of climate destabilization caused by Defendants.

33. Throughout Jacob's life, wilderness and healthy natural environments have been essential parts of his spiritual and emotional wellbeing. Jacob frequently and regularly recreates in the natural areas of Oregon, through hiking, exploring, snowboarding, and rafting. Native ecosystems and animal species have always been the main source of inspiration for Jacob's writing, music, and poetry. Jacob also spends significant time fishing, gathering mussels, and crabbing as a source of both enjoyment and food for himself and his family. Jacob intends to continue all of these activities in the future. In 2014-2015, Jacob experienced drastic snow retreat on Crater Lake National Park and Mount Hood, as well as the nearby South Umpqua River drying up in some spots, adversely affecting his use and enjoyment of these areas. Low river flows and warm water temperatures all have contributed and contribute to losses of fish in the salmon runs in the rivers near Roseburg, on which Jacob relies for recreation and food.

Rising sea levels caused by Defendants threaten the natural areas of the Oregon coast used and enjoyed by Jacob. Ocean acidification caused by Defendants has already begun to adversely impact shellfish along the coast, and is projected to take its toll on crabs, mussels, and all shelled seafood. Jacob is adversely affected by these changes caused by Defendants' actions as described herein.

34. The Pacific Connector Natural Gas Pipeline, which would connect to the Jordan Cove LNG Terminal at Coos Bay, would run directly behind the Rose Hill Farms. The Pacific Connector Natural Gas Pipeline would adversely affect Jacob's aesthetic, inspirational, and spiritual enjoyment of the property. This pipeline also carries risks of dangerous leaks or explosions, which could trigger a wildfire in the hot summer months. The associated hundred-foot clear-cut area would affect the landscape integrity and biodiversity of Jacob's immediate surroundings, all of which adversely impact Jacob.

34-A. Jacob's individual injuries to his farm and livelihood, his food and water sources, his physical, spiritual and mental health, his personal security and safety in his home and the snow and waters he relies upon for life sustenance and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Jacob's individual injuries each year. Jacob is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Jacob is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his farm and livelihood, his food and water sources, his physical, spiritual and mental health, his personal security and safety in his home and the snow and waters he relies upon for life sustenance and happiness. The further loss

of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Jacob. Another separate injury is the deprivation of Jacob's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Jacob's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Jacob makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Jacob and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Jacob can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Jacob will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Jacob would obtain relief to safeguard his life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Jacob's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Jacob's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

35. Plaintiff **Zealand B.**, by and through his guardian and mother Kimberly Pash-Bell, is an 11-year-old citizen of the U.S. and a resident of Eugene, Oregon. Zealand has worked to increase community awareness about climate change caused by Defendants and has advocated before local and state governmental bodies for science-based government action on climate change. Zealand and his family minimize their impact on the environment and reduce their carbon footprint by biking, gardening, participating in community-supported agriculture, buying

locally-made products, and picking up litter in the places where they recreate. Zealand has experienced and will continue to experience harm from climate change caused by Defendants if immediate action is not taken to secure a stable climate system.

36. Zealand loves living in Oregon and hopes to stay in Oregon in the future. He enjoys skiing, biking, rock climbing, rafting, and camping in Oregon. Oregon's rivers are especially important to Zealand. While rafting along the rivers in Oregon, Zealand enjoys the solitude of the wilderness and the experience of seeing plants and animals in their natural habitat. Rafting trips with his family have been canceled or shortened due to the increased temperatures, drought, and reduced water levels. Zealand and his family twice experienced large forest fires while rafting on Oregon rivers.

37. The record-setting heat during the summer of 2015 adversely impacts Zealand and his enjoyment of outdoor activities by making bike-riding, playing soccer, and playing basketball difficult. Zealand suffers from allergies, which have increased in severity over the past few years, and caused him to decrease the amount of time that he spends outside in the spring and early summer. Heat waves and an increase in pollen counts will worsen with further climate change caused by Defendants and harm Zealand's recreational and health interests.

38. Warmer winters and decreased snowpack levels in Oregon have harmed, and will continue to harm, Zealand and his family. Zealand's mother usually works during the winter at the Willamette Pass ski resort, but that seasonal job was not available during the winter of 2014-2015 due to the lack of snow, resulting in lost income. The lack of snow also meant Zealand was unable to ski. Decreased snowpack levels in the future will also harm the availability of drinking water for Zealand, his family, and his community, as Eugene's only water source, the McKenzie River, is fed by melting snowpack.

39. Zealand and his family spend substantial time at the Oregon Coast. He enjoys playing in the dunes, camping, surfing, boogie boarding, and taking pictures of the ocean and surrounding areas. The impacts from warmer water temperatures, rising sea levels, and ocean acidification caused by Defendants will negatively impact Zealand's future ability to enjoy the same areas on the coast that he now loves and to eat the same seafood, which is an important part of his diet.

39-A. Zealand's individual injuries to his physical and mental health, his personal security and safety in his home and the snow, forests, and waters he relies upon for life sustenance and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Zealand's individual injuries each year. Zealand is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Zealand is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his physical and mental health, his personal security and safety in his home and the snow, forests, and waters he relies upon for life sustenance and happiness. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Zealand. Another separate injury is the deprivation of Zealand's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to

prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Zealand's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Zealand makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Zealand and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Zealand can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Zealand will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Zealand would obtain relief to safeguard his life, liberty, property,

and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Zealand's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Zealand's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

40. Plaintiff **Avery M.**, by and through her guardian and mother Holly McRae, is a 10-year-old citizen of the U.S. and a resident of Eugene, Oregon. Avery has worked to increase awareness in her community about impacts of climate change caused by Defendants and advocated for CO_2 reductions before her representatives at both the municipal and state levels. Avery and her family limit their carbon footprint as much as possible by recycling, biking, eating less meat and growing some of their own food, repairing, reusing, and buying second-hand goods, decreasing energy use at home, and minimizing their vehicle and air travel.

41. The impacts from climate change caused by Defendants are harming and will continue to harm Avery and her enjoyment of and interaction with nature and wildlife. Avery's favorite activity is swimming in natural bodies of water. Avery and her family enjoy boating, hiking, backpacking, camping, and watching salmon spawn throughout Oregon. In 2015, Avery was not been able to participate in these recreational activities as frequently as past years due to warmer temperatures, drought, low water levels, forest fires, and algal blooms. The 2015

summer heat has caused Avery to avoid outdoor activities to prevent becoming overheated. Avery also suffers from allergies, which will worsen with increased pollen count and a changing climate caused by Defendants. Avery enjoys taking vacations to Yellowstone with her family and has seen burned, beetle-killed forests on these trips. The increase of hungry bears in the area due to the decline in white bark pine trees forced her family to postpone Avery's first big backpacking trip in the area.

42. Climate change caused by Defendants has reduced snowpack levels in Oregon, negatively impacting Avery's enjoyment of winter activities and the future availability of drinking water for her and her family. Every winter, Avery takes a trip with her family to Clear Lake, where she enjoys snowshoeing and sledding. These winter activities were not possible from 2013-2015 due to lack of snow.

43. Avery enjoys eating seafood and going to the Oregon coast, where she wades in the water and explores tide pools. At the coast, Avery has noticed coastal erosion and her recreational experience is harmed by seeing dead wildlife from the coastal changes. Warmer water temperatures, sea level rise, and ocean acidification caused by Defendants will worsen and negatively impact Avery's enjoyment of the Oregon coast and the food she eats.

43-A. Avery's individual injuries to the waters of Oregon, her food sources, her physical and mental health, and the places in nature she relies upon for life, sustenance, and happiness, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Avery's individual injuries each year. Avery is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Avery is also injured by each passing year

of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her water and food sources, her physical and mental health, and the places in nature she relies upon for life, sustenance, and happiness. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Avery. Another separate injury is the deprivation of Avery's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Avery's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Avery makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Avery and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world

as to whether Avery can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Avery will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Avery would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Avery's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Avery's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

44. Plaintiff **Sahara V.**, by and through her guardian and mother Toña Aguilar, is an 11-year-old citizen of the U.S. and a resident of Eugene, Oregon. Sahara is experiencing harm as a result of Defendants' aggregate actions and omissions in causing climate change. Sahara has

been involved in both local and state initiatives to raise awareness about climate change and advocate for science-based CO_2 emission reductions. In order to reduce her impact on the environment, Sahara and her family bike, garden, recycle, and practice vegetarianism. Sahara spends time with her family recreating in Oregon's rivers, lakes, beaches, sand dunes, and forests. She enjoys swimming, biking, camping, and mushroom hunting. Sahara frequently visits her grandparents' home on the Mohawk River and has witnessed the water levels decrease dramatically.

45. Climate impacts caused by Defendants, such as increased temperatures and drought conditions, infringe upon Sahara's enjoyment and use of freshwater resources and will continue to do so in the future if immediate action is not taken to reduce CO_2 emissions. Sahara and her family take frequent trips to the Oregon coast to visit her grandparents, who own property in Yachats. On the Oregon coast, Sahara enjoys climbing rocks and sand dunes, swimming, and tidepooling to see marine life. Sahara's enjoyment of these activities is being increasingly harmed in the future by sea level rise, greater erosion, enhanced ocean acidification, and increased water temperatures.

46. Sahara has asthma, and the increased frequency of forest fires in Oregon, due to hotter and drier conditions, has triggered severe asthma attacks for Sahara. The smoke inhibits her ability to breath, causes her throat to close up, and necessitates the use of her inhaler. As a result of Defendants' actions in causing climate change, Sahara has become more susceptible to grass allergies, further aggravating her asthma. These health effects will worsen as climate change becomes more severe. Warmer winters and the lack of snow in Oregon have prevented Sahara's enjoyment of winter activities and will negatively impact her water supply in the future.

Sahara wants to stay in Oregon, yet she fears her children and grandchildren will be unable to experience and enjoy Oregon's natural resources and wildlife.

46-A. Sahara's individual injuries to her physical and mental health, water and food sources, her personal security and safety, her ability to seek sustenance and happiness in the natural places she enjoys, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Sahara's individual injuries each year. Sahara is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Sahara is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to physical and mental health, water and food sources, her personal security and safety, her ability to seek sustenance and happiness in the natural places she enjoys. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Sahara. Another separate injury is the deprivation of Sahara's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Sahara's

injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Sahara makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Sahara and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Sahara can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Sahara will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Sahara would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Sahara's injuries at the hands of her government will end, providing substantially

meaningful partial redress of her injuries. The Court will thereby preserve Sahara's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

47. Plaintiff **Kiran Isaac Oommen** is an 18-year-old citizen of the U.S. and a resident of Eugene, Oregon. Kiran enjoys camping, hiking, kayaking, biking, and swimming in Oregon. In recent years, decreased water levels and rising temperatures have limited Kiran's enjoyment of both these activities and the special places in Oregon Kiran visits. Local Oregon produce and seafood are staples in Kiran's diet. Ocean acidification and the warmer water temperatures and lower water levels in rivers and streams have negatively impacted Kiran's ability to enjoy eating shellfish and salmon. Kiran enjoys cross-country skiing in the winter, but was not able to ski in 2015 due to the lack of snow in Oregon. Kiran enjoys visiting the Oregon coast to walk along the beach, swim, and go tidepooling. Impacts of climate change, such as sea level rise, will negatively impact Kiran's future ability to enjoy the Oregon coast.

48. Due to drastic seasonal variations, Kiran has endured increasingly severe grass and tree pollen allergies, making it difficult for them to enjoy outdoor activities. Kiran used to be able to regularly visit their friend's family farm in southern Oregon but the increased prevalence of forest fires due to dry conditions and high temperatures has impacted Kiran's ability to visit this farm, as the intensity of the smoke and ash have shortened their trips and inhibited their ability to breathe.

49. Kiran has family they visit in Olympia, Washington and near Miami, Florida, both areas scientists predict will be gravely impacted by sea level rise. When Kiran visited Florida in the past, they enjoyed seeing wildlife and experiencing the beauty of the Florida Keys, which is a place Kiran plans to visit again. Kiran would like to continue visiting their family in these coastal areas in the future, but the increasing severity of climate impacts, unless promptly abated, will prevent them from doing so – as large portions of these areas will be inundated by the rising seas.

49-A. Kiran's individual injuries to their water and food sources, their personal security and safety, their mental wellbeing, and their freedom to live, travel, and recreate safely, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Kiran's individual injuries each year. Kiran is additionally injured by each passing year of losing the ability to prevent the worsening of their injuries. Kiran is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to their water and food sources, their personal security and safety, their mental wellbeing, and their freedom to live, travel, and recreate safely. The further loss of the ability to protect their life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Kiran. Another separate injury is the deprivation of Kiran's ability to act in their own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect their life, all the while suffering these ongoing harms each year from Defendants' national energy

system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Kiran's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Kiran makes to safeguard their life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Kiran and which foreclose their ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Kiran can prevent their irreversible injury. If the national energy system remains predominantly fossil fuel-based, Kiran will permanently lose their ability to obtain relief that will protect themself and their rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the

likelihood that Kiran would obtain relief to safeguard their life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Kiran's injuries at the hands of their government will end, providing substantially meaningful partial redress of their injuries. The Court will thereby preserve Kiran's opportunity to obtain relief to safeguard their life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

50. Plaintiff **Tia Marie Hatton** is a citizen of the U.S. and a resident of Bend, Oregon. She is 18 years old and will enter the University of Oregon in September 2015. For the past two years Tia has experienced pronounced climate change impacts in Bend and surrounding areas. Tia is an avid Nordic skier, and has skied competitively since middle school. During 2013-2015, her ability to ski was limited by the record low snowfall in the Bend area. Tia regularly skis at Virginia Meissner Sno-Park and Willamette Pass Resort. These areas were closed this past winter because of record low snowfall. In 2015, ski teams from across Oregon, including Tia's team, had to move their state competition to higher elevations at Mt. Bachelor where trails were limited and not well groomed. In the future, unless the severe impacts to our nation's climate system are immediately abated, she will not be able to ski at all, even at higher elevations.

51. For the 2015 summer, Oregon's Governor issued a drought declaration for Deschutes County, where Tia lives. Tia spends most of her time recreating outdoors, not only skiing, but cross-country running, rock climbing, hiking, camping, and kayaking. Warmer summer temperatures and forest fires in Deschutes National Forest south of Bend are preventing Tia from participating in these activities as often as she would like and once could. For the past several years there have been fires every summer in the forests surrounding Bend, and residents have had to evacuate. Tia is psychologically impacted by these events, as it is hard for her to watch the destruction of the wilderness she loves and its ecosystems. Tia and her family vacation around Oregon and have experienced coastal erosion in Seaside, Florence, and Newport. Tia has also experiences the climate impacts similar to those in the Bend area when she visits the Steens Mountain for running camp.

52. Tia works hard to protect the environment and create awareness about the impacts of climate change caused by Defendants. In high school she was a member of her school's Green Club, and spent time planning Earth Day activities to raise awareness and educate the student body. Tia tries to limit her transportation via cars and is participating in the Bend Energy Challenge, a nationwide energy-saving competition, to help her family save energy and make their home healthier.

52-A. Tia's individual injuries to her physical and mental wellbeing, her personal security and safety, and the snow that she depends on for her health and her pursuit of happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Tia's individual injuries each year. Tia is additionally injured by each passing year of losing the ability to prevent the

worsening of her injuries. Tia is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her physical and mental wellbeing, her personal security and safety, and the snow that she depends on for her health and her pursuit of happiness. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Tia. Another separate injury is the deprivation of Tia's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Tia's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Tia makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Tia and which foreclose her ability to obtain relief that will protect herself. The composition of the United

States national energy system is the most important factor in the world as to whether Tia can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Tia will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Tia would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Tia's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Tia's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

53. Plaintiff **Isaac V.**, by and through his guardian and mother, Pamela Vergun, is a thirteen-year-old U.S. citizen and a resident of Beaverton, Oregon. Isaac is involved in climate

activism and he founded Plant for the Planet Academy in Oregon, along with his mom and sister. Isaac started a petition asking the city of Beaverton to adopt a resolution to lower the city's carbon emissions. At home, his family installed solar panels on their roof and they drive an electric vehicle.

54. Isaac and his family are experiencing the adverse impacts of climate change caused by Defendants. 2015 has been the hottest summer Isaac remembers, with temperatures at 100 degrees Fahrenheit in his hometown. The groundwater level in his backyard has dropped significantly, causing trees to die. Isaac enjoys recreating along the Spring Water Trail near Portland, Oregon and is harmed by the drought conditions, which have eliminated a substantial portion of the flow in Johnson Creek. In parts of southern and eastern Oregon, wildfires are tearing through forests where Isaac enjoys recreating, threatening the ecosystems he relies upon for his personal enjoyment.

55. In winter, Isaac recreates in the Oregon snow and thereby derives emotional, spiritual, and physical benefits. He intends to continue his use and enjoyment of the snow. The record-low snowfall across the state, caused by Defendants' actions and the climate change resulting from those actions, harms Isaac by reducing his opportunity to recreate in the snow.

56. Since he was very young, Isaac has had asthma. Isaac's asthma is worsening and will continue to worsen as air quality becomes more polluted from increased pollen counts and smoke from wildfires. Isaac enjoys athletic activities including hiking, soccer, and basketball. He intends to continue these activities in the future. Increasing temperatures caused by Defendants' actions will worsen his asthma, affect his athletic performance, and make him less likely to play sports.

56-A. Isaac's individual injuries to his lungs and his overall physical and mental health, as well as his personal security and safety, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Isaac's individual injuries each year. Isaac is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Isaac is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his overall physical and mental health, as well as his personal security and safety. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Isaac. Another separate injury is the deprivation of Isaac's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Isaac's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Isaac makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as

constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Isaac and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Isaac can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Isaac will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Isaac would obtain relief to safeguard his life, liberty, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Isaac's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Isaac's opportunity to obtain relief to safeguard his life, liberty, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial

federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

57. Plaintiff **Miko V.**, by and through her guardian and mother, Pamela Vergun, is a 14-year-old citizen of the United States and a resident of Beaverton, Oregon. Miko is a climate activist. Along with her Mother and brother, Miko started the first Plant for the Planet Academy in Oregon to help plant 150 trees per person in the United States to combat deforestation. She is spreading awareness to other young people and working to educate adults about the climate crisis. At home, her family has solar panels on their roof and they use an electric hybrid vehicle to reduce their emissions when they drive. Miko is committed to living a low-carbon lifestyle.

58. Miko was born in the Marshall Islands, and her low-lying home island is threatened by sea level rise. She fears she will never be able to travel back to the Marshall Islands as she intends to because the islands will likely be underwater in the future. In the last couple of years, Miko has experienced record-breaking heat waves in Beaverton and Portland, Oregon. Miko recently visited Timothy Lake, 75 miles southeast of Beaverton, to swim and fish, but the water levels were lower than usual, negatively impacting her use and enjoyment of the area.

59. Seafood is an important part of Miko's diet. Ocean acidification and warming ocean, coastal, and river waters are negatively affecting the health of fish and sea life on which Miko depends.

59-A. Miko's individual injuries to her familial heritage and land, her food sources, her personal security and safety, her mental wellbeing, and her freedom to travel to and spend time in the Marshall Islands, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Miko's individual injuries each year. Miko is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Miko is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her familial heritage and land, her food sources, her personal security and safety, her mental wellbeing, and her freedom to travel to and spend time in the Marshall Islands. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Miko. Another separate injury is the deprivation of Miko's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Miko's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Miko makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to

power it with fossil fuels at levels that are dangerous for Miko and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Miko can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Miko will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Miko would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Miko's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Miko's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

60. Plaintiff **Hazel V.**, by and through her guardian and mother Margo Van Ummersen, is an 11-year-old citizen of the U.S. and a resident of Eugene, Oregon. Hazel has advocated in her community to raise awareness about climate change caused by Defendants and before her city leaders to ask for science-based reductions of CO_2 emissions. Hazel and her family reduce their carbon footprint by gardening, recycling, buying local products, biking, and walking.

61. Hazel enjoys swimming, canoeing, kayaking, camping, and hiking in Oregon. In recent years, she has been unable to fully enjoy these activities and special places she visits due to the increased temperatures, low water levels, and abnormal seasonal variations caused by the acts and omissions of Defendants. Hazel frequently visits the Oregon coast, where she enjoys bodysurfing, playing on the beach, tidepooling, harvesting seaweed, and hunting mushrooms. Increased surface and ocean temperatures, sea level rise, and ocean acidification caused by the acts of Defendants threaten Hazel's future ability to enjoy these activities, which are important aspects of her childhood. Salmon and seafood are important parts of Hazel's diet that will continue to be threatened due to increased water temperatures, drought, and ocean acidification caused by the acts of Defendants.

62. During the winter, Hazel enjoys skiing and sledding. However, due to declining snowpack and warmer winters, she has been unable to ski or sled. Decreased snowfall in the Cascades will have long-term adverse impacts on the water level in the McKenzie River, which provides drinking water to Hazel's hometown of Eugene. In June 2015, extreme heat caused by the acts of Defendants adversely impacted Hazel's health on a trip she took to Washington, D.C. During that trip, she suffered from two episodes of heat exhaustion.

62-A. Hazel's individual injuries to her personal security and safety, her mental wellbeing and physical health, and her freedom to live, recreate, and pursue happiness, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Hazel's individual injuries each year. Hazel is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Hazel is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her personal security and safety, her mental wellbeing and physical health, and her freedom to live, recreate, and pursue happiness. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Hazel. Another separate injury is the deprivation of Hazel's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Hazel's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Hazel makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Hazel and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Hazel can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Hazel will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Hazel would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Hazel's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Hazel's opportunity to obtain relief to safeguard her life, liberty, property, and equal

protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

63. Plaintiff **Sophie K.**, by and through her guardian and grandfather, Dr. James Hansen, is a 16-year-old citizen of the U.S., and a resident of Allentown, Pennsylvania. Through stories from her grandfather, Dr. James Hansen, Sophie has become passionate about climate science and feels a sense of urgency and responsibility to compel government action on climate change. Extreme weather events, including Hurricane Sandy, caused Sophie to miss school on many occasions; hailstorms have damaged her house; floodwaters often inundate roads by her house; and Sophie has even been forced to prepare for tornado warnings, which are very unusual for the area where she lives. Intense summer heat now diminishes Sophie's ability to participate in and enjoy outdoor activities, including track and tennis. Sophie would like to have the ability to one day live in coastal cities like New York or Los Angeles, but rising sea levels may inundate these coastal areas within Sophie's lifetime unless Defendants cease their actions that otherwise will soon ensure these catastrophic impacts. Sophie is distressed knowing the inundation of these, and other coastal hubs of our nation's economy and commerce, will have profoundly negative economic impacts on our nation and on her own life as she gets older, looks for work to support herself, and begins her professional career.

64. Climate change substantially caused by the acts of Defendants is harming, and will continue to harm, the ability of Sophie and her family to grow food in her garden as the population of bees and other pollinators decline. In 2015, Sophie's health was adversely impacted for the first time by pollen allergies, a condition exacerbated by global and regional

warming. Extreme weather events, intense heat, and rising seas have had, and will increasingly have, a negative impact on Sophie. Sophie is deeply concerned about the future because she knows that climate change will not only harm her, but will also harm the entire fabric of human civilization and all living things on Earth that she cherishes and relies on for her life, liberties, and property.

64-A. Sophie's individual injuries to her food sources, her personal security and safety, her physical health and mental wellbeing, and her freedom to live in coastal areas and to pursue her happiness, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Sophie's individual injuries each year. Sophie is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Sophie is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her food sources, her personal security and safety, her physical health and mental wellbeing, and her freedom to live in coastal areas and to pursue her happiness. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Sophie. Another separate injury is the deprivation of Sophie's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being

progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Sophie's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Sophie makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Sophie and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Sophie can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Sophie will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Sophie would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system

unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Sophie's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Sophie's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

65. Plaintiff **Jaime B.**, by and through her guardian and mother Jamescita Peshlakai, is a 14-year-old citizen of the U.S. and a resident of Flagstaff, Arizona. Jaime is a member of the Navajo Nation. Jaime was born into the Bitter Water Clan, with maternal grandfathers of the Red House Clan and paternal grandfathers of the Towering House Clan. Jaime and her family are experiencing harm from climate change caused by the acts of Defendants and will experience even more severe climate impacts in the future. Since she was four years old, Jaime has been working to protect the earth. Beginning in elementary school, Jaime has written letters to President Obama about her concerns for the environment, asking him to protect the Arctic National Wildlife Refuge and ensure that oil spills do not continue to happen.

66. Jaime grew up in Cameron, Arizona, on the Navajo Nation Reservation. In 2011, Jaime and her Mother had to move from Cameron to Flagstaff because of water scarcity. Jaime and her extended family on the Reservation remember times when there was enough water on the Reservation for agriculture and farm animals, but now the springs they once depended on year-round are drying up. Jaime and her Mother were not able to sustain living on the

Reservation because of the costs of hauling water into Cameron for themselves and their animals. Jaime is worried that her extended family, all of whom live on the Reservation, will also be displaced from their land, which will erode her culture and way of life. Participating in sacred Navajo ceremonies on the Reservation is an important part of Jaime's life, and climate impacts caused by the acts of Defendants are starting to harm the ability for Jamie and her tribe to participate in their traditional ceremonies.

67. Jaime now lives on property her Mother owns in the Kaibab National Forest. The forest is Jaime's favorite place to spend time. Jaime finds peace being outside in the forest surrounding her home, and she walks for 1-2 hours in the forest after school every day. Jaime's ability to spend time in the forest is going to be limited due to increasing climate change caused by the acts of Defendants. Large parts of the Kaibab National Forest have been destroyed due to pine beetle infestations and forest fires. In 2014, Jaime and her Mother were evacuated from their home for two days because of the Oak Creek Canyon fire north of their property. Winds brought smoke and ash into their neighborhood. Jaime is worried that the area surrounding their home is becoming unsafe due to an increase in drought conditions and forest fires caused by the acts of Defendants. Jaime and her Mother have seen climate change impact the vegetables they grow for food on their property in Flagstaff. Jaime's severe allergies have become increasingly worse over the last several years. She takes over-the-counter medication to combat her symptoms. With record-setting temperatures and a drought that has lasted several years, Jaime fears for her future and for the future of her family, their history, their traditions, and their way of life.

67-A. Jaime's individual injuries to her indigenous way of life, culture, and traditions, her family's property, her water and food sources, her personal security and safety, her physical

and mental health, and her freedom to pass to the next generation of Dine´ their heritage, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Jaime's individual injuries each year. Jaime is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Jaime is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to indigenous way of life, culture, and traditions, her family's property, her water and food sources, her personal security and safety, her physical and mental health, and her freedom to pass to the next generation of Dine´ their heritage. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Jaime. Another separate injury is the deprivation of Jaime's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Jaime's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Jaime makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Jaime and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Jaime can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Jaime will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Jaime would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Jaime's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Jaime's opportunity to obtain relief to safeguard her life, liberty, property, and equal

protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

68. Plaintiff **Journey Z.**, by and through his guardian and mother Erika Schneider, is a 15-year-old citizen of the U.S. Journey is a Native American born in South Dakota and a federally enrolled member of the Yankton Sioux Tribe. In 2009, Journey and his family moved to the island of Kaua'i, Hawai'i. Journey attends a Hawaiian cultural immersion school, has adopted the Hawaiian culture as his own, and speaks the native Hawaiian language. Journey has deep cultural and spiritual connections with the Earth and all life. These connections depend on a stable climate system for survival, providing Journey with a fundamental sense of responsibility to protect the Earth for his generation and for future generations. Journey is a youth leader on the Rising Youth for a Sustainable Earth ("RYSE") Youth Council and a youth ambassador for the Center for Native American Youth. Journey has advocated directly to President Obama's administration and other federal government officials to secure government action to stabilize the climate system and protect his fundamental rights.

69. Journey participates in many culturally important activities, such as working in the taro fields, organic farming, playing Tahitian drum, fire dancing, and performing Halau Hula O Leilani. He also enjoys swimming, snorkeling, fishing, canoeing, stand-up paddle boarding, and walking and biking along the beach. His participation in and enjoyment of these activities has been and will continue to be negatively impacted by the impacts of climate change and ocean acidification caused by Defendants.

70. Journey's food security and his enjoyment of the biological diversity of the coral reefs are and will continue to be adversely impacted by ocean acidification and the climate change impacts of sea-level rise, increased sea surface temperature, alteration in ocean circulation, and increased storm intensity, all caused by the acts of Defendants. These problems are all deleterious to coral reefs in Hawai'i and their associated ecosystems and fisheries. Journey's health, personal safety, cultural practices, and recreational interests are adversely impacted by the climate impacts of rising sea levels and intense storms that increase coastal flooding and erosion in Hawai'i, damaging coastal ecosystems, infrastructure, and agriculture, on which Journey relies. Watching beaches erode away and disappear has emotionally harmed Journey. Journey performs Halau Hula O Leilani at the hotels along the beaches and will not be able to do so in the future with continued sea level rise. The rock wall at Journey's favorite swimming beach eroded and fell into the ocean, and additional erosion will make it unsafe for Journey to swim there in the future. Decreased rainfall on Kaua'i and the resulting lower river water levels, combined with saltwater inundation from sea level rise, have caused serious water quality problems, high bacteria levels, and increased shark activities that threaten Journey's health and safety, preventing his use and enjoyment of rivers he frequently enjoyed. Declining freshwater availability also threatens Journey's future access to drinking water and ability to stay on the island. Drought conditions on part of Kaua'i and saltwater inundation negatively impact the soil and the agricultural productivity of the farms and taro patches where Journey works. While total rainfall has decreased, rain intensity has increased. In 2012, this increased rain intensity threatened Journey's personal safety when he and his family were displaced by widespread flooding and evacuated to a Red Cross shelter.

70-A. Journey's individual injuries to his physical and mental health, personal security and safety, cultural practices, food and freshwater sources, and the coral reefs and ocean life he depends on for sustenance and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Journey's individual injuries each year. Journey is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Journey is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his physical and mental health, personal security and safety, cultural practices, food and freshwater sources, and the coral reefs and ocean life he depends on for sustenance and happiness. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Journey. Another separate injury is the deprivation of Journey's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Journey's injuries stem precisely from Defendants' belief, and

resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Journey makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Journey and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Journey can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Journey will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Journey would obtain relief to safeguard his life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Journey's injuries at the hands of his government will end, providing substantially

meaningful partial redress of his injuries. The Court will thereby preserve Journey's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

71. Plaintiff **Vic B.**, by and through his guardian and mother Daisy Calderon, is a 16-year-old citizen of the U.S. and a resident of White Plains, New York. In September 2015, Vic will be a junior in high school at Notre Dame School of Manhattan in New York City. Since 2013, Vic has been active in the climate movement, educating people about climate change and working to mitigate it. Vic was a fellow with the Alliance for Climate Education and continues to advocate for education and action on climate change in New York.

72. Vic has become emotionally distressed by the increase in superstorms in the Northeast. Vic was harmed by Hurricane Sandy when he and his family lost power to their home, his school shut down, and his forms of public transportation were not operating. Vic is also harmed by the increasing sweltering summer temperatures, which limit the time he spends outdoors in New York. In recent years, his pollen allergies have become worse, making it even more difficult to enjoy being outside. Vic lives on low-lying land, which is threatened by rising sea levels and more frequent storm surges.

72-A. Vic is Honduran-American and belongs to the Afro-Indigenous Garifuna community that settled on the northern coast of Honduras hundreds of years ago and his and his family's traditional heritage, way of life, food sources, land, and home are critically endangered by sea level rise. Vic's individual injuries to his Garifuna heritage, his physical and mental

health, his personal security and safety, and his family's property are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Vic's individual injuries each year. Vic is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Vic is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his Garifuna heritage, his physical and mental health, his personal security and safety, and his family's property. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Vic. Another separate injury is the deprivation of Vic's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Vic's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Vic makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as

constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Vic and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Vic can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Vic will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Vic would obtain relief to safeguard his life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Vic's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Vic's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a

substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

73. Plaintiff **Nathaniel B.**, by and through his guardian and mother Sharon Baring, is a 15-year-old citizen of the U.S. and a resident of Fairbanks, Alaska. Nathaniel and his family are already witnessing the impacts of climate change and he is psychologically harmed knowing of the inevitable and increasingly severe climate impacts he will experience in the future.

74. Nathaniel is an avid Nordic skier who also enjoys downhill skiing. Nathaniel has been harmed by the reduced snowfall during the past few winters. Snow that typically comes in August is coming as late as November. In 2014-2015, Anchorage received its lowest seasonal snowfall to date. Nathaniel is experiencing more ice storms in Fairbanks. Last year the city declared a state of disaster after a severe ice storm created widespread power outages. Nathaniel and his family suffered without power for nearly a week in temperatures of 18 degrees Fahrenheit.

75. This summer, Alaska experienced over 300 wildfires across the state, all occurring at once. Wildfires have become a common occurrence every summer in Alaska. During the summer of 2015, Fairbanks was surrounded by numerous wildfires and air quality rivaled that of some of the world's smoggiest cities. As an asthma and allergy sufferer, the hot dry wildfire season makes it hard for Nathaniel to breathe outside and participate in cross-country running, one of his favorite sports. Nathaniel is distraught knowing that changing temperatures caused by Defendants will affect his way of life and the animals and ecosystems that surround him and on which he relies for recreation and food. His family raises chickens on their property and they hunt for moose and grouse for food. These animals are harmed by the extreme climate changes happening in Alaska caused by Defendants. Nathaniel has also noticed

a sharp decline of salmon, especially king salmon, which is important for his diet. This summer Alaska had a very small king salmon run on the Yukon River. Nathaniel and his family take fishing trips and he has experienced firsthand the decline in salmon runs. Nathaniel enjoys visiting Alaska's glaciers and intends to continue to do so. However, the glaciers Nathaniel visits are significantly receding, including the Mendenhall Glacier in Juneau, which has retreated over 1.5 miles.

76. Nathaniel is working hard to take actions to reverse and mitigate the effects of climate change through his membership in Alaska Youth for Environmental Action and his work with Citizens Climate Lobby and his church. At home, Nathaniel and his family try to ride bikes as much as possible. Nathaniel participates in the "dime a gallon" program at church, where members contribute a certain pre-arranged amount for every gallon of gas they use for transportation, which is then used to install insulation in their buildings, and other greening projects, such as solar panels.

76-A. Nathaniel's individual injuries to his physical and mental health, his food sources, his personal security and safety in his home, and the snow and winter conditions that he relies upon for life, sustenance, and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Nathaniel's individual injuries each year. Nathaniel is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Nathaniel is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his physical and mental health, his food sources, his personal security and safety in his home, and the snow and winter conditions

that he relies upon for life, sustenance, and happiness. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Nathaniel. Another separate injury is the deprivation of Nathaniel's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Nathaniel's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Nathaniel makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Nathaniel and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Nathaniel can prevent his irreversible injury. If the national energy

system remains predominantly fossil fuel-based, Nathaniel will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Nathaniel would obtain relief to safeguard his life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Nathaniel's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Nathaniel's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

77. Plaintiff **Aji P.**, by and through his guardian and mother Helaina Piper, is a 15-year-old citizen of the U.S. and a resident of West Seattle, Washington. Aji is experiencing the impacts of climate change caused by Defendants, and has been harmed by the increasing severity

of such impacts. In 2014, the State of Washington had the worst wildfire in the state's recorded history, the Carlton Complex fire. Aji and his family were impacted by that wildfire while on a trip through the Cascade Mountains when they were forced to breathe the smoke in the air. During the summer of 2015, Aji has struggled to participate in his regular summer outdoor activities because of temperatures climbing above 90 degrees Fahrenheit for extended periods, which is highly unusual for temperate Seattle.

78. Aji has also experienced the negative effects of climate change on Puget Sound and the freshwater systems and fish. The decreasing water quality in Puget Sound is causing dead zones to occur and ocean acidification is killing fish and shellfish. Aji recreates in these areas and enjoys seeing marine life. The impacts to shellfish and the diminishing numbers of starfish harm Aji's recreational and aesthetic interests. Aji has also been unable to touch or eat shellfish in Puget Sound due to toxicity levels. Aji is distraught by seeing the ecosystems surrounding his home harmed by climate change and ocean acidification caused by Defendants.

79. The impacts of climate change in other places in the western United States are also affecting Aji. On a trip to Montana with his grandparents, Aji experienced dead forests killed by pine bark beetles. Although Aji's mother is from Albuquerque, New Mexico, and they have family there, Aji and his family will not move back to New Mexico because of water shortage issues and the declining aquifer.

80. Aji advocates for actions to reverse and mitigate the effects of climate change caused by Defendants. He is a member of Plant for the Planet Leadership Corps, in which he plants trees, helps restore local forests, and speaks to the public about climate change impacts. He is also a member of Rising Youth for a Sustainable Earth. Aji is a vegetarian and he and his

family try to limit the time they spend driving as much as possible, opting to walk, bike, or take public transportation.

80-A. Aji's individual injuries to his physical and mental health, his personal security and safety, and the natural areas he relies upon for life, sustenance, and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Aji's individual injuries each year. Aji is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Aji is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his physical and mental health, his personal security and safety, and the natural areas he relies upon for life, sustenance, and happiness. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Aji. Another separate injury is the deprivation of Aji's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Aji's injuries stem precisely from Defendants' belief, and

resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Aji makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Aji and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Aji can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Aji will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Aji would obtain relief to safeguard his life, liberty, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Aji's injuries at the hands of his government will end, providing substantially

meaningful partial redress of his injuries. The Court will thereby preserve Aji's opportunity to obtain relief to safeguard his life, liberty, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

81. Plaintiff **Levi D.**, by and through his guardian and mother Leigh-Ann Draheim, is a citizen of the U.S. and a resident of Indialantic, Florida. Levi is 8-years-old and he is experiencing the impacts of climate change and working to take action and spread awareness about protecting the climate system.

82. Levi lives with his Mother and maternal grandparents in Indialantic, which is situated on a barrier island that separates the Indian River Lagoon from the Atlantic Ocean. The barrier island consists of primarily unconsolidated sand that sits on top of porous limestone bedrock. During the summer of 2015, Levi experienced a lack of rainfall that the island usually receives in the afternoons. Temperatures have been abnormally hot, making it harder than normal for Levi and his family to grow vegetables and herbs.

83. The beaches on the island are Levi's backyard. During the summer months he spends time at the beach five days a week. In the last couple of years, Levi has noticed a Sargassum seaweed invasion, with seaweed covering the beaches along the island. Levi is having a hard time enjoying beach activities because the rotting seaweed smells like sulfur. Levi has also seen climate impacts affect ecosystems at the beach, and has specifically experienced fewer sea turtles in the area. Levi can no longer swim in the Indian River Lagoon because of increasing flesh-eating bacteria and dead fish. Levi and his family are able to smell the dead fish

in their community. He is also now limited by where he can swim in the Atlantic Ocean, due to an increase in flesh-eating bacteria.

84. Levi and his family regularly visit the City of Satellite Beach. In 2009, Satellite Beach, an 8-minute drive from Levi's house, authorized a project to assess rising sea levels and work to mitigate impacts. In July 2010, the Sea Level Rise Subcommittee of Satellite Beach provided the results of the study: the City needs to plan for sea level rise. The island's real estate prices are declining, and Levi's family knows the property they own will decrease in value, and could eventually be lost completely, due to sea level rise caused by climate change and melting ice.

85. In the last two years, Levi's severe allergies have made it harder for him to spend time outdoors. Experiencing nature and wilderness in healthy conditions is important for Levi's emotional wellbeing, and his fears for the future of the beaches and springs in Florida and the wildlife that inhabit them are causing adverse psychological impacts to Levi. Levi works hard to keep the environment healthy on the coast by cleaning up the beaches and maintaining the dunes; at church by teaching his friends about how they can help the environment; and at home by conserving water by taking short timed showers, eating a vegetarian diet, and recycling.

85-A. Levi's individual injuries to his physical and mental health, his personal security and safety in his home, his family's property, and the waters and beaches and wildlife he relies upon for life, sustenance, and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Levi's individual injuries each year. Levi is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Levi is also injured by each passing year of losing

the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his physical and mental health, his personal security and safety in his home, his family's property, and the waters and beaches and wildlife he relies upon for life, sustenance, and happiness. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Levi. Another separate injury is the deprivation of Levi's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Levi's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Levi makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Levi and which foreclose his ability to obtain relief that will protect himself. The composition of the United

States national energy system is the most important factor in the world as to whether Levi can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Levi will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Levi would obtain relief to safeguard his life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Levi's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Levi's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

86. Plaintiff **Jayden F.**, by and through her mother and guardian Cherri Foytlin, is a 12-year-old citizen of the U.S. and a resident of Rayne, Louisiana. In 2005, Jayden moved to

Louisiana Since then, she has lived through three hurricanes and many more tropical storms. Jayden has suffered harm and will continue to suffer harm to her and her family's personal safety, bodily integrity, property, economic stability, food security, and recreational interests from rising sea levels, increased frequency and severity of hurricanes with ensuing storm surges, flooding, and high winds, all associated with or exacerbated by climate change caused by Defendants. Jayden is also directly harmed by Defendants' support and promotion of fossil fuel development in Louisiana, which adversely impacts her air and water quality and health and exacerbates the climate impacts she has experienced and will experience in the region.

87. Impacts from climate change and fossil fuel development threaten Jayden's life, liberty, and property. With warmer ocean water temperatures, hurricanes are becoming more frequent and more destructive. Rising sea level means higher storm surges, even from relatively minor storms, which increase coastal flooding, storm damage, and land loss where she lives. Defendants' approval of the dredging of canals through marshes for oil and gas exploration and pipelines has compounded the problem by its destruction of natural storm barriers, increased erosion, and intense saltwater intrusion, resulting in additional land loss. In 2008, during Hurricane Gustav, Jayden's family lost power and water for a week.

88. The air and water pollution from the development of fossil fuels in southern Louisiana also threaten the health of Jayden and her family. Jayden and her family used to enjoy visiting the beach frequently, swimming in the Gulf of Mexico, crabbing, and eating seafood, but she has avoided these activities since the BP oil spill because residual oil is continually dispersed across the Gulf when the increasing number of storms or hurricanes come ashore due to climate change, making such normally enjoyable activities dangerous. Jayden enjoys traveling and visiting family friends all along the Gulf Coast in every state from Texas to Florida and plans to

do so in the future, but the coastal impacts from climate change caused by Defendants, including increased coastal flooding, storm damage, and land loss, will impair her ability to do so in the future.

88-A. Jayden's individual injuries to her personal security, her safety and bodily integrity, her mental health, her home and property, her food and water security, the air she breathes, and her pursuit of happiness in nature, are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Jayden's individual injuries each year. Jayden is additionally injured by each passing year of losing the ability to prevent the worsening of her injuries. Jayden is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to her personal security, her safety and bodily integrity, her mental health, her home and property, her food and water security, the air she breathes, and her pursuit of happiness in nature. The further loss of the ability to protect her life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Jayden. Another separate injury is the deprivation of Jayden's ability to act in her own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect her life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress

will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Jayden's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Jayden makes to safeguard her life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Jayden and which foreclose her ability to obtain relief that will protect herself. The composition of the United States national energy system is the most important factor in the world as to whether Jayden can prevent her irreversible injury. If the national energy system remains predominantly fossil fuel-based, Jayden will permanently lose her ability to obtain relief that will protect herself and her rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Jayden would obtain relief to safeguard her life, liberty, property, and equal protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional

policies and practices of the national energy system. The worsening of Jayden's injuries at the hands of her government will end, providing substantially meaningful partial redress of her injuries. The Court will thereby preserve Jayden's opportunity to obtain relief to safeguard her life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

89. Plaintiff **Nicholas V.**, by and through his legal guardian and mother, Marie Venner, is a 14-year-old citizen of the U.S. and a resident of Lakewood, Colorado. Nick sees climate change caused by Defendants as a threat to human civilization and has given numerous presentations educating people about the science of climate change. As a Catholic, he is drawn to the intersection between his church and environmental stewardship, and was inspired by Pope Francis's 2015 encyclical, *On Care for Our Common Home*.

90. Pine beetles and wildfires, forcing Nick to stop visiting some of his favorite places, have destroyed forests in Colorado, where Nick used to go hiking, fishing, and camping. Nick enjoys fishing, especially in Boulder Creek, but due to wildfires and variable water flows from droughts and floods, he has not been able to go fishing for the past three years. Nick and his family grow fruit trees, have a garden, and buy food from local farmers. Hail, rainstorms, drought, and pests have ruined their garden several years over the last decade. The unusual weather has affected Nick's consumption of the locally grown produce available through community-supported agriculture. Rising summer temperatures make it harder for Nick to enjoy

outdoor activities, including hiking, biking, and tennis. Warmer winters mean Nick gets to ski less; moreover, when he does go skiing, his favorite parts of the mountain frequently are closed.

90-A. Nick suffers from asthma that is made worse by fossil fuel burning and climate destabilization, especially the increase in the number of very hot days and the extended wildfire and smoke season where Nick lives, breathes, and recreates. Nick's mental health is harmed by both his physical injuries and living in a nation whose government is knowingly harming him and Earth's ability to sustain human life. Nick's individual injuries to his lungs, and his overall physical and mental health, and access to the food, forests, and waters he relies upon for life, sustenance, and happiness are already occurring. Defendants' national energy system is a substantial cause of those actual injuries.

a. Defendants' national energy system worsens Nick's individual injuries each year. Nick is additionally injured by each passing year of losing the ability to prevent the worsening of his injuries. Nick is also injured by each passing year of losing the ability to prevent the irreversibility and inevitability of a lifetime of worsening hardship to his lungs, and his overall physical and mental health, and access to the food, forests, and waters he relies upon for life, sustenance, and happiness. The further loss of the ability to protect his life, while suffering these harms, is a separate concrete psychological, emotional, and mental health injury to Nick. Another separate injury is the deprivation of Nick's ability to act in his own interest to preserve the window of opportunity to prevent irreversible and inevitable injury going forward and therefore protect his life, all the while suffering these ongoing harms each year from Defendants' national energy system, which they know is causing these injuries. The opportunity to prevent

irreversible and inevitable injuries is still available now and is being progressively foreclosed by the ongoing national energy system. When the irreversibility of these harms becomes certain, redress will be forever foreclosed by this Court or the political majority through the ballot box. Thus, Nick's injuries stem precisely from Defendants' belief, and resultant policies and practices, that the national energy system is constitutionally compliant.

b. Every attempt Nick makes to safeguard his life, liberties, property, and equal protection of the law fails because Defendants view the national energy system as constitutionally compliant. As long as Defendants operate under the belief that the national energy system is constitutionally compliant, Defendants will continue to power it with fossil fuels at levels that are dangerous for Nick and which foreclose his ability to obtain relief that will protect himself. The composition of the United States national energy system is the most important factor in the world as to whether Nick can prevent his irreversible injury. If the national energy system remains predominantly fossil fuel-based, Nick will permanently lose his ability to obtain relief that will protect himself and his rights.

c. If this Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and these government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein, the Court will have ordered a change in legal status that would have practical consequences. A declaratory judgment would significantly increase the likelihood that Nick would obtain relief to safeguard his life, liberty, and equal

protection of the law. If the Court declares the nation's energy system unconstitutional in its present form, Defendants will correct the unconstitutional policies and practices of the national energy system. The worsening of Nick's injuries at the hands of his government will end, providing substantially meaningful partial redress of his injuries. The Court will thereby preserve Nick's opportunity to obtain relief to safeguard his life, liberty, property, and equal protection of the law from irreversible and inevitable injury. Protecting the opportunity for freedom and happiness and safety and security, by eliminating a substantial federal government restraint on freedom and decreasing the substantial risk of irreversibility, is tremendously meaningful redress.

91. [DELETED]

92. Plaintiff **Future Generations, by and through their Guardian Dr. James Hansen,** retain the legal right to inherit well-stewarded public trust resources and to protection of their future lives, liberties, and property – all of which are imminently threatened by the actions of Defendants challenged herein. Guardian Hansen stands in this case both to demand effective governmental action to protect these fundamental rights and, until that is done, a cessation of governmental action that exacerbates the imposed risk.

93. Dr. James Hansen is the former Director of the NASA Goddard Institute for Space Studies, and is presently an Adjunct Professor at Columbia University's Earth Institute, where he directs a program in Climate Science, Awareness, and Solutions. Dr. Hansen trained in physics and astronomy in the space science program of Dr. James Van Allen at the University of Iowa, receiving a bachelor's degree with highest distinction in physics and mathematics, master's degree in astronomy, and Ph.D. in physics in 1967. In his early research Dr. Hansen

used telescopic observations of Venus to extract detailed information on the physical properties of the cloud and haze particles that veil Venus. Since the mid-1970s, Dr. Hansen has focused on studies and computer simulations of the Earth's climate, for the purpose of understanding the human impact on global climate. His testimony on climate change to Congress in the 1980s helped raise broad awareness of the global warming issue.

94. In recent years, Dr. Hansen has drawn attention to the danger of passing climate tipping points, producing irreversible climate impacts that would yield a different planet from the one on which civilization developed. Dr. Hansen has also outlined steps that are needed to stabilize climate. Dr. Hansen's most recent work clearly establishes that danger and those steps, and it is summarized in Dr. Hansen's declaration, which Plaintiffs attach hereto as **Exhibit A**. Dr. Hansen has long advocated for government actions to protect the climate system for present and future generations.

95. Dr. Hansen is an elected member of the United States National Academy of Sciences (1995) and a recipient of the Heinz Award for the Environment (2001), the Leo Szilard Award for Use of Physics for the Benefit of Society (2007), the American Association for the Advancement of Science Award for Scientific Freedom and Responsibility (2007), the Sophie Prize (2010), and the Blue Planet Prize (2010).

95-A. As described above, Youth Plaintiffs are actually harmed in uniquely individual and particularized ways by Defendants' fossil fuel energy policies and practices that make up the national energy system. Youth Plaintiffs are actually harmed physically by the national energy system. Youth Plaintiffs are actually harmed psychologically, mentally, and emotionally by the national energy system. Youth Plaintiffs are also being injured because their federal government continues to put them at greater risk of even more physical and mental health harm than they

already experience, as the policies and practices that make up the national energy system continue and the climate crisis worsens. The United States' ongoing energy system places Youth Plaintiffs at great risk of sustaining additional irreversible physical and mental health harms. The national energy system hastens the irreversibility and worsening of the existing injuries and that hastening in and of itself is an injury to Youth Plaintiffs. Declaratory judgment in Youth Plaintiffs' favor would be substantially likely to stop the United States' hastening of the environmental apocalypse that locks in irreversible injuries to Plaintiffs.

95-B. If the national energy system is not declared unconstitutional, Youth Plaintiffs will disproportionately and irrevocably suffer from the worsening physical and mental health harms caused by the national energy system and the hastening irreversibility of them. If the energy system is not declared unconstitutional, the energy system will inflict additional irreversible and catastrophic harm on these young Plaintiffs. If the energy system is declared unconstitutional, on information and belief, Defendants will take corrective action and change and/or cease the policies and practices that make the national energy system unconstitutional. If the national energy system is declared unconstitutional and Defendants thereafter abide by this Court's declaratory judgment, it is substantially likely that Youth Plaintiffs' injuries will be minimized, reduced to some meaningful extent and in some cases abated entirely. It is also substantially likely that the hastening of the irreversibility of these injuries will slow or cease.

95-C. The systematic conduct making up the national energy system, which has caused and is causing Plaintiffs' ongoing injuries, includes government policies, practices, and aggregate actions, such as permits, licenses, leases, subsidies, standards, and authorizations for the extraction, development, processing, combustion, and transportation of fossil fuel. Until the Court resolves this constitutional controversy, these young Plaintiffs will continue to be harmed

and put at extreme risk by the GHG emissions caused by Defendants' national energy system and Defendants will be free to continue to operate the national energy system to cause harmful GHG emissions in an unconstitutional manner, avoiding the constitutional check of Article III courts and undermining the separation of powers that the Framers intended. Without declaratory relief in the first instance, Defendants will be free to continue this systematic conduct that "may hasten an environmental apocalypse" and carry out "the Nation's willful destruction."

95-D. Declaratory judgment will eliminate the current and substantial legal controversy and inform the parties of the unlawfulness or lawfulness of the government's national energy system, especially as to whether Defendants' policies, practices, and aggregate actions cause a deprivation of rights secured by the Constitution. That declaratory judgment will have immediate practical consequences and will be substantially likely to provide meaningful redress because upon information and belief Defendants will abide by any declaratory judgment order and bring the national energy system into constitutional compliance.

96. Youth Plaintiffs[2] represent the youngest living generation, beneficiaries of the public trust. Youth Plaintiffs have a substantial, direct, and immediate interest in protecting the atmosphere, other vital natural resources, their quality of life, their property interests, and their liberties. They also have an interest in ensuring that the climate system remains stable enough to secure their constitutional rights to life, liberty, and property, rights that depend on a livable future, in other words, a stable climate system capable of sustaining human life. A livable future includes the opportunity to drink clean water, to grow food, to be free from direct and imminent property damage caused by extreme weather events, to benefit from the use of property, and to enjoy the abundant and rich biodiversity of our Nation. Youth Plaintiffs are suffering both

[2] The term "Youth Plaintiffs" refers to each of the individually named Plaintiffs.

immediate and threatened injuries as a result of actions and omissions by Defendants alleged herein and will continue to suffer life-threatening and irreversible injuries without the relief sought. Youth Plaintiffs have suffered and will continue to suffer harm to their health, personal safety, bodily integrity, cultural and spiritual practices, economic stability, food security, property, and recreational interests from the impacts of climate change and ocean acidification caused by Defendants. Youth Plaintiffs have also been denied the procedural right to participate in decision-making regarding the Department of Energy's approval of LNG exports from the Jordan Cove LNG terminal in Coos Bay, Oregon. Youth Plaintiffs, and all of them, have suffered procedural harm as a result of this denial.

97. [DELETED]

DEFENDANTS

98. Defendant **the United States of America** ("United States") is the sovereign trustee of national natural resources, including air, water, sea, shores of the sea, and wildlife. In its sovereign capacity, the United States controls our nation's air space and atmosphere. In its sovereign capacity, the United States controls federal public lands, waters, and other natural resources, including fossil fuel reserves. In its sovereign capacity, the United States controls articles of interstate and international commerce, including extraction, development, and conditions for the utilization of fossil fuels, such as allowing CO_2 emissions from major sources. As a result of both its exercise of control over the national energy system, exercised through its fossil fuel energy policies, practices, and aggregate actions, as well as its failure to limit and phase-out CO_2 emissions, the United States has caused dangerous levels of CO_2 to build up in the atmosphere. That build-up seriously threatens the relatively stable climate system that enabled civilization to develop over the last 10,000 years. It impairs essential national public

trust resources required by Youth Plaintiffs and future generations. This failure to prevent the present and looming climate crisis constitutes a breach in the government's basic duty of care to protect Plaintiffs' fundamental constitutional rights. United States' ongoing energy system places Youth Plaintiffs at great risk of sustaining additional irreversible physical and mental health harms.

99. [DELETED]

100. Defendant **the Office of the President of the United States** includes the Council on Environmental Quality ("CEQ"), the Office of Management and Budget ("OMB"), and the Office of Science and Technology Policy ("OSTP").

a. CEQ's mission is to promote the well-being of our country for both current and future generations, which includes curbing the carbon pollution that is causing climate change.

b. OMB serves as the implementation and enforcement arm of all Presidential policy, including budget development and execution, coordination and review of all significant federal regulations, and issuance of executive orders. OMB promotes the government's affirmative aggregate acts in the areas of fossil fuel production, consumption, and combustion by coordination and review of Federal regulations by executive agencies and review and assessment of information collection requests.

c. OSTP leads interagency efforts to develop and implement sound science and technology policies and budgets, and to work with state and local governments, the scientific community, private sectors, and other nations

toward this end. Pursuant to authority granted by Congress under National Science and Technology Policy, Organization, and Priorities Act of 1976, President Bush's 2001 Executive Order 13226, and President Obama's 2010 Executive Order 13539, OSTP has been involved in the President's strategy for addressing climate change. Despite its charge to ensure that the policies of the Executive are informed by sound science, OSTP has permitted additional fossil fuel projects, including extraction, processing, transportation, combustion, and exportation of coal, oil, and gas from conventional and unconventional reserves.

101. The policies and practices promoted by CEQ, OMB, and OSTP have been contrary to sound science. These policies and practices have led to the current dangerous levels of atmospheric CO_2, dangerous interference with a stable climate system, and violations of Plaintiffs' constitutional rights. Specifically, the policies and practices continue to allow dangerous levels of carbon pollution and, at best, promise very modest future limitations and no near-term CO_2 phase out, as is required to preserve a stable climate system capable of sustaining human life.

102. Defendant **Brenda Mallory** is the current Director of CEQ, and in her official capacity is responsible for all actions of CEQ.

103. Defendant **Shalanda Young** is the current Director of OMB, and in her official capacity is responsible for all actions of OMB.

104. Defendant **Arati Prabhakar** is the current Director of OSTP, and in her official capacity is responsible for all actions of OSTP.

105. Defendant **the United States Department of Energy** ("DOE") is a federal agency whose mission is to advance the national, economic, and energy security of the United States through clean, reliable, and affordable energy; to protect the environment; and to encourage innovations in science and technology that improve the quality of life. DOE's mission statement is to "ensure America's security and prosperity by addressing . . . environmental . . . challenges through transformative science." DOE through the Office of Fossil Energy issues short-term and long-term authorizations for the import and export of natural gas pursuant to authority granted by Congress under the Natural Gas Act of 1938, 15 U.S.C. § 717, as amended by section 201 of the Energy Policy Act of 1992, Pub. L. No. 102-486, § 201, 106 Stat. 2776, 2866. DOE permits domestic energy production and interstate commerce of fossil fuels pursuant to authority granted by Congress under the Department of Energy Organization Act of 1977, 42 U.S.C. § 7112. DOE through the Office of Energy Efficiency and Renewable Energy, regulates the minimum number of light duty alternative fuel vehicles required in certain federal fleets pursuant to authority granted by Congress under the Energy Policy Act of 1992. DOE, through the Building Technology Office, also sets energy efficiency standards, which dictate energy consumption rates for appliances and equipment pursuant to authority granted by Congress under The Energy Policy and Conservation Act, 42 U.S.C. § 6201, as amended.

a. The Federal Energy Regulatory Commission ("FERC"), an agency of DOE, regulates the transmission and sale of electricity and natural gas in interstate commerce; regulates the transportation of oil by pipeline in interstate commerce; reviews proposals for natural gas terminals, pipelines, and storage facilities; ensures the safe operation and reliability

of proposed and operating LNG terminals; and monitors and investigates energy markets.

106. DOE has knowingly failed to perform its duty to transition our nation away from the use of fossil fuel energy. DOE's actions and omissions have substantially contributed to unsafe levels of atmospheric CO_2 and a dangerous climate system.

107. DOE, through the Office of Fossil Energy, issued DOE/FE Order No. 3041, granting long-term multi-contract authorization to export liquefied natural gas by vessel from the Jordan Cove LNG Terminal in Coos Bay.

108. Defendant **Jennifer Granholm** is the current Secretary of Energy and, in her official capacity, is responsible for all actions of DOE.

109. Defendant **the United States Department of the Interior** ("DOI") manages one-fifth of our nation's land, including forests and grazing lands, thirty-five thousand miles of coastline, and 1.76 billion acres of the Outer Continental Shelf. DOI's mission is to protect America's natural resources and heritage, honor cultures and tribal communities, and supply the energy to power the future of our country. DOI claims to be taking the lead in protecting our nation's resources from climate impacts and in managing federal public lands to mitigate climate change.

110. DOI, through the Bureau of Land Management ("BLM"), leases minerals and manages oil and gas development activities on over 570 million acres of federal lands, as well as on private lands where the federal government retained mineral rights, pursuant to the authority granted by Congress in the Mineral Leasing Act of 1920, 30 U.S.C. § 182, as amended, and the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1719(a). BLM and other federal agencies manage most of the land suitable for oil and gas development in the U.S.

111. DOI, through the Bureau of Ocean Energy Management ("BOEM"), leases the Outer Continental Shelf, the submerged lands, subsoil, and seabed, lying between the seaward extent of the jurisdiction of the States and the seaward extent of Federal jurisdiction, for oil and gas development pursuant to authority granted by Congress under the Outer Continental Shelf Lands Act of 1953, 43 U.S.C. § 1333(a), as amended. As of January 2015, BOEM was administering more than 6,000 active oil and gas leases covering nearly 33 million Outer Continental Shelf acres. Pursuant to authority granted by Congress under the Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594, 760, DOI repealed the 160-acre cap on coal leases, allowed the advanced payment of royalties from coal mines, and provided incentives to companies to drill for oil in the Gulf of Mexico.

112. Through its policies and practices in permitting the extraction of coal, coal-bed methane, oil, oil-shale and natural gas, and oil, coal and electric infrastructure and transmission facilities, and logging, livestock grazing, and off-road vehicle use on public land, the DOI is substantially contributing to dangerous levels of atmospheric CO_2 and a dangerous climate system in our Nation.

113. Defendant **Deb Haaland** is the current Secretary of Interior and, in her official capacity, is responsible for all actions of DOI.

114. Defendant **the United States Department of Transportation** ("DOT") is a federal agency overseeing this Nation's aviation, road, highway, railway, truck, and marine transportation infrastructure. DOT's regulations of emissions related to that infrastructure play a vital role in the Federal Government's response to climate change.

a. DOT, through the Federal Aviation Administration, the Federal Highway Administration, and the Pipeline and Hazardous Materials Safety

Administration, oversees and regulates the spending programs that finance construction and maintenance of our nation's transportation infrastructure, pursuant to authority granted by Congress under the Department of Transportation Act of 1966, 49 U.S.C. § 305, as amended.

b. DOT, through the National Highway Traffic Safety Administration, sets fuel economy standards for U.S. vehicle manufacturers, pursuant to authority granted by Congress under the Energy Policy and Conservation Act of 1975, Pub. L. No. 94–163, § 301, 89 Stat. 902, 903, 905, as amended by the Energy Independence and Security Act of 2007, 49 U.S.C. § 32902.

115. With the power to regulate the means of transportation throughout our country, DOT has the responsibility to ensure that all modes of transportation use only clean energy and eliminate dangerous carbon pollution. Further, DOT permits the transport of fossil fuels via truck and rail. DOT's stated mission is to "[enhance] the quality of life of the American people, today and into the future." DOT acknowledges the severity of the threats of climate change, yet continues to facilitate the severity of climate change impacts by contributing approximately 27% of U.S. CO_2 emissions in 2013.

116. Defendant **Pete Buttigieg** is the current Secretary of Transportation and, in his official capacity, is responsible for all DOT policies and practices.

117. Defendant **the United States Department of Agriculture** ("USDA") is a federal agency whose vision statement expresses the agency's goal to preserve and conserve our nation's natural resources. USDA's mission statement states that it will use the best available science as it carries out its responsibilities in caring for natural resources. USDA has authority over our

nation's food and agriculture, as well as many natural resources, including national forests, which serve the vital role of absorbing CO_2 from our atmosphere—commonly referred to as "carbon sequestering."

a. USDA, through the U.S. Forest Service, authorizes 25% of U.S. coal production.

b. The U.S. Forest Service, along with BLM, coordinates and authorizes the leasing of federal public lands for the extraction of oil and gas pursuant to authority granted by Congress under the Mineral Leasing Act of 1920, as amended by both the Federal Onshore Oil and Gas Leasing Reform Act, and the Mineral Leasing Act for Acquired Lands. The U.S. Forest Service, in conjunction with BLM, issues leases and mining permits for coal mining development and oversees coal mining on federal public lands pursuant to authority granted by Congress, under the Mineral Leasing Act of 1920, as amended, and the Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. § 1273.

c. USDA's Forest Service Minerals & Geology Management division manages and oversees aspects of the development and production of energy and mineral resources, including authorizing ancillary projects such as roads and pipelines that are part of the energy and minerals development projects of USDA.

d. USDA has substantially contributed to and continues to substantially contribute to a dangerous climate system by permitting large-scale logging in national forests, by supporting polluting farming and agricultural

practices, and by authorizing fossil fuel extraction and use under its jurisdiction. USDA has not protected the nation's National Forest System as a carbon sink.

118. Defendant **Thomas J. Vilsack** is the current Secretary of Agriculture and, in his official capacity, is responsible for all actions of the USDA.

119. Defendant **the United States Department of Commerce** ("Commerce") is a federal agency that is supposed to promote sustainable development. Commerce has authority over the monitoring equipment for greenhouse gas ("GHG") emissions, giving it direct oversight of our nation's industries and emissions pursuant to authority granted by Congress under Title 15 of the United States Code.

a. Commerce, through National Institute of Standards and Technology, oversees research in energy efficiency opportunities for homes and companies nationwide.

b. Commerce, through the International Trade Administration's Office of Energy and Environmental Industries, promotes fossil fuel export opportunities, including identifying for the fossil fuel industry oil and gas markets where export activities can make the biggest impact, pursuant to authority granted by Congress, under the Reorganization Plan No. 3 of 1979.

c. Commerce, through the Bureau of Industry and Security ("BIS"), authorizes and administers the rules governing crude oil exports pursuant to 15 C.F.R. § 754.2. BIS issues permits to export crude oil to all destinations, including Canada.

d. Commerce, through the National Oceanic and Atmospheric Administration, is charged with overseeing the preservation and protection of the oceans and the atmosphere pursuant to authority granted by Congress under the Reorganization Plan No. 4 of 1970.

e. Commerce has abrogated its duty to preserve and protect the atmosphere and other natural resources under its jurisdiction and has not prevented the waste of the public trust in the atmosphere and oceans.

120. Defendant **Gina Raimondo** is the current Secretary of Commerce and, in her official capacity, is responsible for all actions of Commerce.

121. Defendant **the United States Department of Defense** ("DOD") is a federal agency charged with ensuring the security of this nation. DOD considers climate change a threat multiplier for its potential to exacerbate many challenges confronting our nation, including infectious disease, regional instability, mass migrations, and terrorism. Climate change has impacted and will continue to impact all military installations, as well as the DOD's supply chains, equipment, vehicles, and weapon systems.

a. DOD is our nation's largest employer and is responsible for significant carbon pollution from both its vehicle fleet, and its 500 bases of military infrastructure, including 300,000 buildings totaling 2.2 billion square feet.

b. For all exports of coal, oil, and gas by ship, the DOD's Army Corps of Engineers authorizes marine export facilities, pursuant to the Clean Water Act and the Rivers & Harbors Act. The Army Corps of Engineers also maintains international navigation channels, including the navigation channel at Coos Bay, pursuant to authority granted by Congress under the

Rivers & Harbors Act. Such exports endanger the climate system on which our nation and plaintiffs alike depend.

122. Defendant **Lloyd Austin** is the current Secretary of Defense and, in his official capacity, is responsible for all actions of DOD.

123. Defendant **the United States Department of State** ("State Department") is a federal agency whose stated mission is to "shape and sustain a peaceful, prosperous, just, and democratic world and foster conditions for stability and progress for the benefit of the American people and people everywhere." The State Department plays a lead role in Defendants' response to climate change. The State Department prepared the 2014 U.S. Climate Action Report, which states that the Federal Government is "committed to continuing enhanced action . . . to lead the global effort to achieve a low-emission, climate resilient future."

a. The State Department leads international efforts on climate change on behalf of the Office of the President.

b. The State Department, through the Office of the Special Envoy for Climate Change is the Administration's chief climate negotiator. In 2009, Special Envoy for Climate Change Todd Stern stated: "The costs of inaction—or inadequate actions—are unacceptable. But along with this challenge comes a great opportunity. By transforming to a low-carbon economy, we can stimulate global economic growth and put ourselves on a path of sustainable development for the 21st century."

c. The Secretary of State receives all applications for Presidential Permits for the construction, connection, operation, or maintenance, at the borders of the United States, of facilities for the exportation or importation of

petroleum, petroleum products, coal, or other fuels, including hazardous liquids to or from a foreign country, and is required to issue a Presidential Permit if such exportation would serve the national interest, under Executive Order 13337, and pursuant to 3 U.S.C. § 301. Specifically, the State Department has jurisdiction over all cross-border oil pipelines, and in the last decade has been considering and approving longer cross-border projects, including those transporting oil sands crude, otherwise known as tar sands. All petroleum products entering and leaving the U.S. by pipeline do so under State Department approval. Currently there are at least 13 active Presidential Permits for oil pipelines. The State Department has consistently approved such permits, even though it has full authority and discretion to deny them where fossil fuel projects endanger the nation by causing or enhancing dangerous climate change.

124. Defendant **Antony Blinken** is the current Secretary of State and, in his official capacity, is responsible for all actions of the State Department.

125. Defendant **the United States Environmental Protection Agency** ("EPA") permits and regulates the activities, industries, and sources of carbon pollution in the U.S. under the Clean Air Act, the Clean Water Act, the Comprehensive Environmental Response, Compensation, and Liability Act, the Safe Drinking Water Act, and the Resource Conservation and Recovery Act. The stated mission of the EPA is to protect human health and the environment and ensure that the Federal Government's actions to reduce environmental risks are based on the best available science. EPA sets CO_2 standards for power plants, which account for our nation's largest source of CO_2 emissions at 37% of U.S. annual emissions. EPA has

authorized, and continues to authorize installations and activities that emit prodigious amounts of CO_2, which authorizations dangerously disrupt and fail to preserve a habitable climate system – in violation of Plaintiffs' fundamental rights.

a. EPA, through the Office of Ground Water and Drinking Water and the Office of Science and Technology, exempts oil and gas producers from certain requirements of the Safe Drinking Water Act (thereby easing regulatory burdens to oil and gas development), pursuant to authority granted by Congress, under the Energy Policy Act of 2005.

126. EPA abrogated its duty to implement its 1990 Plan, entitled "Policy Options for Stabilizing Global Climate," to reduce CO_2 emissions (a pollutant under its jurisdiction) in line with the best available science, and continues to allow CO_2 emissions in excess of what is necessary for climate stability.

127. That failure is not allayed by EPA's August 3, 2015 final "Clean Power Plan" because CO_2 emissions reductions projected under the "Clean Power Plan" do not even approach the rate required to preserve a habitable climate system. First, the "Clean Power Plan" affects emissions only in the power sector. Second, the "Clean Power Plan" aims for power plant emissions reductions of only approximately 32% from 2005 levels by full implementation in 2030. Those power plant emission reductions from 2005 levels would achieve only an 8-10% reduction in total U.S. emissions by 2030. The annualized emissions reduction rate is thus, even accepting EPA's biased math, approximately 1.25% per year, a reduction rate that is a fifth of that minimally required to preserve a habitable climate system. Moreover, nearly half of the EPA-asserted emission reduction was already realized in the 2005-2014 period, namely *before* the "Clean Power Plan" was finalized. Furthermore, upon information and belief, the "Clean

Power Plan" will allow fossil fuel-fired power units to continue to operate and will encourage increased investment in, utilization, and reliance on natural gas (whose principle constituent, methane, is a highly potential greenhouse gas). The "Clean Power Plan," moreover, does nothing to halt or otherwise diminish fossil fuel extraction, production, and exportation in the United States, fails even to return U.S. emissions to 1990 levels, and continues to allow CO_2 emissions far in excess of what is minimally required to secure a stable climate system. EPA's "Clean Power Plan," accordingly, is not an adequate or proportionally appropriate response to the climate crisis. By allowing emissions to continue at dangerous levels, EPA continues to jeopardize the climate system on which Plaintiffs depend, now and in the future.

128. Defendant **Michael Regan** is the current Administrator of EPA and, in his official capacity, is responsible for all actions of EPA.

129. Pursuant to its policies and practices that make up the national energy system, Defendants have permitted, authorized, and subsidized the extraction, production, transportation, and utilization of fossil fuels through aggregate actions across the U.S. (and beyond). Defendants retain authority to limit or to deny that extraction, production, transportation, and utilization of fossil fuels, and otherwise to limit or prohibit their emissions. The vastness of our nation's fossil fuel enterprise renders it infeasible for Plaintiffs to challenge every instance of Defendants' violations and, even if feasible, challenging each of Defendants' actions would overwhelm the court. Nonetheless, Defendants' liability arises from the policies and practices that make up Defendants' national energy system. The national energy system has substantially caused the present climate crisis and Plaintiffs' injuries.

130. Director Brenda Mallory, Director Shalanda Young, Director Arati Prabhakar, Secretary Jennifer Granholm, Secretary Deb Haaland, Secretary Pete Buttigieg, Secretary

Thomas J. Vilsack, Secretary Gina Raimondo, Secretary Lloyd Austin, Secretary Antony Blinken, and Administrator Michael Regan, through their respective offices, departments, and agencies, CEQ, OMB, OSTP, DOE, DOI, DOT, USDA, Commerce, DOD, State Department, and EPA, are primarily responsible for the United States' energy system through authorizing, permitting, and incentivizing fossil fuel production, consumption, transportation, and combustion, causing the atmospheric CO_2 concentration to increase to at least 400 ppm and, thus, substantial harm to Plaintiffs. Defendants have failed to preserve a habitable climate system for present and future generations, and instead have created dangerous levels of atmospheric CO_2 concentrations. The national energy system and the affirmative aggregate acts, omissions, and policies and practices of Defendants that make up the national energy system, jointly and severally, have violated and continue to violate Plaintiffs' fundamental constitutional rights to freedom from deprivation of life, liberty, and property; Plaintiffs' constitutional rights to equal protection; Plaintiffs' unenumerated inherent and inalienable natural rights; and Plaintiffs' rights as beneficiaries of the federal public trust.

STATEMENT OF FACTS

I. THE FEDERAL GOVERNMENT HAS KNOWN FOR DECADES THAT CARBON DIOXIDE POLLUTION WAS CAUSING CATASTROPHIC CLIMATE CHANGE AND THAT MASSIVE EMISSION REDUCTIONS AND A NATION-WIDE TRANSITION AWAY FROM FOSSIL FUELS WAS NEEDED TO PROTECT PLAINTIFFS' CONSTITUTIONAL RIGHTS.

131. As early as 1899, scientists understood that CO_2 concentrations in the atmosphere cause heat retention on Earth and that a doubling or tripling of the CO_2 content in 1899 would significantly elevate Earth's surface temperature. Scientists also understood that CO_2 was the determinative factor for global heating. By the turn of the 20th Century, it was widely accepted in the scientific community that increasing the atmospheric concentration of CO_2 could cause global climate change.

132. By 1965, the Executive Branch reported that anthropogenic pollutants, including CO_2, impair our nation's economy and its quality of life. In the 1965 Report of President Lyndon Johnson's Scientific Advisors, "Restoring the Quality of Our Environment," the White House confirmed that anthropogenic pollutants, including CO_2, threaten "the health, longevity, livelihood, recreation, cleanliness and happiness of citizens who have no direct stake in their production, but cannot escape their influence."

133. For fifty years, the Executive Branch has known that "pollutants have altered on a global scale the CO_2 content of the air" through "the burning of coal, oil and natural gas." The Executive Branch predicted that CO_2 "will modify the heat balance of the atmosphere to such an extent that marked changes in climate, not controllable th[r]ough local or even national efforts, could occur." The Executive Branch warned that "carbon dioxide [gases] are accumulating in such large quantities that they may eventually produce marked climatic change."

134. Fifty years ago, the Executive Branch described the marked climatic changes from CO_2 pollution as including the melting of the Antarctic icecap, rising sea levels, warming oceans, acidifying waters, and additional releasing of CO_2 and methane due to these events. It recommended reducing the heating of the Earth because of the extraordinary economic and human importance of our climate system.

135. Fifty years ago, the White House recommended that a tax system be implemented to tax polluters, including air pollution, "in proportion to their contribution to pollution" to incentivize pollution reduction.

136. In 1969, Patrick Moynihan, then-Adviser to President Nixon, wrote a letter to White House counsel John Ehrlichman stating that CO_2 pollution resulting from burning fossil fuels was a problem perhaps on the scale of "apocalyptic change," threatening the loss of cities

like New York and Washington D.C. from sea level rise. The 1969 Moynihan Letter urged the Federal Government to immediately address this threat.

137. In 1978, Congress passed the National Climate Program Act "to establish a national climate program that will assist the Nation and the world to understand and respond to natural and man-induced climate processes and their implications." 15 U.S.C. § 2901(3).

138. On June 23, 1988, Plaintiff-Guardian Dr. James Hansen, then Director of NASA's Institute for Space Studies and a leading climate scientist in the Federal Government, testified before Congress that carbon pollution in the atmosphere was causing global warming and that impacts were already being observed.

139. Around the time of Dr. Hansen's testimony, Congress directed its own offices and EPA to separately prepare reports on how to stabilize the global climate system and transition our country away from the use of fossil fuels.

140. In response, in December 1990, EPA submitted a report to Congress on "Policy Options for Stabilizing Global Climate." The EPA's 1990 Report concluded: "responses to the greenhouse problem that are undertaken now will be felt for decades in the future, and lack of action now will similarly bequeath climate change to future generations."

141. The EPA's 1990 Report called for a 50% reduction in total U.S. CO_2 emissions below 1990 levels by 2025. EPA explained that such reductions were the only pathway to achieve Congress' goal of stopping global warming and stabilizing the climate system. The EPA's 1990 Report also called for stabilizing atmospheric CO_2 concentrations at 350 ppm, the current level of that time, a response to the congressional objective that total global warming not exceed 1.5° C above the preindustrial level. In its 1990 Report, EPA confirmed the Executive Branch's findings from 1965 that CO_2 was a "dangerous" pollutant.

142. In 1991, promptly following EPA's 1990 Report, the Congressional Office of Technology Assessment ("OTA") delivered to Congress its own report, "Changing By Degrees: Steps to Reduce Greenhouse Gases." Finding the United States was the single largest contributor to carbon pollution, the OTA's 1991 Report developed "an energy conservation, energy-supply, and forest-management package that can achieve a 20- to 35-percent emissions reduction" through a mix of regulatory and market-based federal policies, in order to prevent global warming and climate change. OTA reported that, if its "package" was implemented, the Federal Government could lower CO_2 emissions 35% from 1987 levels by 2015 and possibly save the Federal Government $20 billion per year. OTA determined that the 35% necessary reduction in CO_2 emissions was only the beginning and further efforts in the 21st century would be required to stabilize our nation's climate system.

143. The OTA's 1991 Report stated that major reductions of CO_2 would require significant new initiatives by the Federal Government and must be sustained over decades, even before all the scientific certainties are resolved: "[I]t is clear that the decision to limit emissions cannot await the time when the full impacts are evident. The lag time between emission of the gases and their full impact is on the order of decades to centuries; so too is the time needed to reverse any effects." The OTA's 1991 Report informed Congress that the level of emission reductions needed would require the country to wean itself from fossil fuels. OTA also urged that, while global warming was a problem on a global scale, U.S. leadership was critical to solving the problem and would seriously impact what happened around the globe.

144. Concluding that actions would be required across the federal government, both the EPA's 1990 Report and the OTA's 1991 Report concluded that an essential component of reducing CO_2 emissions was implementing a rising carbon tax.

145. On October 15, 1992, following receipt of the EPA and OTA Reports, the Senate ratified the United Nations Framework Convention on Climate Change ("UNFCCC"). The UNFCCC was executed to "protect the climate system for the benefit of present and future generations of humankind." The UNFCCC evidences an "overwhelming weight" of support for protection of the atmosphere under the norms and principles of intergenerational equity. UNFCCC, Art. 3. The minimal objective of the UNFCCC is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner." UNFCCC, Art. 2.

146. The recommendations in the EPA's 1990 Report ("Policy Options for Stabilizing Global Climate") and the OTA's 1991 Report ("Changing By Degrees: Steps to Reduce Greenhouse Gases") were never implemented. U.S. fossil fuel production, consumption, and combustion all continued to accelerate at dangerous speeds for decades.

147. On December 7, 2009, nearly 17 years after the United States ratified the UNFCCC, the then-Administrator of EPA, Lisa Jackson, issued EPA's formal endangerment finding under the Clean Air Act. The finding stated that current and projected atmospheric concentrations of greenhouse gases including, in particular, CO_2, threatened the public health and welfare of current and future generations. EPA issued its endangerment determination only after being compelled to do so by the U.S. Supreme Court in *Massachusetts v. EPA*, 549 U.S. 497 (2007).

148. On January 2, 2011, EPA commenced partial regulation of greenhouse gases under the Clean Air Act from mobile and stationary sources of air pollution.

149. More than two decades have passed since the EPA's 1990 Report and the OTA's 1991 Report were issued to Congress. Little has been accomplished in the way of phasing out emissions even though, as DOE admits in its strategic plan, "our responsibility to future generations is to eliminate most of our carbon emissions and transition to a sustainable energy future."

150. During the last decade, Defendants have repeatedly stated that allowing "business as usual" CO_2 emissions will imperil future generations with dangerous and unacceptable economic, social, and environmental risks. As Defendants have acknowledged, the use of fossil fuels is a major source of these emissions, placing our nation on an increasingly costly, insecure, and environmentally dangerous path.

II. IN SPITE OF KNOWING OF THE SEVERE DANGERS POSED BY CARBON POLLUTION, DEFENDANTS CREATED AND ENHANCED THE DANGERS THROUGH FOSSIL FUEL EXTRACTION, PRODUCTION, CONSUMPTION, TRANSPORTATION, AND EXPORTATION

A. Despite the Known Danger, Defendants Caused Climate Instability and Allowed U.S. Fossil Fuel Extraction, Production, Consumption, Transportation, and Exportation and Associated Emissions, to Dangerously Increase

151. Through its policies, practices, and aggregate acts, the United States has long had and continues to have a national energy system that has made fossil energy the dominant form of energy used in the United States. In 2014, over 80% of U.S. energy comes from fossil fuels. Between 1751 and 2014, the United States has been responsible for emitting 25.5% of the world's cumulative CO_2 emissions to the atmosphere from within its borders. Those emissions do not account for the embedded emissions in imported goods and materials that are consumed in the United States. Defendants enabled and permitted those cumulative emissions.

152. In the last fifty years, total U.S. production and consumption of fossil fuels drastically increased.

153. Acting with deliberate indifference, Defendants have not implemented, or complied with, the EPA's 1990 Report and the OTA's 1991 Report to reduce carbon pollution from fossil fuels, stop global warming, and protect the climate system for future generations. Had Defendants followed the EPA's 1990 Report and the OTA's 1991 Report, CO_2 emissions today would be reduced by 35% from 1987 levels. Instead, since 1991, Defendants have knowingly allowed at least an additional 130,466 million metric tons of CO_2 emissions from fossil fuel combustion.

154. Accordingly, instead of pursuing their own plans to slash emissions and reduce the risk of dangerous climate change, Defendants knowingly acted to exacerbate that risk and impose harm on the nation and on Plaintiffs.

155. Total Fossil fuel production in the U.S. climbed to 65.244 Quadrillion Btu in 2014, up substantially from such consumption in 1965.

U.S. Primary Energy Production by Source (Quadrillion Btu)				
Year	**Coal**	**Natural Gas**	**Petroleum**	**Fossil Fuels**
1965	13.055	15.775	16.521	45.351
1991	21.636	18.229	15.701	55.566
2014	20.287	26.516	18.441	65.244

156. Total Fossil fuel energy consumption in the U.S. climbed to 80.366 Quadrillion Btu in 2014, up substantially from such consumption in 1965.

U.S. Primary Energy Consumption by Source (Quadrillion Btu)				
Year	**Coal**	**Natural Gas**	**Petroleum**	**Fossil Fuels**
1965	11.581	15.769	23.246	50.596
1991	18.992	20.033	32.846	71.871
2014	17.991	27.592	34.783	80.366

157. Fossil fuel emissions from energy consumption in the U.S. climbed to 5.4 billion metric tons of CO_2 in 2014, up substantially from such emissions in 1965.

U.S. CO2 Emissions From Energy Consumption by Source (Million Metric Tons of CO2)				
Year	**Coal**	**Natural Gas**	**Petroleum**	**Total Fossil Fuels**
1965	1,075	828	1,483	3,386
1991	1,807	1,047	2,005	4,859
2014	1,713	1,441	2,249	5,404

158. In 2011, fossil fuel combustion in the U.S. accounted for 94% of CO_2 emissions.

159. The above emissions figures are from U.S. Government sources and, regrettably, underreport the amount of emissions that Defendants' actions have substantially caused. EPA uses a sector-based emission inventory, upon which the other Defendants also rely. A sector-based emission inventory accounts only for in-boundary emissions, and not those attributed to embedded emissions – emissions that account for the consumption of goods imported to the U.S. Defendants have not provided a national consumption-based inventory for CO_2 emissions, which would include all embedded CO_2 emissions for goods produced outside of the U.S. and consumed within the U.S.

160. In 2012, the U.S. was the largest producer of natural gas, producing a total that year of 24,058 billion cubic feet (Bcf). Also in 2012, the U.S. was second in "Total Primary Coal Production," with 1,016,458 thousand short tons; second in "Total Primary Energy Production," producing 79.212 Quadrillion Btu; and second in "Total Primary Energy Consumption," consuming 95.058 Quadrillion Btu.

161. In 2014, according to the United States Energy Information Administration ("EIA"), the U.S. was the largest producer of total petroleum and other liquids with 13,973 thousand barrels produced per day.

162. The U.S. is by far the dominant producer of both shale gas and tight oil in the world. Also, the U.S. is one of four countries in the world that is producing commercial volumes of either natural gas from shale formations (shale gas) or crude oil from shale formations (tight oil).

163. The aggregate actions by Defendants in allowing fossil fuel production, consumption, and emissions to increase in the U.S. since 1965 ignored science driven considerations of climate system protection. These aggregate actions were taken with deliberate indifference to the need for a national carbon budget or a national plan that includes an analysis of the cumulative impacts of Defendants' actions upon the climate system and with respect to the fundamental rights of the present and future generations.

B. Defendants Have Allowed Excessive Fossil Fuel Production on Federal Public Lands.

164. In 2013, 25% of all fossil fuels extracted in the U.S. originated on federal public lands.

165. In 2014, Defendant United States, through the President, DOI through BLM, DOD through Army Corps of Engineers, and EPA, authorized and oversaw the sale of 421 million tons of coal from federally-leased lands.

166. Since January 1990, DOI through BLM has leased 107 coal tracts, and associated coal production and revenues have grown. In 2015, the BLM reported that approximately 40% of all coal produced in the United States comes from federal lands. The United States has more coal deposits available than any other fossil fuel resource within its borders and, as of 2015, has 28% of the world's coal reserves.

167. In 1985, there were 18,849 recorded federal producing oil and gas leases issued by DOI through BLM. By 2014 there were 23,657 recorded federal producing oil and gas leases issued by DOI through BLM.

168. As of June 2014, DOI's BLM has authorized approximately 47,000 oil and gas leases on public lands, and approximately 95,000 oil and gas wells, with an additional 3,000 wells drilled annually by the oil and gas industry. The BLM oversees approximately 700 million subsurface acres of mineral estate. There are currently 36 million acres of federal land under lease for potential fossil fuel development in 33 states, pursuant to DOI's BLM authorization.

169. From 2009-2011, the President and DOI through BLM processed more applications for permits to drill oil and gas, despite receiving far fewer applications, than the prior administration from 2006-2008.

170. Since 1985, DOI through BLM has issued between 1,486 to 6,617 permits annually to drill on federal lands. BLM has approved approximately 99% of all received applications for permits to drill, without taking into consideration that such permits would endanger Plaintiffs or increase Plaintiffs' susceptibility to harm.

C. Defendants Subsidize the Fossil Fuel Industry

171. In addition to leasing federal public lands for fossil fuel exploitation, the United States subsidizes, funds, and subsidizes fossil fuel production and consumption.

172. The United States subsidizes the fossil fuel industry by undervaluing royalty rates for federal public leasing, as well as through royalty relief resulting in the loss of billions of dollars of foregone revenue. U.S. royalty rates are consistently less than state royalty rates. For example, Texas's royalty rate for leasing is double the federal percentage.

173. Through eleven federal fossil fuel production tax provisions, the United States incurs approximately $4.7 billion in annual revenue costs. Through a fossil fuel consumption subsidy, the United States annually forgoes approximately $3.4 billion in revenue.

174. The United States provides approximately $5.1 billion per year in tax provision subsidies to support fossil-fuel exploration.

175. Two tax code provisions for the benefit of the fossil fuel enterprise were introduced in the early 1900s. These provisions are still in place today, resulting in substantial revenue losses. The "intangible drilling costs" provision was introduced in 1916, 26 U.S.C. § 263(c); in 1926 the "percentage depletion allowance" provision was introduced, 26 U.S.C. § 613.

176. According to the International Monetary Fund ("IMF"), the United States is the world's top subsidizer of fossil fuels, in absolute terms, in the amount of $502 billion per year, which includes the IMF's accounting of negative externalities.

177. The United States has supported fossil fuel development through overseas public financing, primarily through the Export-Import Bank of the United States, an agency of the Office of the President. For example, through the Export-Import Bank of the United States, the Office of the President provided $14.8 billion in commitments for 78 transactions or projects in

the petroleum sector, including 49 transactions in Latin American, 14 in Africa, six in Russia/FSU, five in the Middle East, and four in Asia. In fiscal year 2010, the Export-Import Bank of the United States provided approximately $3 billion in financing for the Papua New Guinea LNG Project or Papua New Guinea Liquefied Natural Gas Project and $18 million for the Sangatta Surface Coal Mine in Indonesia. The Export-Import Bank of the United States also supported numerous coal and gas power plants.

178. The United States supports fossil fuel development by allowing the fossil fuel industry to avoid the true social cost of CO_2 emissions from fossil fuels. Based on EPA's social cost of carbon estimates, CO_2 emissions from fossil fuels have the potential to cause trillions of dollars in damages.

D. Defendants Recklessly Allow Interstate and International Transport of Fossil Fuels

179. Despite knowledge of the harm to Plaintiffs caused by the CO_2 emissions from fossil fuels, Defendants recklessly allow all interstate transport of fossil fuels. Despite knowledge of the harm to Plaintiffs caused by the CO_2 emissions from fossil fuels, Defendants recklessly authorize and/or permit the exportation and importation of fossil fuels and/or the facilities allowing the exports and imports of fossil fuels.

180. The Office of the President exercises permitting authority over the construction and operation of "pipelines, conveyor belts, and similar facilities for the exportation or importation of petroleum, [and] petroleum products." President Obama has failed to dismantle the U.S. fossil fuel edifice, adding an additional 100,000 miles to the 2.5 million miles of oil and gas pipelines within the nation.

181. A presidential exemption or federal license is required for all exports of crude oil to all destinations. In 2014, DOE oversaw the importation of 2,677,911 thousand barrels of

crude oil, and Commerce through BIS authorized the exportation of 126,152 thousand barrels of crude oil, both increases from 2013.

182. No natural gas can be exported or imported without DOE authorization through FERC. FERC permits all LNG export terminals, including Jordan Cove LNG Terminal. Since 1995, the U.S. has imported 71,730 Bcf of natural gas and exported 14,623 Bcf. In 2014, through DOE's authorization, 51,824 thousand barrels of natural gas plant liquids and liquefied refinery gases were imported and 257,948 thousand barrels of natural gas plant liquids and liquefied refinery gases were exported.

183. Although in 1975 Congress authorized the Office of the President to restrict coal exports under the Energy Policy and Conservation Act of 1975, 42 U.S.C. § 6212(a), the President has not exercised this authority to impose any significant export restrictions on coal. In fact, since 1990, the United States has promoted expanding coal exports. Coastal facilities through which coal may be exported are subject to federal approvals. In the Pacific Northwest alone, three new marine coal terminal projects are under various stages of federal permitting and review.

184. In 2011, the U.S. exported 107 million short tons of coal. In 2012, U.S. coal exports totaled 125 million short tons, the highest level of coal exports in over twenty years. Most recently, in 2014 the EIA reported that the U.S. imported 11 million short tons of coal and exported 97 million short tons of coal.

E. Defendants Recklessly Allow CO_2 Pollution From Combustion of Fossil Fuels

185. Either directly or through the control of the Federal Government, Defendants authorize the combustion of all fossil fuels in the U.S., including coal, oil, and gas. Such

combustion occurs primarily in the energy and refineries sector, the transportation sector, and the manufacturing sector.

186. In 2012, petroleum accounted for 36.5% of the total primary energy consumption in the U.S., the single largest source of energy consumption. All U.S. petroleum refineries are permitted and regulated by EPA.

187. In 2013, fossil fuel combustion from various industrial processes accounted for approximately 15% of total CO_2 emissions in the U.S. The EPA regulates these industrial processes.

188. The DOE establishes efficiency standards in buildings and appliances. These standards affect levels of energy consumption and combustion.

189. Since 1975, through the Corporate Average Fuel Economy ("CAFE") program, the United States has required manufacturers of vehicles sold in the U.S. to comply with fuel economy standards set by DOT. By controlling the fuel economy standards, Defendants have exercised control over CO_2 emissions in the transportation sector.

190. From 1996-2014, through tax breaks, the United States subsidized the purchase, and thus increased demand for, vehicles weighing more than 6,000 pounds ("SUVs"). SUVs are less fuel-efficient and emit greater quantities of CO_2 per mile than lighter-weight vehicles, other factors held equal.

191. In 2012, U.S. CO_2 equivalent emissions from transportation were 1,837 million metric tons. In 2012, CO_2 equivalent emissions from transportation of all vehicles in the U.S., including aviation, passenger cars, SUVs, heavy-duty trucks, freight rail, ships, and boats, were responsible for 28% of total U.S. greenhouse gas emissions.

III. THE JORDAN COVE LNG EXPORTS

192. Enacted in 1992, Section 201 of the Energy Policy Act mandates the authorization of natural gas imports from, or exports to, a nation with which the United States has a free trade agreement, without modification or delay, to any person applying for such authorization. Accordingly, under the Energy Policy Act, such natural gas imports and exports are automatically deemed consistent with the public interest. 15 U.S.C. § 717b(c).

193. Pursuant to Section 201 of the Energy Policy Act, on December 7, 2011, DOE, through the Office of Fossil Energy, issued DOE/FE Order No. 3041, granting long-term multi-contract authorization to Jordan Cove Energy Project, L.P. to export liquefied natural gas from Jordan Cove LNG Terminal in Coos Bay, Oregon, to free trade agreement nations. The DOE/FE Order authorizes the export of up to 13,140 Bcf of natural gas over 30 years. That quantity of natural gas would result in approximately 716.2 million metric tons of CO_2 emissions, more than all of the CO_2 emitted in 2012 by our nation's largest emitter, Texas.

194. Jordan Cove will be operational in the first quarter of 2018, according to the Vice President of the Jordan Cove Energy Project, LLC, seven years after receiving its export authorization from DOE.

195. Pursuant to its authorization, the Jordan Cove LNG L.P. has given notice to DOE that, by the end of 2015, even before it has all final approvals from other agencies, it will enter into "binding long-term liquefaction tolling service agreements" for the full liquefaction capacity of the export terminal.

196. The sources of natural gas for Jordan Cove LNG's exports authorized by DOE include suppliers operating in the Rocky Mountain region of the U.S., western Wyoming, northwestern Colorado, northern Utah, northern Nevada, and northern California.

197. In a letter of support for Jordan Cove LNG Terminal exports, Governor John Hickenlooper of Colorado wrote to DOE and FERC: "Jordan Cove is of specific interest to Colorado . . . The project terminal is the only LNG facility on the west coast that would directly link Colorado to new energy markets via the Ruby Pipeline which originates in northwest Colorado and carries natural gas from that region to states further west of Colorado."

198. Jordan Cove LNG will liquefy this natural gas for export at its proposed LNG export terminal in Coos Bay, Oregon. Jordan Cove plans to build a new power plant to provide the additional electricity needed to liquefy the natural gas for export. The proposed 420-MW South Dunes Power Plant would be the second-largest single source of greenhouse gas emissions in Oregon and would be the largest single source of CO_2 emissions in Oregon in 2020 if it were built. The Jordan Cove South Dunes Power Plant would emit 51.6 million tons of CO_2 over 30 years, or 1.72 million tons of CO_2 per year.

199. According to the EIA, liquefying natural gas requires the energy equivalent of 10% of the gas being exported.

200. The CO_2 emissions resulting from the Jordan Cove LNG Terminal exports and the South Dunes Power Plant emissions will harm Youth Plaintiffs who live in and around Oregon, as well as Future Generation Plaintiffs, by further endangering the climate system.

201. Youth Plaintiffs who live in Colorado are also adversely impacted by the opening up of an international market for the export of natural gas being extracted through hydraulic fracturing in the State of Colorado, and in the Rocky Mountain region of the U.S. generally, and then shipped by pipeline to Oregon for liquefaction and export abroad, ultimately to be burned, thereby causing additional CO_2 emissions. The Youth Plaintiffs from Colorado and Oregon are harmed by the fossil fuel exploitation in and running through their states, which will be

connected by the Pacific Connector Natural Gas Pipeline and 3,900 mile gas transmission system crossing the states of Washington, Oregon, Idaho, Wyoming, Utah, and Colorado.

IV. CURRENT SCIENCE ON GLOBAL CLIMATE CHANGE AND OCEAN ACIDIFICATION

202. There is a scientific consensus that climate change endangers humanity and nature. Present climate change is a consequence of anthropogenic GHGs, primarily CO_2, derived from the combustion of fossil fuels. The fossil fuel emissions have led to an energy imbalance and consequent dangerous disruption of the climate system upon which our nation and Plaintiffs depend.

203. Atmospheric CO_2 levels greater than 350 ppm cause this energy imbalance. That energy imbalance is now approximately 0.6 Watts/m2 averaged over the entire planet, equivalent to exploding more than 400,000 Hiroshima atomic bombs per day, 365 days per year, throughout our planet.

204. The 2014 National Climate Assessment acknowledged that "[t]he cumulative weight of the scientific evidence . . . confirms that climate change is affecting the American people now, and that choices we make will affect our future and that of future generations."

205. Greenhouse gases in the atmosphere act like a blanket over the Earth, trapping energy received from the sun. More GHG emissions in the atmosphere means that more energy is retained on Earth, with less being radiated back into space.

206. A substantial portion of every ton of CO_2 emitted by humans persists in the atmosphere for as long as a millennium or more. Therefore, the impacts associated with past and current CO_2 emissions will be borne by our children and future generations. Our nation will continue to warm in response to concentrations of CO_2 from past emissions, as well as future emissions.

207. The current level of atmospheric CO_2 concentration caused by human-made climate change has already taken our country into the danger zone.

208. In 2013, the atmospheric CO_2 concentration exceeded 400 ppm for the first time in recorded history. The pre-industrial concentration was 280 ppm. Emissions must be rapidly and systematically reduced to well below the natural rate of draw-down into Earth's forests, soils, and crust in order to restore energy balance and avoid crossing tipping points that set in motion disastrous impacts to human civilization and nature.

209. March 2015 was the first month that the monthly global average concentration of CO_2 was 400 ppm for an entire month, reaching levels that have not been seen for about three million years. CO_2 concentrations have risen more than 120 ppm since pre-industrial times, with half of that rise occurring since 1980.

210. Earth has now warmed about 0.9°C above pre-industrial temperatures. That temperature is equivalent to the maximum temperatures of the Holocene era, the period of climate stability over the last 10,000 years that enabled human civilization to develop. Warming is expected to hit 1°C in 2015-16.

211. Civilization and the water sources, crops, foods, wildlife, marine life, and coastlines on which people depend have developed within a very narrow set of climatic conditions. It will be nearly impossible for Plaintiff to adapt to all of the current climate change impacts in the quick time-frame in which they will occur. The survival and well-being of Plaintiffs is significantly threatened by climate destabilization.

212. Declaring the United States' energy system to be unconstitutional would resolve the controversy between the parties. Defendants would abide by the decree and bring the energy system into constitutional compliance, thereby redressing a substantial cause of Youth Plaintiffs'

constitutional injuries and eliminating a source of their significant risk of sustaining worsening injuries. Any "[f]urther or proper relief" that may be granted based on the declaratory judgment, 22 U.S.C. § 2202, regarding Defendants' national energy system policies and practices would further aid in reducing the earth's energy imbalance, the severity of the Youth Plaintiffs' injuries, the severity of Defendants' disruption of the climate system, and the severity and pace of ocean acidification, within the lifetimes of Youth Plaintiffs.

V. EXISTING IMPACTS OF CLIMATE CHANGE ACROSS THE NATION

213. Climate change is already damaging human and natural systems, causing loss of life and pressing species to extinction. Unless arrested by government action informed by science, climate change will impose increasingly severe impacts on our nation and others, potentially to the point of collapse.

214. Recent scientific reports, for example, warn of the disintegration of both the West Antarctic ice sheet and the East Antarctic ice sheet, causing multi-meter sea-level rise. Such will devastate coastal regions, including much of the eastern seaboard. Millions of Americans and trillions of dollars in property damage will result. The risk of this devastation approaches certainty, unless fossil fuel emissions are rapidly phased out. The recent studies more fully than prior studies account for the potential for non-linear ice sheet melting, which could raise the sea level by 10 feet (or more) by mid-century.

215. If carbon pollution is not quickly abated, there is near scientific certainty that humanity will suffer sea level rise of several meters, submerging much of the eastern seaboard of the U.S., including Florida, as well as other low lying areas of Europe, the Far-East, and the Indian sub-continent.

216. Well-documented and observable impacts from the changes in Earth's climate system highlight that the current level of atmospheric CO_2 concentration has already taken our nation into a danger zone. Increased CO_2 emissions are already resulting not only in the warming of land surfaces, but also in the warming of oceans, increasing atmospheric moisture levels, rising global sea levels, and changing rainfall and atmospheric air circulation patterns that affect water and heat distribution.

217. One key observable change is the rapid increase in recorded surface temperatures. As a result of increased atmospheric CO_2 from human activities, our nation has been warming as scientists predicted as early as 1965. The increased concentrations of greenhouse gases in our atmosphere have raised global surface temperature by approximately 0.9° Celsius. In the last thirty years, Earth has been warming at a rate three times faster than that over the previous one hundred years. 2014 was the hottest on record, according to the National Aeronautics and Space Administration ("NASA").

218. As expected, our country's sea levels have also risen from glacial and ice cap melting, as well as from the thermal expansion of the ocean itself. Based on measurements taken from 1993 to 2010, sea levels have been rising at an average rate of 3.2 millimeters per year. Though sea levels rose about 170.18 millimeters (0.2 meters) over the last century, within the last decade, the rate of sea-level rise has nearly doubled. Rising seas have caused and will cause flooding in coastal and low-lying areas. The combination of rising sea levels and more severe storms creates conditions conducive to severe storm surges during high tides. In coastal communities this can overwhelm levees and sea walls, as witnessed during Hurricane Katrina, Hurricane Sandy, and other major storms.

219. Today, rising sea levels are submerging low-lying lands, eroding beaches, converting wetlands to open water, exacerbating coastal flooding, and increasing the salinity of estuaries and freshwater aquifers. Between 1996 and 2011, twenty square miles of land were inundated by rising sea levels along the Atlantic coast. Coastal states, such as Maryland and Louisiana, are experiencing wetland loss due to rising sea levels. Scientists have predicted that wetlands in the mid-Atlantic region of the U.S. cannot withstand a seven-millimeter per year rise in sea levels.

220. Similarly, climate change is already causing, and will continue to result in, more frequent, extreme, and costly weather events, such as floods and hurricanes. The annual number of major tropical storms and hurricanes has increased over the past 100 years in North America, coinciding with increasing temperatures in the Atlantic sea surface. Across the U.S., nine of the top ten years for extreme one-day precipitation events have occurred since 1990.

221. Changes in our country's water cycle as a result of climate change also increase the potential for, and severity of, droughts. Even in arid regions, increased precipitation is likely to cause flash flooding, and will be followed by drought. These changes are already occurring. Droughts in parts of the Midwestern, Southeastern, and Southwestern U.S. have increased in frequency and severity within the last fifty years, coinciding with rising temperatures. Most of the recent heat waves can be attributed to human-caused climate disruption.

222. In higher altitude and latitude regions, including in mountainous areas, more precipitation is falling as rain rather than snow. With early snow melt occurring because of climate change, the reduction in snowpack can aggravate water supply problems. The snow cover extent of North America in June 2015 was 0.75 million square miles, the second lowest ever recorded behind June 2012, with 0.68 million square miles. The average area of North

America covered by snow decreased by about 3,500 square miles per year between 1972 and 2013.

223. Arctic sea ice is declining precipitously and is expected to disappear completely in the coming decades. In 2013, Arctic sea ice extent for September was 700,000 square miles below the 1981-2010 average for the same period. In 2014, the Arctic sea ice extent for September was 463,000 square miles below average. In 2015, the maximum extent of the Arctic sea ice was the lowest in the satellite record. With less sea ice, less solar radiation is reflected back to space, a positive feedback loop serving to amplify regional and global warming.

224. Similarly, there has been an increase in permafrost temperatures and melting in Alaska. Substantial methane releases from thawing permafrost have already been observed in Alaska. Because much of the Alaskan permafrost overlays old peat bogs that sequester methane, permafrost melting ill release methane that will further increase global warming to even more dangerous levels. CO_2 and methane released from thawing permafrost could contribute as much as 0.4°F to 0.6°F of warming by 2100.

225. Mountain glaciers are receding nationwide because of warming temperatures. In 2010, Glacier National Park in Montana had only twenty-five glaciers larger than twenty-five acres, as opposed to 150 such glaciers in 1850. In the Brooks Range of northern Alaska, all of the glaciers are in retreat and in southeastern Alaska, 98% are in retreat.

226. The melting of mountain glaciers is particularly serious in areas that rely on snow melt for irrigation and drinking water supply. In effect, a large snow pack or glacier acts as a supplemental reservoir or water tower, holding a great deal of water in the form of ice and snow through the winter and spring and releasing it in the summer when rainfall is lower or absent. The water systems of the western U.S., particularly in California and Oregon, heavily rely on this

natural water storage. Yet as temperatures warm, not only will these areas lose this supplemental form of water storage, but severe flooding is also likely to increase as rainfall accelerates the melting of glaciers and snow packs.

227. Changes in water supply and water quality will also impact agriculture in the U.S. Increased heat and associated issues such as pests, crop diseases, and weather extremes, will all impact crop and livestock production and quality. For example, anthropogenic climate change in the U.S. has produced warmer summers, enabling the mountain pine beetle to produce two generations of beetles in a single summer season, where it had previously only been able to produce one. In Alaska, the spruce beetle is maturing in one year when it had previously taken two years. The expansion of the forest beetle population has killed millions of hectares of trees across the U.S. and resulted in millions of dollars lost from decreased tourism revenues.

228. Agriculture is extremely susceptible to climate change, threatening food security. Higher temperatures generally reduce yields of desirable crops while promoting pest and weed proliferation. Climate change is predicted to decrease crop yields, increase crop prices, decrease nationwide calorie availability, and increase malnutrition.

229. Increased wildfires, shifting precipitation patterns, higher temperatures, and drought conditions also threaten forest industries and private property. In the U.S., 72,000 wildfires have been recorded, on average, each year since 1983. Nine of the ten years with the largest acreage burned have occurred in the fourteen years since 2000.

230. Increased CO_2 emissions are having a severe negative impact on the health of our oceans. The oceans absorb approximately 25-30% of global CO_2 emissions, resulting in a 30% increase in surface ocean acidity.

231. Ocean acidification has been rising at a geologically unprecedented rate. Currently, acidity is rising at least 100 times faster than at any other period during the last 100,000 years, threatening marine life, including human food sources. Organisms at risk include: corals, oysters, clams, scallops, mussels, abalone, crabs, geoducks, barnacles, sea urchins, sand dollars, sea stars, sea cucumbers, many common single-celled organisms and protists that act as prey, and various forms of seaweed. The loss of some of these species can cause entire food webs to collapse.

232. By 2100, the surface waters of the ocean could be nearly 150% more acidic, resulting in a pH that the oceans have not experienced for more than 20 million years. In recent years, ocean acidification has already contributed to oyster reproductive failures impacting the Pacific Northwest's shellfish industry, including oyster harvests in Coos Bay, Oregon. In addition, warmer water in regional estuaries, such as Puget Sound, may contribute to a higher incidence of harmful blooms of algae linked to paralytic shellfish poisoning and may result in adverse economic impacts from beach closures affecting recreational harvesting of shellfish, such as razor clams.

233. The rise in ocean acidity places coral reefs at considerable risk. Given that coral reefs are among the most biologically diverse and economically important ecosystems, the impact of their loss cannot be overstated. Coral reefs provide shelter to a quarter of all marine species.

234. For major U.S. coral reefs, projections show extensive bleaching and dramatic loss of shallow coral cover occurring by 2050, and near complete loss by 2100. In Hawai'i, coral cover is projected to decline from 38% (current coral cover) to approximately 5% by 2050, with further declines thereafter. In Florida and Puerto Rico, where present-day temperatures are

already close to bleaching thresholds, coral is projected to disappear even faster. Given the severity of these impacts, it is inevitable that these effects would be felt across our country, and by future generations.

235. Climate change and ocean acidification are threatening the survival and wellbeing of plants, fish, wildlife, and biodiversity. As many as one in six species are threatened with extinction due to climate change. Many more species that do not face extinction will face changes in abundance, distributions, and species interactions that cause adverse impacts for ecosystems and humans.

236. Salmon have historically been associated with human society and been a major contributor to the economy. Due to physical changes to freshwater ecosystems resulting from climate change, salmon populations have declined significantly across the country. The optimum water temperature for salmonids is 55° to 64° Fahrenheit; massive fish kills have occurred at or above 71° Fahrenheit. As of 2015, four salmon species in eighteen locations are on NOAA's Endangered and Threatened Marine Species list; in five locales they are extinct. Scientists from the Salmon 2100 Project, housed in an EPA research laboratory in Oregon, have predicted that, despite current recovery efforts, salmon runs are not likely to sustain themselves through 2100 and other recovery strategies must be adopted to combat climatic shifts.

237. Fossil fuel extraction and combustion, and the resulting climate change, is already contributing to an increase in allergies, asthma, cancer, cardiovascular disease, stroke, heat-related morbidity and mortality, food-borne diseases, injuries, toxic exposures, mental health and stress disorders, and neurological diseases and disorders. Climate change threatens the basic requirements for maintaining health like clean air, pure water, sufficient food, and adequate shelter. It also increases occurrence of infectious diseases.

238. In the U.S., 8,000 Americans have died from heat-related illnesses over the last three decades. There are now twice as many Lyme disease cases than were reported in 1991. In the past three decades, the percentage of Americans with asthma has more than doubled, and climate change is putting those Americans at greater risk of requiring hospitalization. Longer growing seasons allow for ragweed to produce pollen for a longer period, resulting in aggravated and prolonged allergies for millions of Americans.

239. Climate change also harms our national security, adding tension even in stable regions of the world. The DOD acknowledged the severity of climate change and its connections to national security when, in its 2014 Quadrennial Defense Review, climate change was classified as a "threat multiplier": "Pentagon leaders have identified three main ways that climate change will affect security; accelerating instability in parts of the world wracked by drought, famine, and climate-related migrations; threatening U.S. military bases in arid Western states or on vulnerable coastlines; and increasing the need for U.S. forces to respond to major humanitarian disasters."

240. By 2025, 40% of the world's population will be living in countries experiencing significant water shortages, while sea-level rise could cause displacement of tens, or even hundreds, of millions of people. As a result, the U.S. will experience an additional need to accept immigrant and refugee populations as droughts increase and food production declines in other countries. Increased extreme weather events (such as hurricanes) will also present an increased strain on foreign aid provided by the U.S. and materially increased deployment of our country's military forces.

241. Our nation is already observing significant impacts from the relatively small amount of warming that has occurred. These impacts constitute harbingers of far more

dangerous changes to come. If unabated, continued GHG emissions, especially CO_2, will initiate dynamic climate change and effects that spin out of control for Plaintiffs and future generations as the planet's energy imbalance triggers amplifying feedbacks and the climate system and biological system pass critical tipping points. Such changes would be irreversible on any time scale relevant to Plaintiffs and threaten their survival.

VI. FUTURE NATIONAL CLIMATE IMPACTS EXPECTED BY 2050 AND 2100

242. By 2050, Youth Plaintiffs will range in age from 43 to 55.

243. By 2100, global mean sea level rise is projected to be at 56 inches, if sea level rise occurs linearly. Based on that global projection, it is predicted that the U.S. will experience a 56-65 inch sea level rise on the East Coast, up to a 76-87 inch sea level rise in areas surrounding the Gulf of Mexico, and a 47-65 inch sea level rise along the West Coast. Sea level rise could be even more catastrophic depending upon the rate of disintegration of the Antarctic ice sheets. Sea level rise will result in increased erosion and the loss of land. In Washington and Oregon, more than 140,000 acres of coastal lands lie within 40 inches in elevation of high tide. Among the most vulnerable parts of the coast is the heavily populated south Puget Sound region, which includes Olympia, Tacoma, and Seattle, Washington.

244. New scientific evidence demonstrates that a non-linear process could trigger much greater sea level rise in a time frame of 50 to 200 years.

245. Global temperature increases are projected to increase by 9° Fahrenheit by 2100. In the U.S., the largest temperature increases are expected in the Mountain West and Northern regions consisting of 14° and 12° Fahrenheit, respectively.

246. In an EPA-funded study, "Ensemble Projections of Wildfire Activity and Carbonaceous Aerosol Concentrations Over the Western United States in the Mid-21st Century,"

scientists estimated that, by 2050, wildfire activity is expected to double in the Southwest, Pacific Northwest, Rocky Mountains Forest, and the Eastern Rockies/Great Plains regions. In the western U.S., increases in temperature are projected to cause an increase of 54% in annual mean area burned by 2050 relative to the present day. Changes in area burned are ecosystem dependent, with the forests of the Pacific Northwest and Rocky Mountains experiencing the greatest increases of 78% and 175%, respectively. Increased area burned results in near doubling of wildfire carbonaceous aerosol emissions by midcentury. The increase in wildfires and the associated emissions will have harmful impacts on health. Polar bears are just one of the species listed as endangered due to the impacts of a changing climate on their habitat. If emissions continue to rise at current rates throughout the 21st century, polar bears will likely be extirpated from much of their present-day range, including Alaska's North Slope Borough. Sea ice, which polar bears depend upon to access their prey, is projected to disappear by 2100. Experts project there will be massive species extinction this century.

247. Human-induced warming, if business continues as usual, is projected to raise average temperatures by about 6° to 11° Fahrenheit in this century. Heat waves would then increase in frequency, severity, and duration. For example, by the end of this century, if Defendants do not dramatically reduce emissions, the number of heat-wave days in Los Angeles is projected to double, and the number of heat-wave days in Chicago to quadruple, resulting in many more deaths.

248. While potential climate change impacts on water resources vary between regions, the western states will be particularly impacted by drought, reduced precipitation, increased evaporation, and increased water loss from plants.

249. Warmer temperatures particularly impact the Pacific Northwest because reduced snowpack and earlier snowmelt alter the timing and amount of water supplies. By 2050, snowmelt is projected to shift three to four weeks earlier than the 20th century average. Since earlier snowmelt will result in warmer and shallower rivers and streams in summer and fall, diseases and parasites that tend to flourish in warmer water threaten to eliminate up to 40% of remaining Northwest salmon populations by 2050.

250. By 2050, biologists conservatively expect decreases in salmon populations will lead to 11% to 14% less annual carcass biomass available to bald eagles, our country's national bird.

251. Defendants, through the Department of Homeland Security, have acknowledged mass human migrations are a potential impact of climate change, and have developed a mass migration plan. Estimates put the number of climate-induced migrants worldwide at 200 million by 2050.

252. Climate change projections estimate an increase in monetary damages associated with inland flooding across most of the contiguous U.S. Approximately 190,000 of our nation's bridges are vulnerable to increased inland flooding caused by climate change, with adaptation costs estimated at $170 billion for the period from 2010 to 2050. In the Northwest, a region including Washington and parts of Oregon and Idaho, 56% of inland bridges are identified as vulnerable in the second half of the 21st Century.

253. In 2100 alone, adaptation costs associated with the 50-year, 24-hour storm moniker in 50 U.S. cities are estimated to range from $1.1 to $12 billion. Further, climate change is projected to result in $5.0 trillion in damage to coastal properties in the contiguous U.S. through 2100.

254. Due to extreme temperature increases and unsuitable working conditions, our nation's labor force may experience a drastic decline in labor hours and lost wages. In 2100, a projected 1.8 billion labor hours will be lost along with approximately $170 billion in lost wages.

255. By 2050, climate change is expected to add thousands of additional premature deaths per year nationally from combined ozone and particle health effects. Higher surface temperatures, especially in urban areas, promote the formation of ground–level ozone, which has adverse impacts on human health by irritating the respiratory system, reducing lung function, aggravating asthma, and inflaming and damaging cells that line the airways. Climate change is expected to increase the frequency of high ozone pollution events by 50% to 100% by 2050.

VII. RESTORING THE ENERGY BALANCE AND PROTECTING AGAINST A DANGEROUS DESTABILIZED CLIMATE SYSTEM IS POSSIBLE BASED ON BEST AVAILABLE SCIENCE

256. An urgent and critical undertaking is required to protect the climate system and cause a cessation of Defendants' infringement of Plaintiffs' constitutional rights. Defendants must act rapidly and effectively to phase out CO_2 emissions so as to restore Earth's energy balance. Absent such immediate action, the Federal Government must cease permitting and authorizing fossil fuel projects so as not to exacerbate the climate crisis and further infringe on Plaintiffs' constitutional rights.

257. Global atmospheric CO_2 concentrations must be reduced to below 350 ppm by the end of the century in order to limit the period of CO_2 overshoot and stabilize our climate system.

258. To reduce global atmospheric CO_2 concentrations to 350 ppm by the end of this century would require a near-term peak in CO_2 emissions and a global reduction in CO_2 emissions of at least 6% per year, alongside approximately 100 gigatons of carbon drawdown this century from global reforestation and improved agriculture.

259. Reducing the global atmospheric CO_2 concentration to 350 ppm by the end of the century is also necessary in order to protect oceans and marine life. As a result of CO_2 emissions, of which approximately 25% are absorbed by the oceans, humans, marine organisms, and ecosystems are already harmed and will increasingly be harmed by ocean acidification. To prevent the further impairment or depletion of the oceans and oceanic resources, it is imperative that Defendants take immediate measures to return atmospheric CO_2 concentrations to below 350 ppm by the end of this century.

260. Targets that aim to limit atmospheric CO_2 concentrations at or below 450 ppm are insufficient to avoid severe, irreversible damage as a result of ocean acidification and ocean warming. For example, the weight of recent evidence establishes that, at a prolonged 450 ppm level, coral reefs will become extremely rare, if not extinct, and at least half of coral-associated wildlife will become either rare or extinct. As a result, coral reef ecosystems will likely be reduced to crumbling frameworks with few calcareous corals remaining.

261. Current actions by Defendants will not yield atmospheric CO_2 levels of 350 ppm by the end of the century, are not based on any scientific standard, and are not adequate to prevent and remedy the degradation, diminution, or depletion of our country's public trust resources.

262. Defendants' national energy system makes it extremely difficult for Plaintiffs to protect their vital natural systems and a livable world. Defendants must act immediately to restore Earth's energy balance and put the nation on a trajectory that is consistent with reducing the atmospheric CO_2 concentrations to no more than 350 ppm by 2100.

VIII. THE FEDERAL GOVERNMENT'S ADMISSIONS OF ITS PUBLIC TRUSTEE OBLIGATIONS

263. Defendants are trustees of national public natural resources. The national public natural resources include the air (atmosphere), seas, shores of the sea, water, and wildlife.

264. In 1968, Congress declared that the Federal Government has "continuing responsibility" to "use all practicable means" so as to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations." 42 U.S.C. § 4331(b)(1).

265. Congress also declared that the Federal Government is among the "trustees for natural resources" and directed Defendants to act as trustees, on behalf of the public beneficiaries, of all natural resources under their management and control. 42 U.S.C. § 9607 (f)(1); *see also* 33 U.S.C. § 2706 (Oil Pollution Act).

266. Pursuant to Congressional direction, the President designated the following federal agencies to act on behalf of the public as trustees for natural resources: the USDA, Commerce, DOD, DOE, and DOI. In this context, the term natural resources "means land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled (referred to as 'managed or controlled') by the United States (including the resources of the exclusive economic zone)." 40 C.F.R. § 300.600(a); *see* 42 U.S.C. § 9607 (f)(2)(A).

267. According to the National Research Council, "fisheries within federal waters are held in public trust for the people of the United States."

268. According to the U.S. Commission on Ocean Policy, "the U.S. government holds ocean and coastal resources in the public trust – a special responsibility that necessitates balancing different uses of those resources for the continued benefit of all Americans."

269. According to NOAA, it "has an obligation to conserve, protect, and manage living marine resources in a way that ensures their continuation as functioning components of marine ecosystems, affords economic opportunities, and enhances the quality of life for the American public." Further, NOAA affirmed that air is a natural resource under the public trust doctrine, and that the Federal Government shares jurisdiction with states over such public trust resources.

270. NOAA admits that one principle of the public trust doctrine is: "The public has fundamental rights and interests in natural resources such as the sea, the shore, and the air."

271. The DOI admits that the public trust doctrine "now encompasses all natural resources," and that natural resources include "land, fish, wildlife, biota, air, water, ground water, drinking water supplies and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the U.S." The DOI admits that the "Department of the Interior, Department of Commerce (delegated to NOAA), Department of Energy, Department of Agriculture, Department of Defense, and any other Federal Land Managing Agency" are "Federal Trustees."

272. The State Department admitted "an obligation to current and future generations to take action" on climate change.

273. The United States has taken the position before federal courts that the Federal Government is a trustee over important national natural resources, including wildlife, and has both rights and obligations under the public trust doctrine.

274. By way of example, in a 2010 complaint filed against British Petroleum, the United States alleged: "Natural resources under the trusteeship of the United States and other sovereigns have been injured, destroyed, or lost as a result of discharged oil and associated

removal efforts. The discharged oil is harmful to natural resources exposed to the oil, including aquatic organisms, birds, wildlife, vegetation, and habitats."

275. Since 1965, Defendants have known they each have mandatory duties to abate CO_2 pollution from fossil fuels in order to stop global climate change: "The pervasive nature of pollution, its disregard of political boundaries including state lines, the national character of the technical, economic and political problems involved, and the recognized Federal responsibilities for administering vast public lands which can be changed by pollution, for carrying out large enterprises which can produce pollutants, for preserving and improving the nation's natural resources, all make it mandatory that the Federal Government assume leadership and exert its influence in pollution abatement on a national scale."

276. Defendants have exerted their influence, control, custodianship, and sovereignty over the polluted atmosphere and the exploitation of fossil fuels, but they have not abated the harm. Because Defendants have put Plaintiffs in danger and increased Plaintiffs' susceptibility to harm, Defendants are responsible for taking action to protect Plaintiffs. In fact, Defendants have exacerbated the harm to our atmosphere in violation of Plaintiffs' constitutional rights.

276-A. This Court should issue a declaratory judgment to resolve this actual constitutional case and controversy between these young Plaintiffs and the government Defendants as to whether Defendants' national energy system has violated and continues to violate Plaintiffs' constitutional rights as described herein. Until the Court resolves this constitutional controversy, these young Plaintiffs will continue to be harmed and put at extreme risk by Defendants' energy system and Defendants will continue policies and practice, made up of many aggregate actions, to perpetuate an unconstitutional energy system, avoiding the constitutional check of Article III courts, and undermining the separation of powers that the

Framers intended. Without declaratory relief in the first instance, Defendants will be free to, and will, continue its policies and practices that make the nation's energy system in a manner that "may hasten an environmental apocalypse" and carry out "the Nation's willful destruction." Declaratory judgment will eliminate the current and substantial legal controversy and inform the parties of the unlawfulness or lawfulness of the government's conduct, especially as to whether Defendants' conduct causes a deprivation of rights secured by the Constitution. It has long been held that there is an expectation in our democracy that government officials will comply with a declaratory judgment. *Utah v. Evans*, 536 U.S. 452, 463-64 (2002). If the constitutional controversy is resolved in their favor by declaratory judgment, Plaintiffs reserve the right to seek further relief as deemed appropriate and consistent with the separation of powers between the three branches of government. Plaintiffs come before this Court to defend and secure their fundamental rights under the Constitution, before it is too late.

CLAIMS FOR RELIEF

First Claim for Relief
Violation of the Due Process Clause of the Fifth Amendment

277. Plaintiffs hereby re-allege and incorporate by reference each of the allegations set forth above.

278. The Constitution recognizes and preserves the fundamental right of citizens to be free from government actions that harm life, liberty, and property. These inherent and inalienable rights reflect the basic societal contract of the Constitution to protect citizens and posterity from government infringement upon basic freedoms and basic (or natural) rights. The rights to life, liberty, and property have evolved and continue to evolve as technological advances pose new threats to these fundamental rights and as new insights reveal discord between the Constitution's central protections and the conduct of government. As set forth in the

Preamble of the Constitution, these rights belong to present generations as well to our "Posterity" (or future generations).

279. Our nation's climate system, including the atmosphere and oceans, is critical to Plaintiffs' rights to life, liberty, and property. Our nation's climate system has been, and continues to be, harmed by Defendants. Defendants harmed our nation's climate system with full appreciation of the results of their acts. Plaintiffs' substantive Fifth Amendment rights have been infringed because Defendants' national energy system is a substantial factor in causing atmospheric CO_2 to rise to levels that dangerously interfere with a stable climate system required alike by our nation and Plaintiffs. The present CO_2 concentration and continuing CO_2 emissions – a function, in substantial part, of Defendants' historic and continuing permitting, authorizing, and subsidizing of fossil fuel extraction, production, transportation, and utilization – endangers Plaintiffs' lives, liberties, and property.

280. For the past fifty years, Defendants have known about the danger to Plaintiffs' safety created by carbon pollution. Acting with full appreciation of the consequences of their acts, Defendants knowingly caused, and continue to cause, dangerous interference with our atmosphere and climate system. Defendants have knowingly endangered Plaintiffs' health and welfare by approving and promoting fossil fuel development, including exploration, extraction, production, transportation, importation, exportation, and combustion, and by subsidizing and promoting this fossil fuel exploitation. All of these deliberate actions by Defendants have cumulatively resulted in dangerous levels of atmospheric CO_2, which deprive Plaintiffs of their fundamental rights to life, liberty, and property.

281. Plaintiffs are suffering harm by the dangerous aggregate actions and deliberate omissions of Defendants. Defendants' dangerous interference with a stable climate system is

having such irreversible and catastrophic consequences as to shock the conscience. The conduct, if not fundamentally altered, will have even worse consequences for future generations.

282. The affirmative aggregate acts of Defendants have been and are infringing on Plaintiffs' right to life by causing dangerous CO_2 concentrations in our nation's atmosphere and dangerous interference with our country's stable climate system.

283. The affirmative aggregate acts of Defendants have been and are infringing on Plaintiffs' liberties by placing Plaintiffs in a position of danger with a destabilized climate system and dangerous levels of CO_2 in our country's atmosphere. Defendants' aggregate acts of increasing CO_2 concentrations in the atmosphere have been and are harming Plaintiffs' dignity, including their capacity to provide for their basic human needs, safely raise families, practice their religious and spiritual beliefs, maintain their bodily integrity, and lead lives with access to clean air, water, shelter, and food.

284. After knowingly creating this dangerous situation for Plaintiffs, Defendants continue to knowingly enhance that danger by allowing fossil fuel production, consumption, and combustion at dangerous levels, thereby violating Plaintiffs' substantive Fifth Amendment due process rights.

285. After placing Plaintiffs in a position of climate danger, Defendants have continued to act with deliberate indifference to the known danger they helped create and enhance. A destabilized climate system poses unusually serious risks of harm to Plaintiffs' lives and their bodily integrity and dignity. As described at length, *supra*, these risks are so substantial as to shock the conscience. Defendants have had longstanding, actual knowledge of the serious risks of harm and have failed to take necessary steps to address and ameliorate the known, serious risk to which they have exposed Plaintiffs. With deliberate indifference,

Defendants have not implemented their own plans for climate stabilization or any other comprehensive policy measures to effectively reduce CO_2 emissions to levels that would adequately protect Plaintiffs from the dangerous situation of climate destabilization.

286. By exercising sovereignty over the air space, the federal public domain, and the national energy system, by assuming authority and regulatory responsibility over fossil fuels, and by allowing and permitting fossil fuel production, consumption, and its associated CO_2 pollution, Defendants have also assumed custodial responsibilities over the climate system within its jurisdiction and influence. In assuming control of our nation's atmosphere, air space, the federal domain, national energy system, fossil fuels, and climate system, Defendants have imposed severe limitations on Plaintiffs' freedom to act on their own behalf to secure a stable climate system and, therefore, have a special relationship with Plaintiffs, and a concomitant duty of care to ensure their reasonable safety. By and through the national energy system resulting in dangerous interference with a stable climate system, Defendants have abrogated their duty of care to protect Plaintiffs' fundamental rights to life, liberty, and property. In their custodial role, Defendants have failed to protect Plaintiffs' needs with respect to the climate system in violation of the Fifth Amendment.

287. Furthermore, Defendants' national energy system, if not fundamentally altered without delay, will effect a complete taking of some of Plaintiffs' property interests by virtue of the sea level rise that is an incident of Defendants' unlawful actions.

288. The United States, through DOE, is depriving Plaintiffs of their fundamental rights to be free from the dangerous government acts, which infringe on their fundamental rights to life, liberty, and property, by requiring and giving approval for the exportation and importation of natural gas resources in the U.S. through section 201 of the Energy Policy Act of

1992. The extraction, interstate transport, liquefaction, exportation, and ultimate combustion of U.S. natural gas, facilitated by section 201 of the Energy Policy Act, increase carbon pollution and exacerbate already-dangerous climate instability. Section 201 of the Energy Policy Act is unconstitutional on its face and as applied to Plaintiffs through DOE's issuance of the section 201 permit for Jordan Cove LNG Terminal in Coos Bay, Oregon. The Energy Policy Act and DOE's actions taken pursuant to the Energy Policy Act deprive Plaintiffs of their fundamental rights to life, liberty, and property.

289. The affirmative aggregate acts of Defendants in the areas of fossil fuel extraction, production, transportation, importation and exportation, and consumption, as described in this Complaint, are causing dangerous concentrations of CO_2 in the atmosphere and a dangerous climate system, and irreversible harm to the natural systems critical to Plaintiffs' rights to life, liberty, and property. The affirmative aggregate acts of Defendants cannot and do not operate to secure a more compelling state interest than Plaintiffs' fundamental rights to life, liberty, and property.

WHEREFORE, Plaintiffs pray for relief as more fully set forth below.

Second Claim for Relief
Violation of Equal Protection Principles
Embedded in the Fifth Amendment

290. Plaintiffs hereby re-allege and incorporate by reference each of the allegations set forth above.

291. Defendants have violated the equal protection principles of the Fourteenth Amendment, embedded in the Due Process Clause of the Fifth Amendment.

292. The affirmative aggregate acts of Defendants in the areas of fossil fuel production and consumption irreversibly discriminate against Plaintiffs' exercise of their fundamental rights

to life, liberty, and property, and abridge central precepts of equality. The affirmative aggregate acts of Defendants in the areas of fossil fuel production and consumption have caused and are causing irreversible climate change. As a result, the harm caused by Defendants has denied Plaintiffs the same protection of fundamental rights afforded to prior and present generations of adult citizens. The imposition of this disability on Plaintiffs serves only to disrespect and subordinate them. The principles of the Equal Protection Clause, which are embedded in the Due Process Clause, prohibit the Federal Government's unjustified infringement of Plaintiffs' right to be free from Defendants' aggregate acts that destabilize our nation's climate system whose protection is fundamental to Plaintiffs' fundamental rights to life, liberty, and property. Because fundamental rights are at stake and are being infringed by the affirmative aggregate acts of Defendants, this Court must apply strict scrutiny for a denial of equal protection of the law.

293. The Fifth Amendment's Due Process Clause and the Fifth Amendment's equal protection principles are profoundly connected but set forth distinct principles, which are implicated here. The reason why a stable climate system is inherent in our fundamental rights to life, liberty, and property becomes more clear and compelling because of the grave and continuing harm to children that results from discriminatory laws and actions that prevent a stable climate system. The application of these dual principles requires strict scrutiny of Defendants' discriminatory laws and actions.

294. Plaintiffs are separate suspect classes in need of extraordinary protection from the political process pursuant to the principles of Equal Protection. As evidenced by their affirmative aggregate acts, Defendants have a long history of deliberately discriminating against children and future generations in exerting their sovereign authority over our nation's air space and federal fossil fuel resources for the economic benefit of present generations of adults.

Plaintiffs are an insular minority with no voting rights and little, if any, political power or influence over Defendants and their actions concerning fossil fuels. Plaintiffs have immutable age characteristics that they cannot change.

295. Future generations do not have present political power or influence, have immutable characteristics, and are also an insular minority.

296. Plaintiffs have no avenues of redress other than this Court, as Plaintiffs cannot challenge or alter Defendants' national energy system. Plaintiffs will disproportionately experience the irreversible and catastrophic impacts of an atmosphere and oceans containing dangerous levels of CO_2 and a dangerous destabilized national climate system. The adults living in our country today will not experience the full scope of catastrophic harms that will be experienced by Plaintiffs.

297. For purposes of the present action, Plaintiffs should be treated as protected classes because the overwhelming majority of harmful effects caused by the acts of Defendants will occur in the future. As Plaintiffs include citizens presently below the voting age and future generations, this Court should determine they must be treated as protected classes, and federal laws and actions that disproportionately discriminate against and endanger them must be invalidated.

298. The affirmative aggregate acts of Defendants reflect a *de facto* policy choice to favor influential and entrenched short-term fossil fuel energy interests to the long-term detriment of Plaintiff—precisely the sort of dysfunctional majoritarian outcome that our constitutional democratic system is designed to check. Such a check is especially appropriate here because our country will soon pass the point where Plaintiffs will no longer be able to secure equal protection of the laws and protection against an uninhabitable climate system.

299. The Energy Policy Act's mandatory authorization for export and import of natural gas discriminates against Plaintiffs by exacerbating already-dangerous levels of atmospheric CO_2 and a dangerous climate system, the consequences of which will be irreversible and catastrophic in Plaintiffs' lifetimes. The Energy Policy Act, section 201, creates a disproportionate impact on suspect classes. Historical evidence demonstrates Defendants' discriminatory and intentional acts against children and future generations in order to foster the short-term economic and energy interests of other classes, including corporations. The Energy Policy Act unconstitutionally deprives minor children and future generations of equal protection of the law because the full impacts of excess atmospheric CO_2 and the dangerous climate system, resulting from the U.S. government-authorized natural gas exports and imports, will be disproportionately imposed upon minor children, including Youth Plaintiffs, and for millennia by future generations.

300. Section 201 of the Energy Policy Act violates Plaintiffs' rights of equal protection under the law.

301. The affirmative aggregate acts of Defendants unconstitutionally favor the present, temporary economic benefits of certain citizens, especially corporations, over Plaintiffs' rights to life, liberty, and property.

WHEREFORE, Plaintiffs pray for relief as more fully set forth below.

Third Claim for Relief
The Unenumerated Rights Preserved for the People
by the Ninth Amendment

302. Plaintiffs hereby re-allege and incorporate by reference each of the allegations set forth above.

303. Protecting the vital natural systems of our nation for present and future generations is fundamental to our scheme of ordered liberty and is deeply rooted in this nation's

history and tradition. Without a stable climate system, both liberty and justice are in peril. Our nation's obligation to protect vital natural systems for Posterity has been recognized throughout American history, particularly through our country's conservation legislation. Our nation's founders intended that the federal government would have both the authority and the responsibility to be a steward of our country's essential natural resources. This stewardship is clear from the delegation of powers to manage lands and the conveyed authority to address major challenges facing our nation as a whole. Among the implicit liberties protected from government intrusion by the Ninth Amendment is the right to be sustained by our country's vital natural systems, including our climate system.

304. Fundamental to our scheme of ordered liberty, therefore, is the implied right to a stable climate system and an atmosphere and oceans that are free from dangerous levels of anthropogenic CO_2. Plaintiffs hold these inherent, inalienable, natural, and fundamental rights.

305. The affirmative aggregate acts of Defendants have unconstitutionally caused, and continue to materially contribute to, dangerous levels of atmospheric and oceanic CO_2 and a destabilized climate system.

306. The affirmative aggregate acts of Defendants have infringed, and continue to infringe, on Plaintiffs' fundamental constitutional rights.

WHEREFORE, Plaintiffs pray for relief as more fully set forth below.

Fourth Claim for Relief
Violation of the Public Trust Doctrine

307. Plaintiffs hereby re-allege and incorporate by reference each of the allegations set forth above.

308. Plaintiffs are beneficiaries of rights under the public trust doctrine, rights that are secured by the Ninth Amendment and embodied in the reserved powers doctrines of the Tenth

Amendment and the Vesting, Nobility, and Posterity Clauses of the Constitution. These rights protect the rights of present and future generations to those essential natural resources that are of public concern to the citizens of our nation. These vital natural resources include at least the air (atmosphere), water, seas, the shores of the sea, and wildlife. The overarching public trust resource is our country's life-sustaining climate system, which encompasses our atmosphere, waters, oceans, and biosphere. Defendants must take affirmative steps to protect those trust resources.

309. As sovereign trustees, Defendants have a duty to refrain from "substantial impairment" of these essential natural resources. The affirmative aggregate acts of Defendants in the areas of fossil fuel production and consumption have unconstitutionally caused, and continue to cause, substantial impairment to the essential public trust resources. Defendants have failed in their duty of care to safeguard the interests of Plaintiffs as the present and future beneficiaries of the public trust. Such abdication of duty abrogates the ability of succeeding members of the Executive Branch and Congress to provide for the survival and welfare of our citizens and to promote the endurance of our nation.

310. As sovereign trustees, the affirmative aggregate acts of Defendants are unconstitutional and in contravention of their duty to hold the atmosphere and other public trust resources in trust. Instead, Defendants have alienated substantial portions of the atmosphere in favor of the interests of private parties so that these private parties can treat our nation's atmosphere as a dump for their carbon emissions. Defendants have failed in their duty of care as trustees to manage the atmosphere in the best interests of the present and future beneficiaries of the trust property, including, but not limited to, Plaintiffs. Such abdication of duty abrogates the

sovereign powers of succeeding members of the Executive Branch and Congress to provide for the survival and welfare of our Nation's citizens and to promote the endurance of our Nation.

PRAYER FOR RELIEF

WHEREFORE, Plaintiffs pray for relief as set forth below:

1. Pursuant to 28 U.S.C. § 2201 and this Court's Article III authority, enter a judgment declaring the United States' national energy system that creates the harmful conditions described herein has violated and continues to violate the Fifth Amendment of the U.S. Constitution and Plaintiffs' constitutional rights to substantive due process and equal protection of the law;
2. Pursuant to 28 U.S.C. § 2201 and this Court's Article III authority, enter a judgment declaring the United States' national energy system that creates the harmful conditions described herein has violated and continues to violate the public trust doctrine;
3. Pursuant to 28 U.S.C. § 2201 and this Court's Article III authority, enter a judgment declaring that § 201 of the Energy Policy Act has violated and continues to violate the Fifth Amendment of the U.S. Constitution and Plaintiffs' constitutional rights to substantive due process and equal protection of the law.
4. Pursuant to this Court's declaratory judgment, 28 U.S.C. § 2202, and this Court's Article III authority, if deemed necessary, just and proper, issue an appropriate injunction restraining Defendants from carrying out policies, practices, and affirmative actions that render the national energy system unconstitutional in a manner that harms Plaintiffs;

5. Award Plaintiffs their costs and reasonable attorneys' fees;

6. Pursuant to 28 U.S.C. § 2202 and this Court's Article III authority, grant such other and further relief as the Court deems just and proper, to redress the constitutional violations so declared.

Respectfully submitted this 8th day of June, 2023,

s/ Julia A. Olson

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Exhibit A

Declaration of Dr. James E. Hansen in Support of Plaintiffs' Complaint for Declaratory and Injunctive Relief

In the matter
Kelsey Cascadia Rose Juliana, Xiuhtezcatl Tonatiuh M. et al. v. United States, Barack Obama et al. (D. Or. Aug. 12, 2015)

I, DR. JAMES E. HANSEN, hereby declare as follows:

1. I make and offer this declaration in my capacity as guardian for Plaintiffs Sophie K. and Future Generations, and as an expert in the field of climate science.

2. I am Sophie's grandfather.

3. I am also a US citizen, an Adjunct Professor at Columbia University's Earth Institute, and Director of the Climate Science, Awareness and Solutions program at the Earth Institute, Columbia University. I am also the immediate past Director of the NASA Goddard Institute for Space Studies and a member of the United States National Academy of Sciences.

I have testified before the United States Senate and House of Representatives on many occasions, and in court on several occasions, in support of efforts to reduce reliance on carbon-intense energy from fossil fuels and rapidly transition to carbon-free energy.

4. My training is in physics and astronomy, with early research on the clouds of Venus. Since the late 1970s, I have focused my research on Earth's climate, especially human-made climate change. Most recently, I have dedicated significant effort towards outlining the actions that must be undertaken by communities, states, the U.S. Government, and others, in order to preserve a viable climate system for young people, future generations, and other life on Earth. For the Court's more complete reference, I have attached my full CV as **Exhibit 1** to this declaration.

5. In my opinion, this lawsuit is made necessary by the at-best schizophrenic, if not suicidal, nature of U.S. climate and energy policy.

6. On the one hand, our federal government has recognized a fundamental duty to protect the public resources of our nation; to safeguard our lives and property; to secure the blessings of liberty; to ensure equal protection under the law for "ourselves and our posterity";

and, pursuant to the United Nations Framework Convention on Climate Change (UNFCCC), to "protect the climate system for present and future generations."

7. On the other hand, the federal government continues to permit and otherwise support industry's efforts to exploit fully our reserves of gas, coal, and oil, even in the face of increasing overwhelming evidence that our continued fossil fuel dependency is driving the atmospheric concentration of carbon dioxide (CO_2) far beyond that in human experience, and constitutes one of the greatest threats to our nation, human civilization and nature alike.

8. These antinomies cannot be explained away as the product of ignorance. Our government has known for decades that the continued burning of coal, oil and natural gas causes global warming and risks dangerous and uncontrollable destabilization of the planet's climate system on which our nation and future generations depend.

9. Moreover, the government has, during this last half decade, promoted the exploitation and consumption of fossil fuels in myriad ways. They include: permitting of fossil fuel development projects within the U.S.; financing of overseas fossil fuel development projects through the Export Import Bank and World Bank; issuance of leases and permits for oil, gas and coal extraction and development on contiguous federal and OCS lands; and subsidies through tax credits, deductions, preferences, percentage depletion, expensing, favorable loans and guarantees, accelerated amortization, below fair-market-value lease and royalty requirements, and other favorable tax treatment for fossil fuel development. This listing is partial.

10. It is now clear, as the relevant scientific community has established for some time, that continued high CO_2 emissions from fossil fuel burning will further disrupt Earth's climate system, and that, in turn, will impose profound and mounting risks of ecological, economic and social collapse. In my view, our government's actions and inactions that cause or contribute to

those emissions violate the fundamental rights of Sophie, other Youth, and future generations. Those violated rights include the right to life, the right to liberty, the right to property, the right to equal protection under the law, the right to government protection of public trust resources, and the right to retain a fighting chance to preserve a habitable climate system.

11. Here, then, I will address the fundamental context in which those fundamental rights violations arise. That context includes Earth's present and growing energy imbalance and the still real, but highly time-limited, opportunity to rapidly phase-down CO_2 emissions, restore energy balance, and stabilize the climate system.

12. The Court will find a more detailed treatment of these points, with supporting explanatory material and data, in two recent papers of which I am the lead author.

13. The first, Assessing ''Dangerous Climate Change'': Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature, was published in late 2013, in conjunction with 17 colleagues. In that study we established that continued fossil fuel burning up to even 2°C above the preindustrial level[1] likely would cause large climate change with disastrous and irreversible consequences, so that actions to rapidly phase out CO_2 emissions are urgently needed to reduce the atmospheric CO_2 concentration to no more than 350ppm and restore Earth's energy balance. I have attached *Dangerous Climate Change* hereto as **Exhibit 2**,[2] and I hereby incorporate by reference, into this declaration, its analyses and conclusions.

[1] We are already 0.9°C above the preindustrial temperature. Indeed, in 2015 global temperature is reaching a level ~1°C above the preindustrial level, but the high 2015 level is partly a temporary effect of a strong El Nino, a natural oscillation of tropical Pacific Ocean temperature.

[2] Published by PLOS One (Dec. 3, 2013) and available at: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0081648

14. The second, Ice Melt, Sea Level Rise and Superstorms: Evidence from Paleoclimate Data, Climate Modeling, and Modern Observations that 2°C Global Warming is Highly Dangerous, was published this month in conjunction with 16 colleagues. In it we conclude that, if CO_2 emissions are allowed such that energy is continuously pumped at a high rate into the ocean, then multi-meter sea level rise will become practically unavoidable, with consequences that may threaten the very fabric of civilization. I have attached *Ice Melt, Sea Level Rise and Superstorms* hereto as **Exhibit 3**,[3] and hereby incorporate by reference into this declaration its analyses and conclusions.

I. PRESENT AND LOOMING CLIMATE CRISES, AND A PATH TO STABILITY

15. As indicated above, our late-2013 study provides a detailed treatment of our present predicament and the route that must be taken to sufficiently reduce atmospheric CO_2 to preserve a habitable climate system. *See* **Exhibit 2**. Our most recent work, establishing that nonlinear melting of Earth's major ice sheets is likely within a century, among other things, if fossil fuel emissions continue unabated, adds an additional element of immediacy to what, for too long, has been treated in practical terms as, at best, a distant but growing complication. *See* **Exhibit 3**.

16. I outline and summarize these matters here, before proceeding to a further explanation of them.

17. **First**: Human burning of fossil fuels has disrupted Earth's energy balance. In response, the planet is heating up – with no end in sight, unless we alter our present path. Atmospheric CO_2 concentration, for example, is now at its highest level in 3 million years, and

[3] *See also*: http://www.atmos-chem-phys-discuss.net/15/20059/2015/acpd-15-20059-2015.pdf

global surface temperatures now have reached the prior maximum of the Holocene era, the period of relatively moderate climate that, over the last 10,000 years, enabled civilization to develop.

18. **Second**: We are observing impacts of the relatively small amount of warming that has already occurred, and these constitute harbingers of far more dangerous change to come. We can discuss the observable consequences, and their implications, but the key point is that, if unabated, continued carbon emissions will initiate dynamic climate change and effects that spin out of human control, as the planet's energy imbalance triggers amplifying feedbacks and the climate and biological systems pass critical tipping points. Sea-level rise provides a key metric here.

19. **Third**: There is still time and opportunity to preserve a habitable climate system -- if we pursue a rational course. I will outline the glide path that we think remains feasible, though further delay in taking effective action will consign that effort to failure. Objectively, then, the situation is urgent and what governments and other decision-makers do, or do not do, today to reduce carbon pollution matters immensely.

II. OUR PLANET IS NOW OUT OF ENERGY BALANCE

20. In Chart 1, we show global fossil fuel CO_2 emissions on an annual basis from the burning of coal, oil, and natural gas, and from cement production and flaring, along with the total emissions from these major sources. Although it is more than twenty years since 170 nations agreed to limit fossil fuel emissions in order to avoid dangerous human-made climate change, the stark reality – as illustrated here – is that global emissions have accelerated. Specifically, the growth rate of fossil fuel emissions increased from 1.5%/year during 1973–2000 to 2.6%/year in 2000–2014 (Chart 1(a)), due in the main to increased utilization of coal, oil, gas and cement (Chart 1(b)).

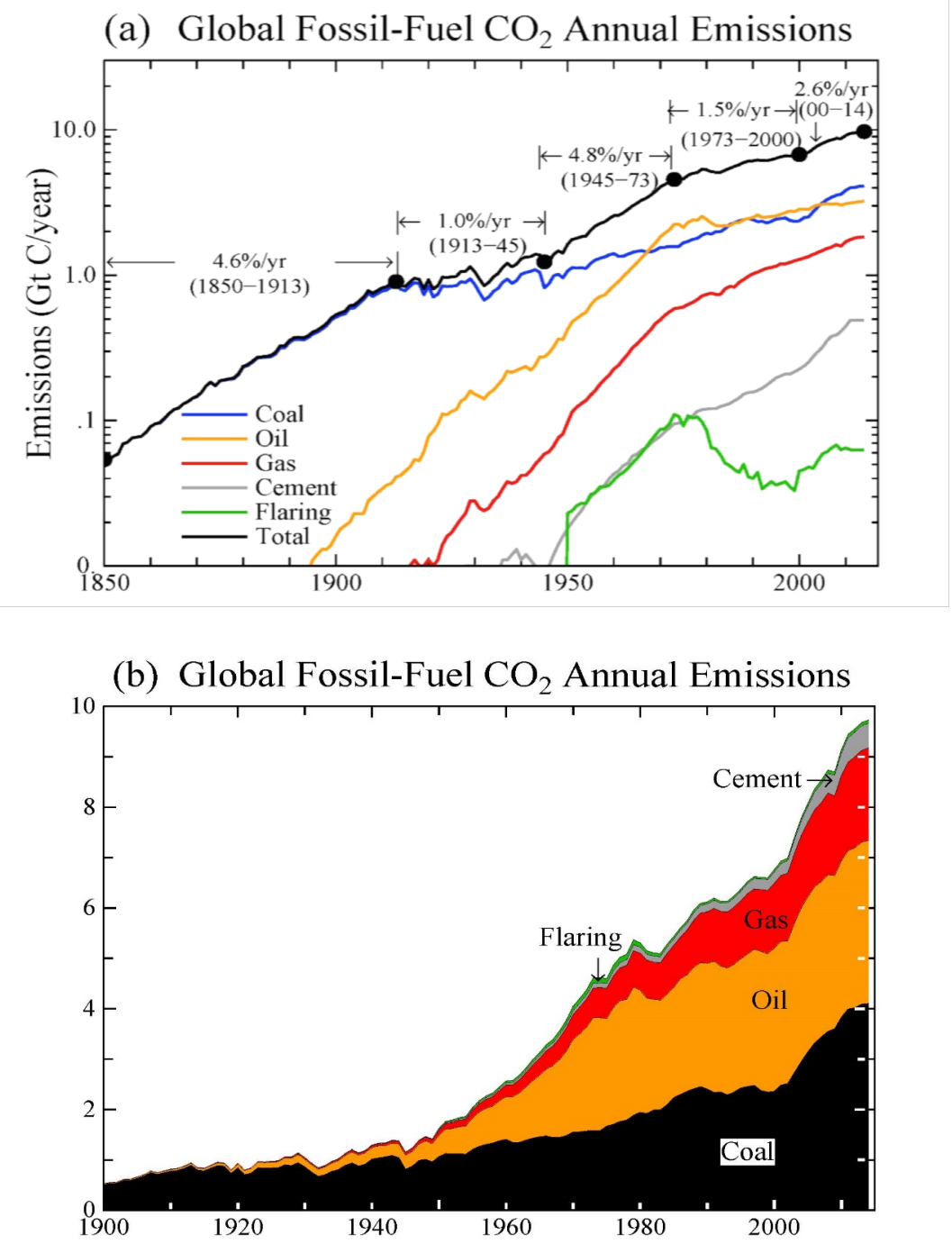

Chart 1: **CO_2 Annual Emissions From Fossil Fuel Use And Cement Manufacture**
Source: *Dangerous Climate Change* (**Exhibit 2** to this Declaration, at Fig. 1), updated through 2014 from http://www.columbia.edu/~mhs119/CO2Emissions/.

21. Our increased emissions are reflected, at least in part, in the rising concentration of atmospheric CO_2, as is illustrated in Chart 2[4] that is based on readings taken at the Mauna Loa, Hawaii, observatory. The CO_2, atmospheric level is now approximately 400 ppm, over 40 percent more than the preindustrial level.

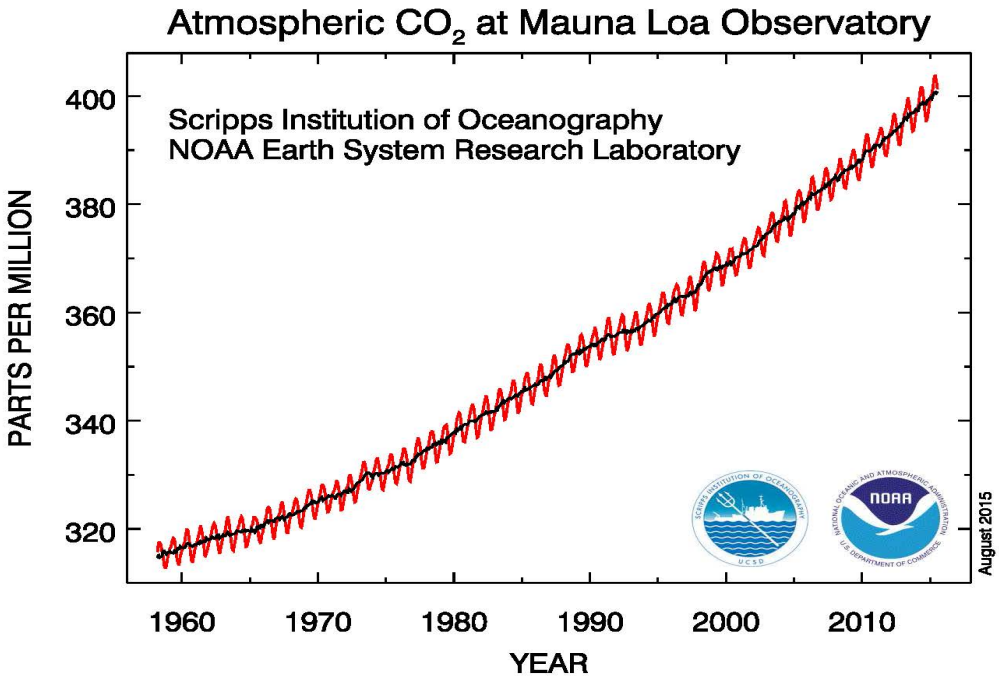

Chart 2: From Noaa's Earth System Research Laboratory
at http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo_full.

22. Moreover, the *increase* in the atmospheric CO_2 concentration is itself speeding up, as is illustrated in Chart 3.[5] The annual mean rate of CO_2 growth more than doubled from 0.85ppm in the 1960-70 period to 2.0ppm in 2000-2010.

[4] *From* http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo_growth

[5] *Id*.

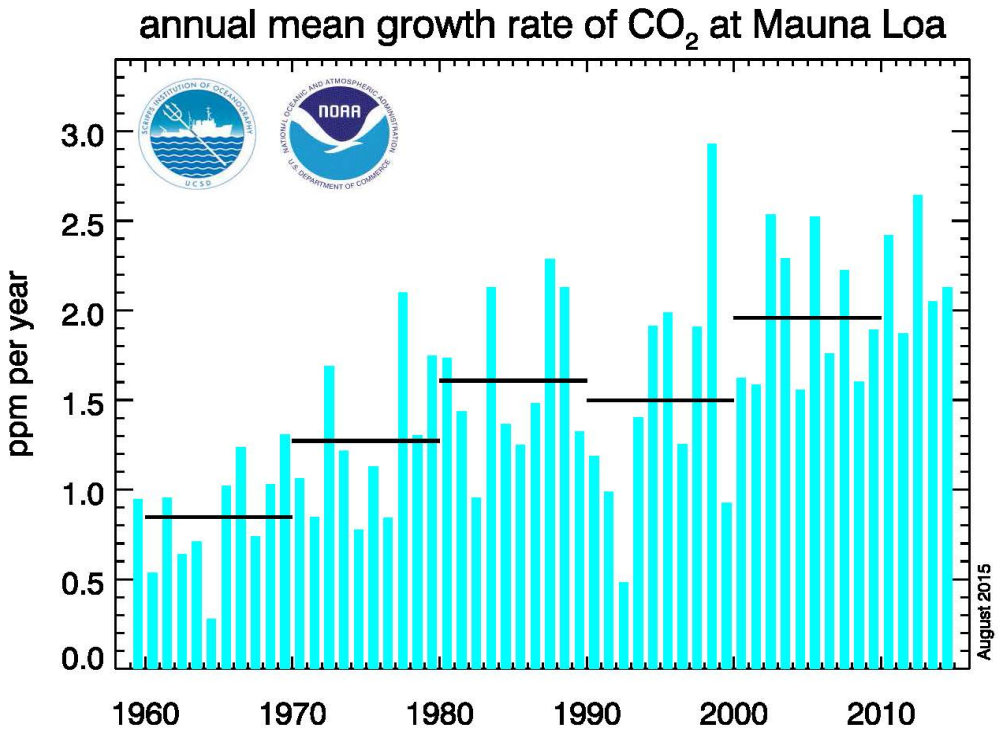

Chart 3: From Noaa's Earth System Research Laboratory
at http://www.esrl.noaa.gov/gmd/ccgg/trends/#mlo_growth.

23. This increased concentration of CO_2 and other GHGs in the atmosphere operates to reduce Earth's heat radiation to space, thus causing an energy imbalance – less energy going out than coming in. This imbalance causes Earth to heat-up until it again radiates as much energy to space as it absorbs from the sun.

24. In point of fact, warming of Earth caused by the increasingly thick CO_2 "blanket" persisted even during the recent five-year solar minimum from 2005-2010. Had changes in insolation been the dominant forcing, the planet would have had a negative energy balance in that period, when solar irradiance was at its lowest level in the period of accurate data, i.e., since the 1970s. Instead, even though much of the greenhouse gas forcing had been expended in causing observed 0.9°C global warming to date, the residual positive forcing from CO_2 emissions

overwhelmed the negative solar. This illustrates, unequivocally, that it is human activity, and not the sun, that is the dominant driver of recent climate change.

25. In terms of responsibility for our present predicament, I will note that it is true, as we can illustrate with the aid of Chart 4 (a) (left side), that in recent years, CO_2 emissions from China have exceeded those from the U.S.

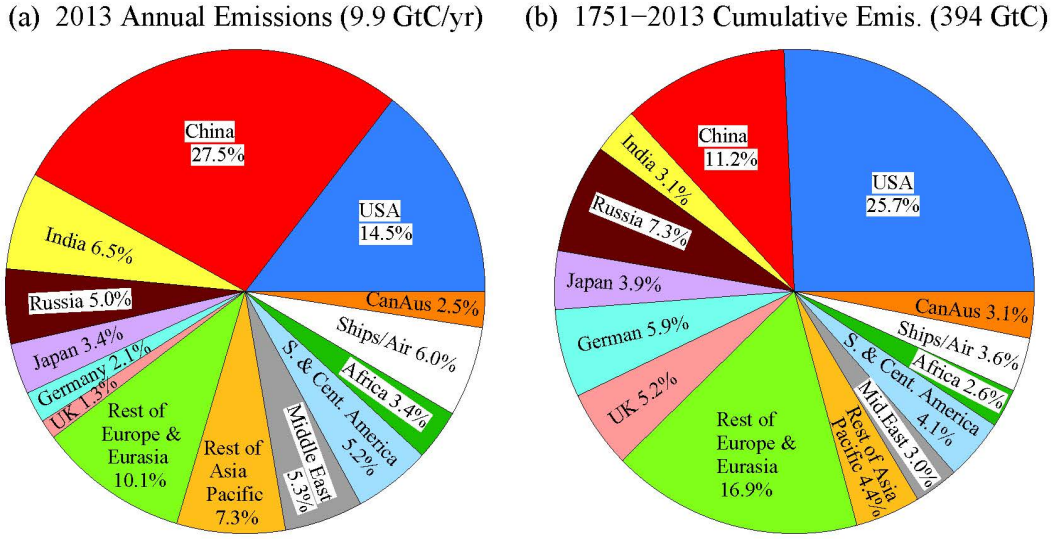

Chart 4: Fossil Fuel CO_2 Emissions
Source: *Dangerous Climate Change* (Exhibit 2 to this Declaration at Fig. 11)
updated through 2013 at http://www.columbia.edu/~mhs119/CO2Emissions/Emis_moreFigs/.

26. However, in light of the long residence time of CO_2 following its injection into the atmosphere, it is a nation's sum total of its emissions that is the more proper measure of its responsibility for already-realized and latent climate change. *See* Chart 4 (b) (right side). That chart illustrates that the United States is more responsible than any other for the present dangerously-highly atmospheric CO_2 concentration.

27. Here, I believe that a further word about the atmospheric residence time of CO_2 is in order, and we can do that with the aid of Chart 5 (left side).

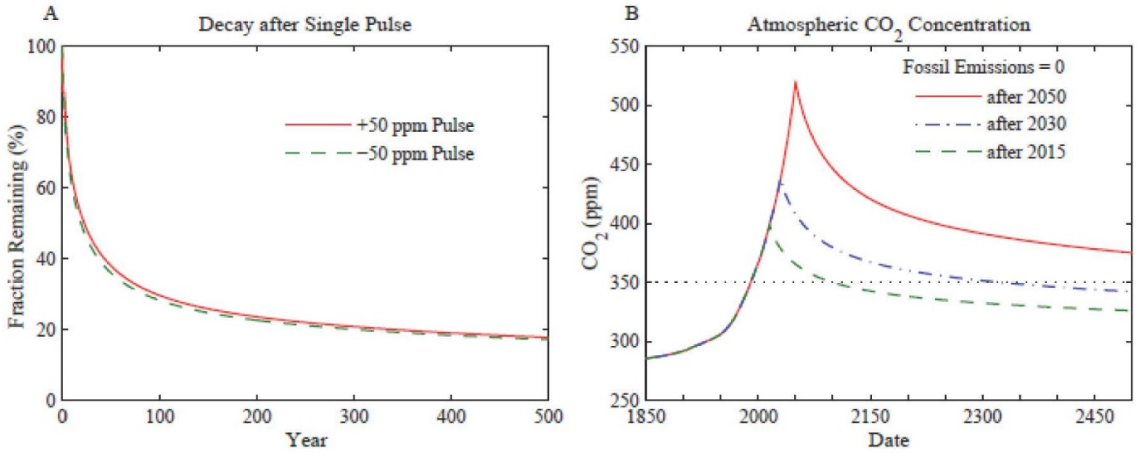

Chart 5: Decay Of Atmospheric CO_2 Perturbations
Source: *Dangerous Climate Change* (Exhibit 2 to this Declaration at Fig. 4). (A) Instantaneous injection or extraction of CO_2 with initial conditions at equilibrium. (B) Fossil fuel emissions terminate at the end of 2015, 2030, or 2050 and land use emissions terminate after 2015 in all three cases, i.e., thereafter there is no net deforestation.

28. A pulse of CO_2 injected into the air decays by half in about 25 years, as CO_2 is taken up by the ocean, biosphere and soil, but nearly one-fifth remains in the atmosphere after 500 years. Indeed, that estimate is likely optimistic, in light of the well-known nonlinearity in ocean chemistry and saturation of carbon sinks, implying that the airborne fraction probably will remain larger for a century and more. It requires hundreds of millennia for the chemical weathering of rocks to eventually deposit all of this initial CO_2 pulse on the ocean floor as carbonate sediments.

29. The critical point here is that carbon from fossil fuel burning remains in the climate system, with much of it in the atmosphere, and thus continues to affect the climate system for many millennia.

30. It is in part for this reason – the atmospheric persistence of CO_2 – that our national contribution to the problem is so large. Moreover, we can observe that, as compared with that of other major CO_2-emitting nations, our national contribution to the global climate crisis is not only

largest in absolute amount (Chart 4b), it dwarfs the contributions of the most populous nations on a per capita basis. Chart 6.

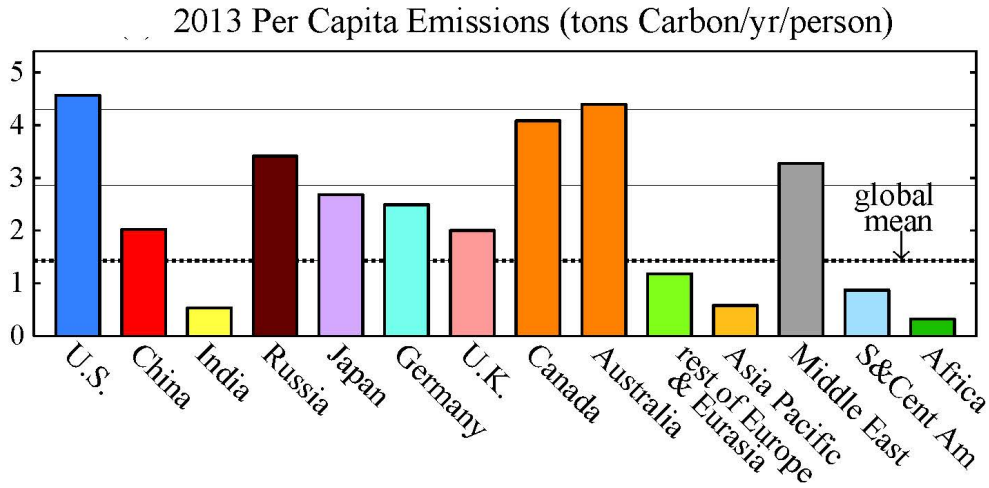

Chart 6: **Cumulative Per Capita Carbon Dioxide Emissions**
Source: www.columbia.edu/~mhs119/YoungPeople/.

31. Turning, now to Chart 7, we see the upward march of recent average global surface temperature.

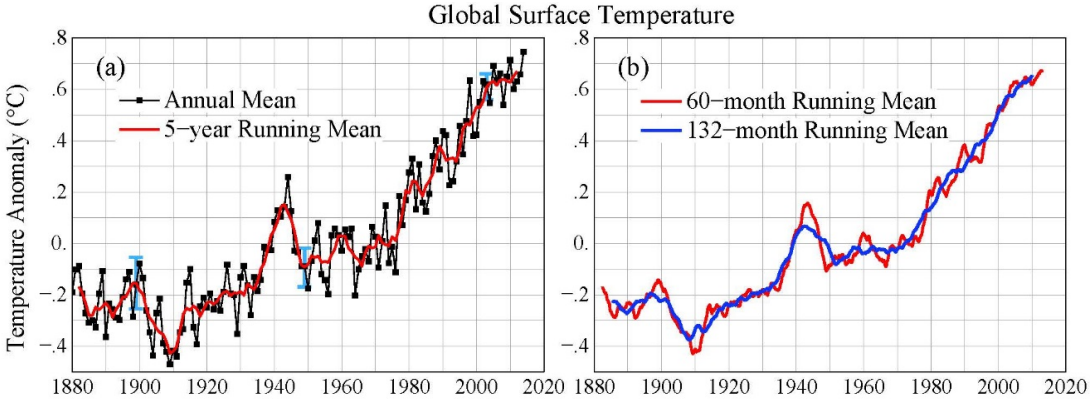

Chart 7: **Global Surface Temperature Anomaly (60-Month And 132-Month Running Means) With A Base Period Of 1951-1980**
Source: *Dangerous Climate Change* (Exhibit 2 to this Declaration at Fig. 3), updated at http://www.columbia.edu/~mhs119/Temperature/.

32. Earth has now warmed about 0.9°C above the pre-industrial level. That is now close to, and probably slightly above, the prior maximum of the Holocene era – the period of relatively stable climate over the last 10,000 years that has enabled human civilization to develop.

33. The warming increases Earth's radiation to space, thus reducing Earth's energy imbalance. However, because of the ocean's great thermal inertia, it requires centuries for the climate system to reach a new equilibrium consistent with a changed atmospheric composition. The planet's energy imbalance confirms that substantial additional warming is "in the pipeline". That energy imbalance is now measured by an international fleet of more than 3000 submersible floats that plumb the depths of the world's ocean measuring the increasing heat content.

34. Earth's energy imbalance now averages about 0.6 Watts/m^2 averaged over the entire planet, but I am uncertain whether this conveys to the Court the scale of what is going on. I can note that the total energy surplus is 300 trillion joules per second, but that large number may still be insufficiently evocative. Accordingly, it may be more useful to observe, and with equal validity, that Earth's energy imbalance is equivalent to exploding more than 400,000 Hiroshima atomic bombs per day, 365 days per year. That is how much extra energy Earth is now gaining each day because of our use of the atmosphere as a waste dump for our carbon pollution.

35. We can turn now to Chart 8.

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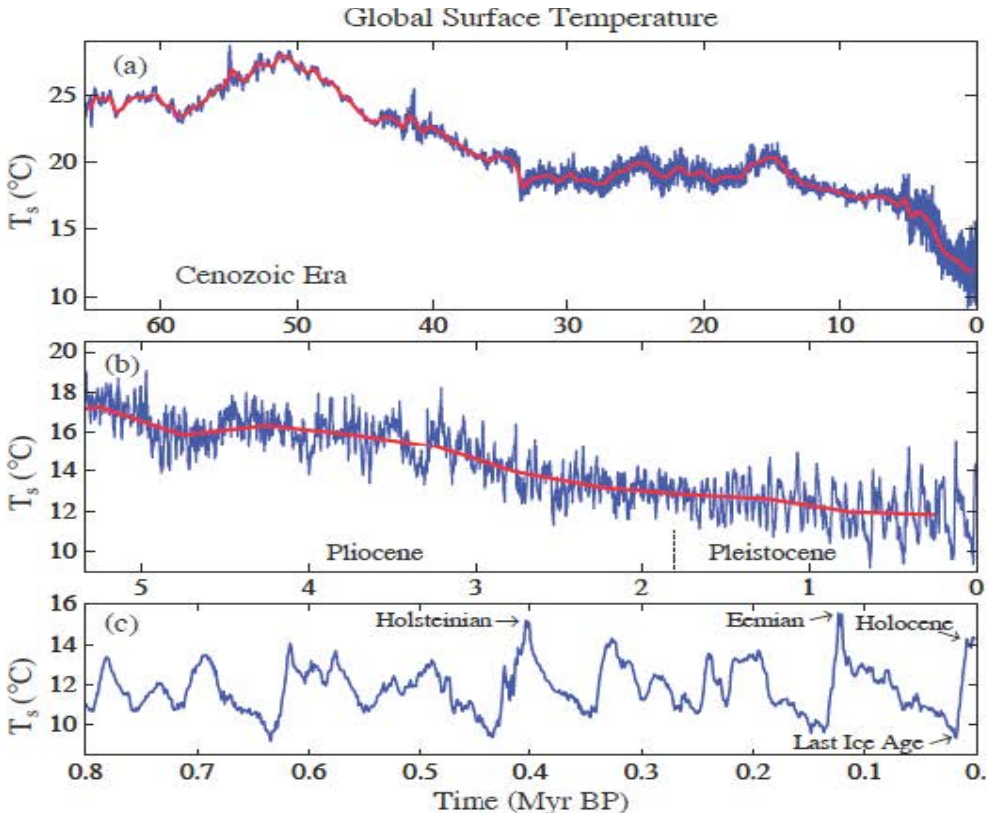

Chart 8: **Surface Temperature Estimate for the Past 65.5 Myr, Including An Expanded Time Scale for (B) The Pliocene and Pleistocene and (C) The Past 800 000 Years**
Source: J. Hansen, et al, *Climate Sensitivity, Sea level and Atmospheric Carbon Dioxide*, Phil Trans R Soc A (2013), Fig. 4.

36. Here, we summarize the average global surface temperature record of the last 65 million years. This record is based on high-resolution ice core data covering the most recent several hundred thousand years, and ocean cores on time scales of millions of years. It provides us with insight as to global temperature sensitivity to external forcings such as added CO_2, and sea level sensitivity to global temperature. It also provides quantitative information about so-called "slow" feedback processes – such as melting ice sheets and lessened surface reflectivity attributable to darker surfaces resulting from melting ice sheets and reduced area of ice.

37. Several relevant conclusions can be drawn. First, the mechanisms that account for the relatively rapid oscillations between cold and warm climates were the same as those operating today. Those past climate oscillations were initiated not by fossil fuel burning, but by slow insolation changes attributable to perturbations of Earth's orbit and spin axis tilt. However, the mechanisms that caused these historical climate changes to be so large were two powerful amplifying feedbacks: the planet's surface albedo (its reflectivity, literally its whiteness) and atmospheric CO_2.

38. Second, the longer paleoclimate record shows that warming coincident with atmospheric CO_2 concentrations as low as 450 ppm may have been enough to melt most of Antarctica. Global fossil fuel emissions – towards which, as I noted above, our nation has contributed more than any other – have already driven up the atmospheric CO_2 concentration to approximately 400 ppm – up from 280 ppm of the preindustrial era.

39. I conclude that the present level of CO_2 and its warming, both realized and latent, is already in the dangerous zone. Indeed, we are now in a period of overshoot, with early consequences that are already highly threatening and that will rise to unbearable unless action is taken without delay to restore energy balance at a lower atmospheric CO_2 amount. We can turn now to a brief review of the increasingly unacceptable, but still avoidable, consequences.

III. UNABATED EMISSIONS MAY DEVASTATE OUR COASTS, CIVILIZATION AND NATURE AS WE KNOW IT

40. I will start with the ocean, in light of our most recent research.

41. While I have postulated previously that major ice sheet disintegration and resulting sea level rise is likely to be nonlinear in the event of continued high fossil fuel impacts, my concern had been based largely on heuristic grounds. Now, utilizing multiple lines of evidence – including satellite gravity measurement, surface mass balances, and satellite radar altimetry – it

has become clear, regrettably, that ice mass losses from Greenland, West Antarctica and parts of East Antarctica are growing nonlinearly, with doubling times so far this century of approximately 10 years.

42. My colleagues and I expect the growth rate for ice mass loss in Greenland to slow, based on the most recent few years of data, but because of amplifying feedbacks described in our paper we also think it likely that Antarctic ice mass loss will continue to climb exponentially – again, if fossil fuel emissions are not rapidly abated. This prospect alone cries out for urgent national and international action to constrain carbon pollution, considering that complete disintegration of the Totten glacier in East Antarctica could raise sea levels by approximately 6-7m; that ice fronted by the Cook glacier in East Antarctica could add 3-4m of sea rise; and that West Antarctic ice fronted by Amundsen Sea glaciers have the potential to raise sea level an additional *3-4m*. *See* **Exhibit 3** at 41.

43. In the light of this and related information, we have concluded that humanity faces "nearly certainty of eventual sea level rise of at least . . . 5-9m if fossil fuel emissions continue on a business-as-usual course." *See* **Exhibit 3** at PDF page 31. Much of the U.S. eastern seaboard,[6] as well as low-lying areas of Europe, the Indian sub-continent, and the Far East, would then be submerged. *See* Chart 9.

[6] Western U.S. cities too are vulnerable, to the degree that parts of them are relatively low-lying. It is estimated, for example, that sea level rise of "only" 10 feet (approximately 3 meters) will inundate over 4,000 acres (and over 3,000 homes) in Seattle, nearly 3,000 acres (and over 13,000 homes) in San Francisco, and over 4,000 acres (and nearly 10,000 homes) in San Diego. *See* Climate Central's "Surging Seas" project at http://sealevel.climatecentral.org/ .

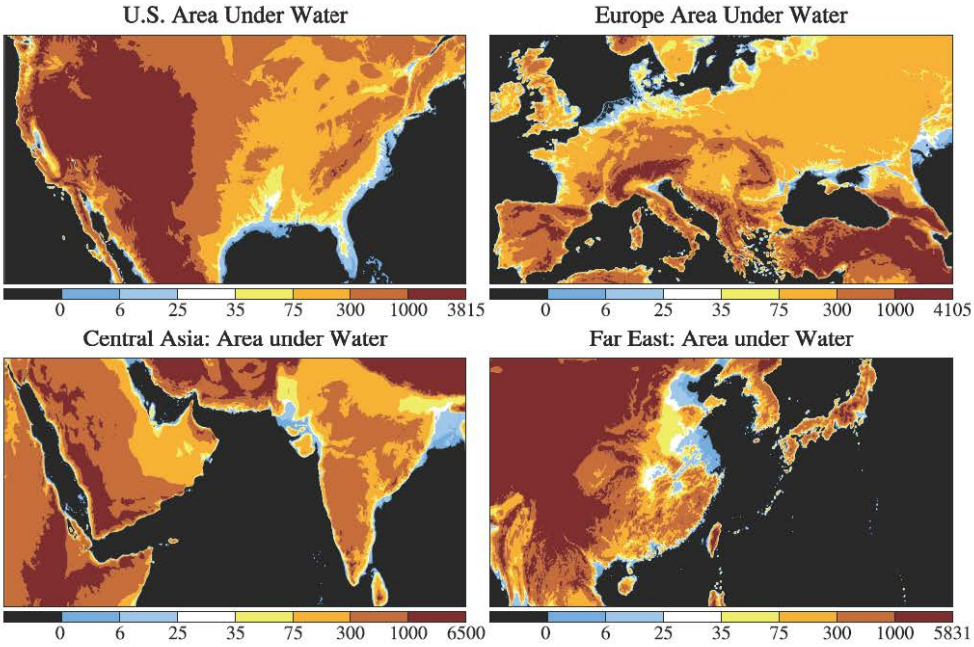

Chart 9: **Areas (Light And Dark Blue) That Nominally Would Be Under Water For 6 And 25 M Sea Level Rise**
Source: Climate Science, Awareness, and Solutions, Earth Institute, Columbia University (2015).

44. That order of sea level rise would result in the loss of hundreds of historical coastal cities worldwide, with incalculable economic consequences. It would also create hundreds of millions of global warming refugees from highly populated low-lying areas, and thus likely cause or exacerbate major international conflicts.[7]

45. To avoid such a calamity, sea level rise must be recognized as a key limit on any conceivably allowable human-made climate forcing and atmospheric CO_2 concentration, with

[7] In addition, strong temperature gradients caused by ice melt freshening is likely to increase baroclinicity and provide energy for more severe weather events, including in the North Atlantic. This set of circumstances will drive the powerful superstorms of our future. Some of these impacts are beginning to occur sooner in the real world than in our climate model. *See* **Exhibit 3** at pdf 31.

fossil fuel emissions and land use changes constrained accordingly.[8] As discussed, ice sheet melting has now commenced even though global warming to date measures "only" 0.9°C above the pre-industrial period. This is consistent with the relevant paleoclimate evidence showing a multi-meter rise in sea level in the late Eemian period, approximately 125K years ago, when temperature was at most ~2°C warmer than pre-industrial climate (at most ~1°C warmer than today). This, in itself, and quite apart from the additional harm to terrestrial systems that must also be considered, implies that national and international goals and targets that aim to limit global warming to no more than 2°C run an unacceptably high risk of global catastrophe.

46. An important effect for the coming period of large scale ice sheet melting, in our view, is that the discharge of ice and cold fresh water will expand sea ice cover and result in ocean surface, regional and global cooling effects. *See* **Exhibit 3** at pdf 3-11. For varying periods, these effects would mask some of the global warming that would otherwise result from projected high CO_2 levels. The temporary surface cooling, however, would be coincident with a further increase in the planet's energy imbalance, with added energy pumped into the ocean, and there be available, at Antarctica and Greenland, to further melt the subsurface shelves that, at present, restrain several of the planet's major ice sheets at their grounding lines. *See* **Exhibit 3** at pdf 18.

47. Upon cessation of ice sheet disintegration and freshwater discharge, global temperature will recover – with the time period for such recovery depending on the amount of ice melt (and sea level rise), and with geographical, geophysical and oceanic circulation factors detailed in our recent study. *See* **Exhibit 3** at pdf 11.

[8] This is so, as we wrote in "Ice Melt, Sea Level Rise and Superstorms," **Exhibit 3** at pdf 32, in light of the "extreme sensitivity of sea level to ocean warming and the devastating economic and humanitarian impacts of a multi-meter sea level rise."

48. With respect to other important natural and human systems, to which I will now turn, the impacts of global warming – including the renewed warming – will depend in part on the magnitude of Earth's energy imbalance, and that, in turn, will be controlled by the level of excess atmospheric CO_2. As I have noted already, global warming to date measures "only" 0.9°C above the pre-industrial period, and yet, that level of warming has already begun to have a widespread effect on natural and human systems.

49. For example, mountain glaciers, the source of fresh water to major world rivers during dry seasons, are receding rapidly all around the world. To cite a close-to-home example, glaciers in iconic Glacier National Park appear to be in full retreat: In 1850, according to the Park Service, Glacier had 150 glaciers measuring larger than twenty-five acres. Today, it has just twenty-five.

50. As well, tropospheric water vapor and heavy precipitation events have increased, as we would expect. A warmer atmosphere holds more moisture, thus enabling precipitation to be heavier and cause more extreme flooding. Higher temperatures, on the other hand, increase evaporation and can intensify droughts when they occur, as can the expansion of the subtropics that occurs as a consequence of global warming.

51. Coral reef ecosystems, harboring more than 1,000,000 species as the "rainforests" of the ocean, are impacted by a combination of ocean warming, acidification from rising atmospheric CO_2, and other human-caused stresses, resulting in a 0.5-2% per year decline in geographic extent.

52. World health experts have concluded with "very high confidence" that climate change already contributes to the global burden of disease and premature death with expansion of

infectious disease vectors. Increasing climate variability is being examined as a possible contributor to the expansion of Ebola.

53. Subtropical climate belts have expanded, contributing to more intense droughts, summer heat waves, and devastating wildfires. Further, summer mega-heat-waves, such as those in Europe in 2003, the Moscow area in 2010, Texas and Oklahoma in 2011, Greenland in 2012, Australia in 2013, *Australia and California in 2014, and India, France and Spain this year (2015),* have become more widespread.[9] The probability of such extreme heat events has increased by several times because of global warming, and the probability will increase even further if fossil fuel emissions continue to be permitted, so that global warming becomes locked in or rendered increasingly severe.

54. I have already mentioned the unparalleled calamity that the loss of scores of coastal cities to rapid sea level rise presents to human civilization. But I should mention that many other impacts also will abound.

55. For example, acidification stemming from ocean uptake of a portion of increased atmospheric CO_2 will increasingly disrupt coral reef ecosystem health, with potentially devastating impacts to certain nations and communities. Inland, fresh water security will be compromised, due to the effects of receding mountain glaciers and snowpack on seasonal freshwater availability of major rivers.

56. As to human health: increasing concentrations of CO_2 and associated increased global temperatures will deepen impacts, with children being especially vulnerable. Climate

[9] Climate researchers in Oregon consider that state's recent heat and dry spell to be consistent with these trends, with the month of June, 2015 being said to be the warmest on record in much of the state. *See* Oregon Climate Service at http://ocs.oregonstate.edu/ . In general, however, local observations of climate (heat) extremes are illustrative of what will occur with the increasing atmospheric CO_2 concentration, but I will caution that other, more stochastic, variables usually will be in play as well.

threats to health move through various pathways, including by placing additional stress on the availability of food, clean air, and clean water. Accordingly, unabated climate change will increase malnutrition and consequent disorders, including those related to child growth and development. It will increase death and illness associated with COPD, asthma, and other respiratory distress triggered by worsened allergies. Unabated emissions will also produce other injuries from heat waves; floods, storms, fires and droughts, and it will increase cardio-respiratory morbidity and mortality associated with increased ground-level ozone.

57. With regard to other species, we see that climate zones are already shifting at rates that exceed natural rates of change; this trend will continue as long as the planet is out of energy balance. As the shift of climate zones becomes comparable to the range of some species, the less mobile species will be driven to extinction. According to the UN Panel on Climate Change, with global warming of 1.6°C or more relative to pre-industrial levels, 9-31 percent of species are anticipated to be driven to extinction, while with global warming of 2.9°C, an estimated 21-52 percent of species will be driven to extinction. These temperature/extinction thresholds will not be avoided absent concerted, rational action on carbon emissions.

58. At present, we remain on track to burn a significant fraction of readily available fossil fuels, including coal, oil, natural gas, and tar sands, and so to raise average surface temperature, over time, to far above pre-industrial levels.

59. High global surface temperatures have been recorded previously, in the age of mammals, with some successful adaptation through evolution of higher surface-area-to-mass ratio body types – for example transient dwarfing of mammals and even soil fauna. However, human-made warming is occurring rapidly and will be fully realized in only centuries, as opposed to millennia, thus providing little opportunity for evolutionary dwarfism to alleviate impacts of

global warming. Along with several colleagues, I have been forced to conclude that the large climate change that would result from burning all or most fossil fuels threatens the survival of humanity.

60. All of which brings me to my third point.

IV. RESTORATION OF OUR CLIMATE SYSTEM, AND SO PROTECTION OF OUR FUTURE, IS STILL POSSIBLE, BUT WE MUST ACT WITH REASON, COURAGE, AND NO FURTHER DELAY

61. As I indicated above, the energy imbalance of Earth is about 0.6 W/m2. In the light of that imbalance, colleagues and I have calculated the level to which atmospheric CO_2 must be drawn down in order to increase Earth's heat radiation to space by the same amount and thus restore energy balance – the fundamental requirement to stabilize climate and avoid further dangerous warming.

62. The measured energy imbalance indicates that CO_2 must be reduced to a level below 350 ppm, assuming that the net of other human-made climate forcings remains at today's level. Specification now of a CO_2 target more precise than <350 ppm is difficult due to uncertain future changes of radiative forcing from other gases, aerosols and surface albedo, but greater precision should be feasible during the time that it takes to turn around CO_2 growth and approach the initial 350 ppm target.

63. Let us return, for a moment, to Chart 5, so as to consider again the question of delay. On the left side of the chart, the long-residence time for atmospheric CO_2 is illustrated. It is reflected in the length of time it would take to return CO_2 to lower concentrations even if, as indicated on the right side of the chart, fossil fuel emissions were to cease entirely.

64. Of course, an abrupt cessation of all CO_2 emissions, whether this year or in 2030, is unrealistic. Industry, other business, and consumers all need time to retool and reinvest in emission-free options to fossil fuels.

65. Accordingly, we have evaluated emissions reduction scenarios to devise the path that is both technically and economically feasible, while being sufficiently rigorous to constrain the period of "carbon overshoot" and avoid calamitous consequences (greatly accelerated warming, ecosystem collapse, and widespread species extermination). *See* Chart 10.

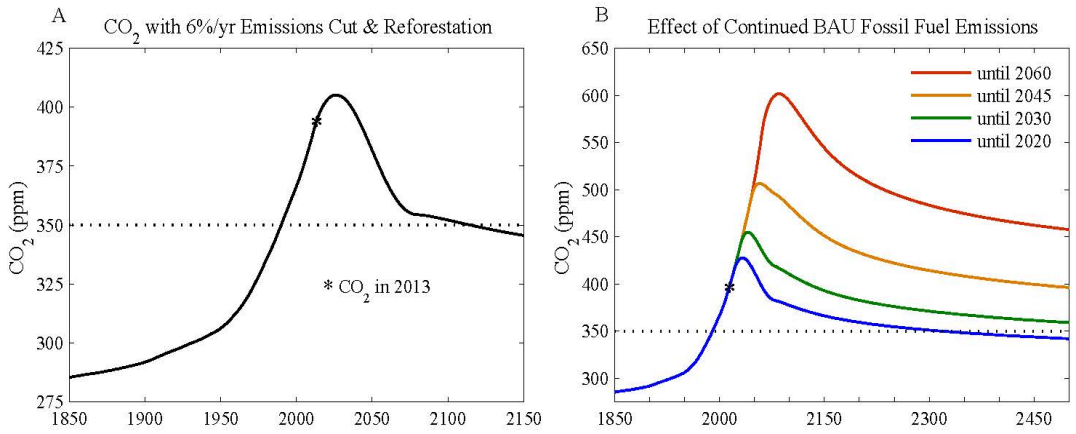

Chart 10: **Atmospheric CO_2 If Fossil Fuel Emissions Are Reduced.**
(A) 6% Or 2% Annual Cut Begins In 2013 And 100 GRC Reforestation Drawdown Occurs In 2031-2080, (B) Effect Of Delaying Onset Of Emission Reductions.
Source: *Dangerous Climate Change* (Exhibit 2 to this Declaration at Fig. 5).

66. Our analysis prescribes a glide path towards achieving energy balance by the end of the century. It is characterized by large, long-term global emissions reductions (of approximately 6 percent annually, if commenced this year), coupled with programs to limit and reverse land use emissions via reforestation and improved agricultural and forestry practices (drawing down approximately 100 GtC by the year 2100).

67. These actions could achieve the goal of restoring the atmosphere to approximately 350 ppm within this century if the plan were commenced without delay, and then adhered to. As I have indicated, such action is minimally needed to restore earth's energy balance, preserve the planet's climate system, and avert irretrievable damage to human and natural systems – including agriculture, ocean fisheries, and fresh water supply – on which civilization depends. However, consistent with the abrupt phase out scenarios discussed in the prior paragraph, if rapid annual emissions reductions are delayed until 2030, then the global temperature will remain more than 1°C higher than preindustrial levels for about 400 years. Were the emissions cessation only to commence after 40 years, then the atmosphere would not return to 350 ppm CO_2 for nearly 1000 years. Overshooting the safe level of atmospheric CO_2 and the safe range of global ambient temperature for anything approaching these periods will consign succeeding generations to a vastly different, less hospitable planet.

68. Considered another way, the required rate of emissions reduction would have been about 3.5% per year if reductions had started in 2005 and continued annually thereafter, while the required rate of reduction, if commenced in 2020, will be approximately 15% per year. Accordingly, the dominant factor is the date at which fossil fuel emission phase out begins, again presuming the rate of annual emissions reductions thereafter are sustained.

V. THE FUNDAMENTAL RIGHTS OF MY GRANDDAUGHTER SOPHIE, OTHER CHILDREN, AND FUTURE GENERATIONS TO A HABITABLE PLANET

69. With all of the above having now been said, and serving as background, I can return, finally, and briefly, to consider the nature of the violations of the rights of my granddaughter and future generations that are properly attributable our government's continued permitting, leasing, and other support for fossil fuel exploitation and expansion projects--

particularly in the absence of any countervailing, coherent, effective government program to rapidly reduce atmospheric CO_2 to a safe level.

70. In this, I include our government's approval of the Jordan Cove project at Coos Bay, Oregon. To be specific, in the context of US emissions to date and the present global climate crisis those emissions have done much to engender, the additional emissions stemming from Jordan Cove will work only to further increase the atmospheric concentrations of CO_2, and thus to further increase Earth's energy imbalance – *thereby driving our planet towards and potentially beyond irretrievable climate system tipping points*.

71. This is so because, by exacerbating or locking-in Earth's energy imbalance, such government action jeopardizes the signal features of the relatively benign and favorable climate system that, over the last 10,000 years, enabled civilization to develop and nature to thrive, as I have discussed. These features included relatively stable coastlines, moderate weather, fertile soils, and dependable hydrological systems – the natural capital on which the lives of Plaintiffs depend no less than did the lives of their parents and *their* forebears.

72. As well, present and future government action that exacerbates or locks-in Earth's energy imbalance risk economic collapse, social disintegration, and the loss of essential natural and human services, as I have discussed. The resulting diminution of Plaintiffs' life prospects – their compromised ability to earn a living, to meet their basic human needs, to safely raise families, to practice their religious and spiritual beliefs, and otherwise to lead dignified lives – is a predictable if not intended result of the government action.

73. In addition, where such government action exacerbates or locks-in Earth's energy imbalance that, in turn, predictably will lead to the climate change-driven inundation, burning, or other destruction of the value of property in which Plaintiffs hold interests. These will include the

homes, farms and other valuable property that their parents or grandparents own and that Plaintiffs will inherit.

74. Further, these government actions, in consequence of their long-term impacts on Earth's climate system and the thermal inertia of the ocean, will disproportionately impose harsh burdens on Plaintiffs. If fossil fuel emissions are not systematically and rapidly abated, as I have discussed above – including in the materials that I have incorporated by reference – then Youth and Future Generations Plaintiffs will confront what reasonably only can be described as, at best, an inhospitable future. That future may be marked by rising seas, coastal city functionality loss, mass migrations, resource wars, food shortages, heat waves, mega-storms, soil depletion and desiccation, freshwater shortage, public health system collapse, and the extinction of increasing numbers of species. That is to mention only the start of it. At this late stage it is important not to sugarcoat the fundamental assault on their right to equal protection of the law: While prior generations and, to a certain extent, some in our present generation have benefitted and, even, been enriched by the exploitation of fossil fuels, our children and their progeny will not similarly benefit. Indeed, the impact on Plaintiffs' will be nearly completely to the contrary, as I have discussed.

75. Closely-related to the above, our government's continued permitting and promotion of the fossil fuel enterprise now impairs and increasingly will compromise the fundamental natural resources on which Plaintiffs will depend. Again, these are the fundamental resources on which the prior and present generations have relied, and on which Plaintiffs now and in the future must rely. They include the air, freshwater, the oceans and stable shores, the soil and its agronomic capacity, the forests and its wildlife, biodiversity on earth, and the planet's climate system in a form conducive to civilization, humanity and nature as we know it.

76. Furthermore, it is clear to me that Plaintiffs' right to a government that retains any significant capacity to address the climate crisis adequately is violated by prior and present government actions that exacerbate or lock-in our planet's energy imbalance. In time and, as I have argued, likely within the century, such action will irretrievably damage our planet's favorable climate system. Once begun, for example, collapsing and disintegrating ice sheets will not readily be reformulated – certainly not within a timeframe relevant to present and foreseeable generations. The loss of species too is irretrievable. Many are adapted to specific climate zones, so those species adapted to polar and alpine regions will have no place to run. Present and pending actions by our government now must be viewed in the context of a climate crisis that our government to date has done so much to bring about. Action is required to preserve and restore the climate system such as we have known it in order for the planet as we have known it to be able to continue adequately to support the lives and prospects of young people and future generations. But that cannot be done effectively by future governments if ours continues to exacerbate the planet's energy imbalance and press our planet towards irretrievable tipping points from which there can be no practical opportunity to return.

77. To further explain this last point, I will note that earlier in this declaration I discussed our nation's outsized role in creating, through its CO_2 emissions, our present emergency with respect to the planet's climate system. *See supra*, text surrounding Chart 4 and Chart 6. Other nations are keenly aware of this basic fact including, most importantly, China. It is, accordingly, worthwhile here – in the context of considering responsibility to resolve the present crisis and preserve a habitable climate system – to consider further these top two emitters' role.

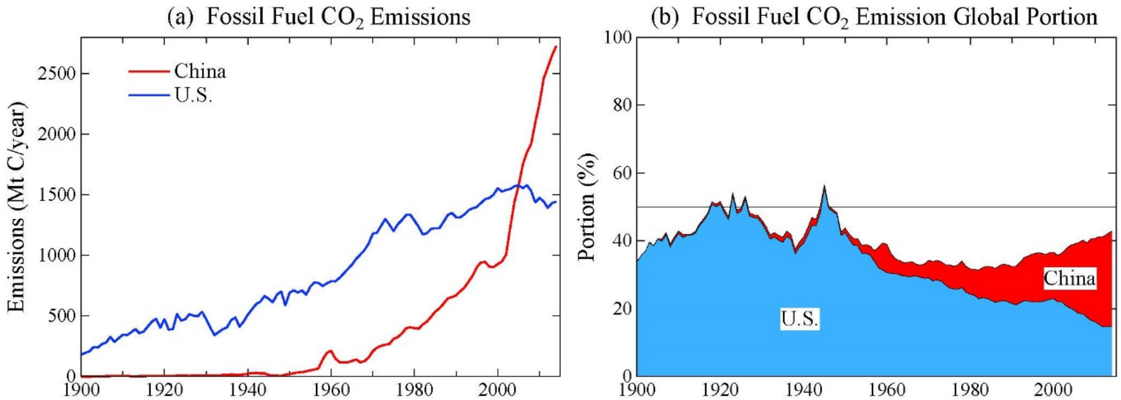

Chart 11: **Top Two Annual Emitters And Their Cumulative Emissions**
(a) Fossil fuel CO_2 Emissions, 1990 Through 2014, (B) Cumulative Shares: U.S. And China
Source: Climate Science, Awareness and Solutions, based on data from ORNL through 2011, updated with BP data through 2014.

78. China's annual CO_2 emissions caught those of the United States in 2005 and then rapidly surpassed U.S. emissions. *See* Chart 11 (a) (left side). However, any nation's contribution to climate change is proportional to its cumulative emissions over time.[10] China's responsibility for global climate change remains a fraction of that of the U.S., despite China's much larger population. *See* Chart 11 (b) (right side). Specifically, China's share of global fossil fuel CO_2 emissions through 2014 is 11.6 percent while the United States share is 25.5 percent.

79. Accordingly, in the light of our preponderant role, the United States has special responsibility for helping to solve the global emissions problem. The remaining carbon "budget" – the amount of emissions that can be tolerated while still allowing the possibility of stabilizing climate – is very small. As we have noted, climate stability requires that global emissions decline by at least 6% per year. In effect, the United States burned not only its fair share of the total (cumulative) carbon budget, it also burned much of China and India's fair shares.

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[10] Hansen, J., *et al.*, Dangerous human-made interference with climate: A GISS modelE study. *Atmos. Chem. Phys.*, **7**, 2287-2312, doi:10.5194/acp-7-2287-2007.

80. It is instructive to examine the emissions of China and India, which are shown in Chart 12. China is the #1 global emitter of CO_2 and India is #3, with the United States being #2. Together the three nations emit about half of global emissions, i.e., the same as the other 190 nations of the world combined. Two conclusions leap out from Chart 12. First, emissions in those nations are accelerating rapidly. Second, most of their emissions are from coal burning. (Note that the scale of the vertical axis is different for China and India. India is in an earlier stage of economic development and its emissions are as yet much smaller than China's.)

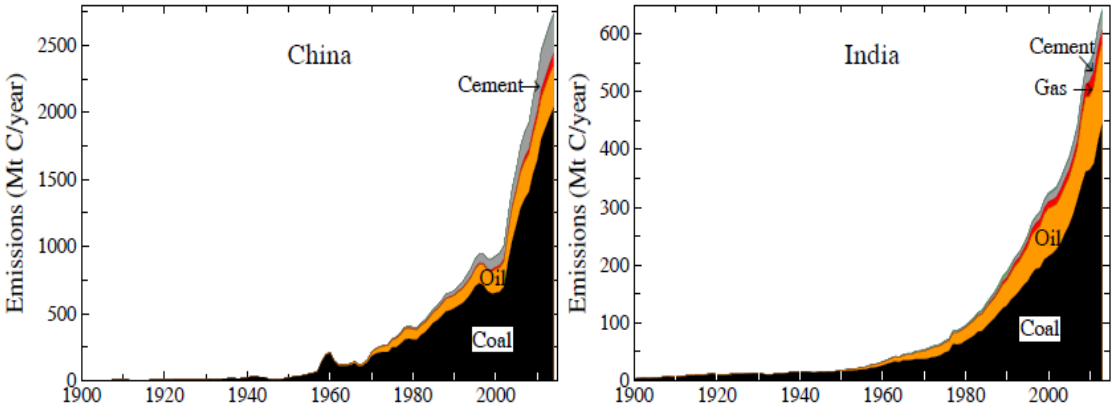

Chart 12: CO_2 Emissions From China (Left Side) And India (Right Side)
Graphic from Climate Science, Awareness and Solutions, utilizing data from the Carbon Dioxide Information Analysis Center and the BP Statistical Review of World Energy (2014).

81. The rapid growth of coal emissions is both a threat to global climate and a source of hope. If coal can be replaced with carbon-free energy, a huge reduction of global emissions becomes possible. In view of the responsibility of the United States for the excess CO_2 in the air today, as well as the fact that U.S. citizens will suffer the consequences of global emissions, it is incumbent upon the U.S. to vigorously assist China with the technology required to replace coal burning. Yet the U.S. government, and its chief executive, the President have not undertaken such actions, leaving today's young people and future generations extremely vulnerable. Indeed,

U.S. actions to date have been mostly rhetorical.[11] Instead, our government including, especially, the U.S. President, should marshal every available tool, talent, and resource to address and resolve the present crisis with honesty and without further delay.

82. Young people have multiple rights that are guaranteed by our Constitution, including equal protection of the law, equal rights to enjoy life, liberty, property, and the pursuit of happiness – rights that should not be denied without due process. It is the duty of all branches of government to protect those rights. Specifically, it is a duty of the chief executive, the President, to lead and propose and pursue policies that achieve the required ends, as opposed to ineffectual actions that are demonstrably far short of what is needed.

83. The essential step, in my view and that of other experts, including economists,[12] is an accord establishing a growing price on CO_2 emissions, which would lead over time to their phase-out. Agreement upon such a domestic fee by major emitters, most notably the United States and China, with a border duty on products from nations that do not have an equivalent domestic carbon fee, would be expected to lead to widespread global movement toward carbon-free energies.

[11] EPA's much-vaunted "Clean Power Plan," for example, actually allows U.S. coal-fired power plants to continue to operate for decades, and that Agency itself anticipates that, under the rule, power plant emission reductions will proceed at a slower pace than occurred in the ten-year period *prior* to the rule's enactment.

[12] These include three co-authors of our 2013 PLOS One study. *See* **Exhibit 2**. The government also has understood the central importance of a rising carbon price, and for at least 25 years. *See*, e.g., Congressional Office of Technology Assessment, *Changing by Degrees: Steps To Reduce Greenhouse Gases* (1991) at 15 ("a particularly effective way of targeting the heaviest economic sanctions against the worst emitters of CO_2."). As colleagues and I noted in 2013, **Exhibit 2** at 19, "[a] rising carbon fee is the *sine qua non* for fossil fuel phase out."

84. I could go on, but will not so as to show mercy on the Court. Accordingly, I end here with a summary statement, in the light of the foregoing material that I have outlined and referenced, and with the offer to further explain my views and reasoning at the Court's request.

85. Simply put: Our government's persistent permitting and underwriting of fossil fuel projects serves now to further disrupt the favorable climate system that to date enabled human civilization to develop. In order to preserve a viable climate system, our use of fossil fuels must be phased out as rapidly as is feasible. Only government can ensure this will be done. Instead, our government seeks approval for permitting of fossil fuel projects that would slam shut the narrowing window of opportunity to stabilize climate and ensure a hospitable climate and planet for young people and future generations. These projects only allow our government to shirk its duty. Our government's permitting of additional, new, or renewed fossil fuel projects is entirely antithetical to its fundamental responsibility to our children and their posterity. Their fundamental rights now hang in the balance.

I am prepared, as necessary, to further explain or elaborate on any of the points I have made in this declaration, as warranted, for the Court.

I, James E. Hansen, declare under penalty of perjury under the laws of the United States of America that the foregoing constitutes my true and correct written testimony in the matter *Xiuhtezcatl Tonatiuh M. et al. v. the United States of America et al.*, No. __, United States District Court, District of Oregon.

I declare under penalty of perjury under the laws of the State of Oregon that the foregoing is true and correct.

Executed this 11th day of August, 2015 in New York City, New York.

James E Hansen

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1-paragraph bio/introduction:
Dr. James Hansen, formerly Director of the NASA Goddard Institute for Space Studies, is an Adjunct Professor at Columbia University's Earth Institute, where he directs a program in Climate Science, Awareness and Solutions. Dr. Hansen is best known for his testimony on climate change in the 1980s that helped raise awareness of global warming. He is a member of the U.S. National Academy of Sciences and has received numerous awards including the Sophie and Blue Planet Prizes. Dr. Hansen is recognized for speaking truth to power and for outlining actions needed to protect the future of young people and all species on the planet.

1-long-paragraph bio:
Dr. James Hansen, formerly Director of the NASA Goddard Institute for Space Studies, is an Adjunct Professor at Columbia University's Earth Institute, where he directs a program in Climate Science, Awareness and Solutions. He was trained in physics and astronomy in the space science program of Dr. James Van Allen at the University of Iowa. His early research on the clouds of Venus helped identify their composition as sulfuric acid. Since the late 1970s, he has focused his research on Earth's climate, especially human-made climate change. Dr. Hansen is best known for his testimony on climate change to congressional committees in the 1980s that helped raise broad awareness of the global warming issue. He was elected to the National Academy of Sciences in 1995 and was designated by Time Magazine in 2006 as one of the 100 most influential people on Earth. He has received numerous awards including the Carl-Gustaf Rossby and Roger Revelle Research Medals, the Sophie Prize and the Blue Planet Prize. Dr. Hansen is recognized for speaking truth to power, for identifying ineffectual policies as greenwash, and for outlining actions that the public must take to protect the future of young people and other life on our planet.

3-paragraph bio:
Dr. James Hansen, formerly Director of the NASA Goddard Institute for Space Studies, is an Adjunct Professor at Columbia University's Earth Institute, where he directs a program in Climate Science, Awareness and Solutions. He was trained in physics and astronomy in the space science program of Dr. James Van Allen at the University of Iowa, receiving a bachelor's degree with highest distinction in physics and mathematics, master's degree in astronomy, and Ph. D. in physics in 1967. Dr. Hansen was a visiting student, at the Institute of Astrophysics, University of Kyoto and Dept. of Astronomy, Tokyo University, Japan from 1965-1966. He received his Ph.D. in physics from the University of Iowa in 1967. Except for 1969, when he was an NSF post-doctoral scientist at Leiden Observatory under Prof. H.C. van de Hulst, he has spent his post-doctoral career at NASA GISS.

In his early research Dr. Hansen used telescopic observations of Venus to extract detailed information on the physical properties of the cloud and haze particles that veil Venus. Since the mid-1970s, Dr. Hansen has focused on studies and computer simulations of the Earth's climate, for the purpose of understanding the human impact on global climate. He is best known for his testimony on climate change to Congress in the 1980s that helped raise broad awareness of the global warming issue. In recent years Dr. Hansen has drawn attention to the danger of passing climate tipping points, producing irreversible climate impacts that would yield a different planet from the one on which civilization developed. Dr. Hansen disputes the contention, of fossil fuel interests and governments that support them, that it is an almost god-given fact that all fossil fuels must be burned with their combustion products discharged into the atmosphere. Instead Dr. Hansen has outlined steps that are needed to stabilize climate, with a cleaner atmosphere and ocean, and he emphasizes the need for the public to influence government and industry policies.

Dr. Hansen was elected to the National Academy of Sciences in 1995 and, in 2001, received the Heinz Award for environment and the American Geophysical Union's Roger Revelle Medal. Dr. Hansen received the World Wildlife Federation's Conservation Medal from the Duke of Edinburgh in 2006 and was designated by Time Magazine as one of the world's 100 most influential people in 2006. In 2007 Dr. Hansen won the Dan David Prize in the field of Quest for Energy, the Leo Szilard Award of the American Physical Society for Use of Physics for the Benefit of Society, and the American Association for the Advancement of Science Award for Scientific Freedom and Responsibility. In 2008, he won the Common Wealth Award for Distinguished Service in Science and was also awarded both the Ohio State University's Bownocker Medal and the Desert Research Institute's Nevada Medal. In 2009, Dr. Hansen received the American Meteorological Society's Carl-Gustaf Rossby Research Medal. In 2010 he received the Sophie Prize and the Blue Planet Prize.

Additional Information:

Http://www.columbia.edu/~jeh1/
http://www.columbia.edu/~mhs119/
Photos: http://ww.mediafire.com/?8ecel33ccmg81

Education:

BA with highest distinction (Physics and Mathematics), University of Iowa, 1963
MS (Astronomy), University of Iowa, 1965
Visiting student, Inst. of Astrophysics, University of Kyoto & Dept. of Astronomy, Tokyo University, Japan, 1965-1966
Ph.D. (Physics), University of Iowa, 1967

Research Interests:

Analysis of the causes and consequences of global climate change using the Earth's paleoclimate history, ongoing global observations, and interpretive tools including climate models. Connecting the dots all the way from climate observations to the policies that are needed to stabilize climate and preserve our planet for young people and other species.

Professional Employment:

1967-1969	NAS-NRC Resident Research Associate: Goddard Institute for Space Studies (GISS), NY
1969	NSF Postdoctoral Fellow: Leiden Observatory, Netherlands
1969-1972	Research Associate: Columbia University, NY
1972-1981	Staff Member/Space Scientist: Goddard Institute for Space Studies (GISS), Manager of GISS Planetary and Climate Programs
1978-1985	Adjunct Associate Professor: Department of Geological Sciences, Columbia University
1981-2013	Director: NASA Goddard Institute for Space Studies
1985-present	Adjunct Professor: Earth and Environmental Sciences, Columbia University
2013-present	Director: Program on Climate Science, Awareness and Solutions, Columbia University

Project Experience:

1971-1974	Co-Principal Investigator AEROPOL Project (airborne terrestrial infrared polarimeter)
1972-1985	Co-Investigator, Voyager Photopolarimeter Experiment
1974-1994	Principal Investigator (1974-8) and subsequently Co-Investigator, Pioneer Venus Orbiter Cloud-Photopolarimeter Experiment
1977-2000	Principal Investigator, Galileo (Jupiter Orbiter) Photopolarimeter Radiometer Experiment

Teaching Experience:

Atmospheric Radiation (graduate level): New York Univ., Dept. of Meteorology & Oceanography
Intro. to Planetary Atmospheres & Climate Change: Columbia Univ., Dept. of Geological Sciences

Awards:

1977	Goddard Special Achievement Award (Pioneer Venus)
1978	NASA Group Achievement Award (Voyager, Photopolarimeter)
1984	NASA Exceptional Service Medal (Radiative Transfer)
1989	National Wildlife Federation Conservation Achievement Award
1990	NASA Presidential Rank Award of Meritorious Executive
1991	University of Iowa Alumni Achievement Award
1992	American Geophysical Union Fellow
1993	NASA Group Achievement Award (Galileo, Polarimeter/Radiometer)
1996	Elected to National Academy of Sciences
1996	GSFC William Nordberg Achievement Medal
1996	Editors' Citation for Excellence in Refereeing for Geophysical Research Letters
1997	NASA Presidential Rank Award of Meritorious Executive
2000	University of Iowa Alumni Fellow
2000	GISS Best Scientific Publication (peer vote): "Global warming – alternative scenario"
2001	John Heinz Environment Award
2001	Roger Revelle Medal, American Geophysical Union
2004	GISS Best Scientific Publication (peer vote): 'Soot Climate Forcing'

2005	GISS Best Scientific Publication (peer vote): 'Earth's Energy Imbalance'
2006	Duke of Edinburgh Conservation Medal, World Wildlife Fund (WWF)
2006	GISS Best Scientific Publication (peer vote): 'Global Temperature Change'
2006	*Time Magazine* designation as one of World's 100 Most Influential People.
2007	Laureate, Dan David Prize for Outstanding Achievements & Impacts in Quest for Energy
2007	Leo Szilard Award, American Physical Society for Outstanding Promotion & Use of Physics for the Benefit of Society
2007	Haagen-Smit Clean Air Award
2008	American Association for the Advancement of Science Award for Scientific Freedom and Responsibility
2008	Nevada Medal, Desert Research Institute
2008	Common Wealth Award for Distinguished Service in Science
2008	Bownocker Medal, Ohio State University
2008	Rachel Carson Award for Integrity in Science, Center for Science in the Public Interest
2009	Carl-Gustaf Rossby Research Medal, American Meteorological Society
2009	Peter Berle Environmental Integrity Award
2010	Sophie Prize for Environmental and Sustainable Development
2010	Blue Planet Prize, Asahi Glass Foundation
2011	American Association of Physics Teachers Klopsteg Memorial Award for communicating physics to the general public
2011	Edinburgh Medal from City of Edinburgh, Edinburgh Science Festival
2012	Steve Schneider Climate Science Communications Award
2012	*Foreign Policy* designation as one of its Top 100 Global Thinkers
2013	Ridenhour Courage Prize
2013	NASA Distinguished Service Medal
2014	Center for International Environmental Law's Frederick R. Anderson Award for Outstanding Contributions to Addressing Climate Change
2014	Walker Prize, Museum of Science, Boston

Publications:

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Review

Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature

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Abstract: We assess climate impacts of global warming using ongoing observations and paleoclimate data. We use Earth's measured energy imbalance, paleoclimate data, and simple representations of the global carbon cycle and temperature to define emission reductions needed to stabilize climate and avoid potentially disastrous impacts on today's young people, future generations, and nature. A cumulative industrial-era limit of ~500 GtC fossil fuel emissions and 100 GtC storage in the biosphere and soil would keep climate close to the Holocene range to which humanity and other species are adapted. Cumulative emissions of ~1000 GtC, sometimes associated with 2°C global warming, would spur "slow" feedbacks and eventual warming of 3–4°C with disastrous consequences. Rapid emissions reduction is required to restore Earth's energy balance and avoid ocean heat uptake that would practically guarantee irreversible effects. Continuation of high fossil fuel emissions, given current knowledge of the consequences, would be an act of extraordinary witting intergenerational injustice. Responsible policymaking requires a rising price on carbon emissions that would preclude emissions from most remaining coal and unconventional fossil fuels and phase down emissions from conventional fossil fuels.

Introduction

Humans are now the main cause of changes of Earth's atmospheric composition and thus the drive for future climate change [1]. The principal climate forcing, defined as an imposed change of planetary energy balance [1–2], is increasing carbon dioxide (CO_2) from fossil fuel emissions, much of which will remain in the atmosphere for millennia [1,3]. The climate response to this forcing and society's response to climate change are complicated by the system's inertia, mainly due to the ocean and the ice sheets on Greenland and Antarctica together with the long residence time of fossil fuel carbon in the climate system. The inertia causes climate to appear to respond slowly to this human-made forcing, but further long-lasting responses can be locked in.

More than 170 nations have agreed on the need to limit fossil fuel emissions to avoid dangerous human-made climate change, as formalized in the 1992 Framework Convention on Climate Change [6]. However, the stark reality is that global emissions have accelerated (Fig. 1) and new efforts are underway to massively expand fossil fuel extraction [7–9] by drilling to increasing ocean depths and into the Arctic, squeezing oil from tar sands and tar shale, hydro-fracking to expand extraction of natural gas, developing exploitation of methane hydrates, and mining of coal via mountaintop removal and mechanized long-wall mining. The growth rate of fossil fuel emissions increased from 1.5%/year during 1980–2000 to 3%/year in 2000–2012, mainly because of increased coal use [4–5].

The Framework Convention [6] does not define a dangerous level for global warming or an emissions limit for fossil fuels. The

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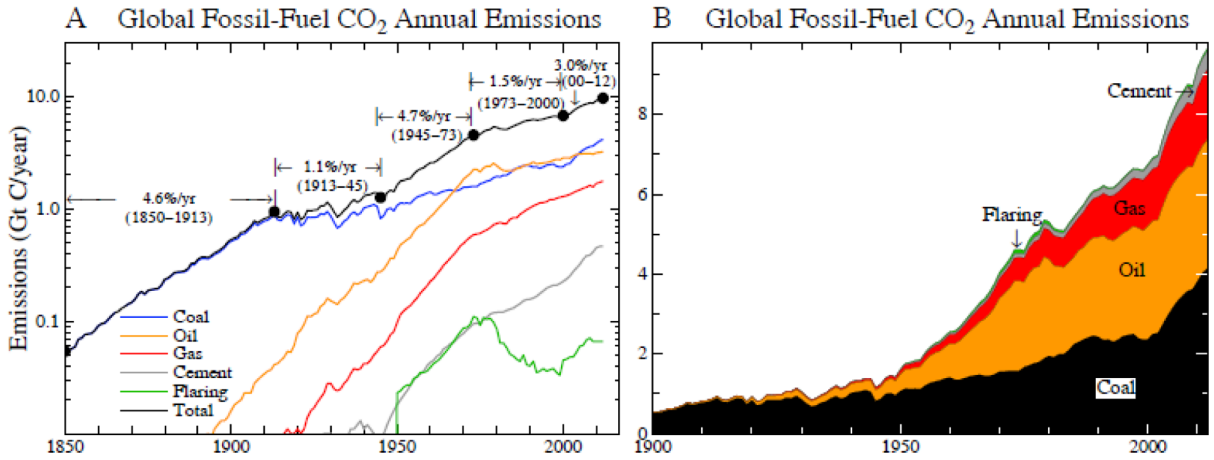

Figure 1. CO_2 annual emissions from fossil fuel use and cement manufacture, based on data of British Petroleum [4] concatenated with data of Boden et al. [5]. (A) is log scale and (B) is linear.
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European Union in 1996 proposed to limit global warming to 2°C relative to pre-industrial times [10], based partly on evidence that many ecosystems are at risk with larger climate change. The 2°C target was reaffirmed in the 2009 "Copenhagen Accord" emerging from the 15th Conference of the Parties of the Framework Convention [11], with specific language "We agree that deep cuts in global emissions are required according to science, as documented in the IPCC Fourth Assessment Report with a view to reduce global emissions so as to hold the increase in global temperature below 2 degrees Celsius…".

A global warming target is converted to a fossil fuel emissions target with the help of global climate-carbon-cycle models, which reveal that eventual warming depends on cumulative carbon emissions, not on the temporal history of emissions [12]. The emission limit depends on climate sensitivity, but central estimates [12–13], including those in the upcoming Fifth Assessment of the Intergovernmental Panel on Climate Change [14], are that a 2°C global warming limit implies a cumulative carbon emissions limit of the order of 1000 GtC. In comparing carbon emissions, note that some authors emphasize the sum of fossil fuel and deforestation carbon. We bookkeep fossil fuel and deforestation carbon separately, because the larger fossil fuel term is known more accurately and this carbon stays in the climate system for hundreds of thousands of years. Thus fossil fuel carbon is the crucial human input that must be limited. Deforestation carbon is more uncertain and potentially can be offset on the century time scale by storage in the biosphere, including the soil, via reforestation and improved agricultural and forestry practices.

There are sufficient fossil fuel resources to readily supply 1000 GtC, as fossil fuel emissions to date (370 GtC) are only a small fraction of potential emissions from known reserves and potentially recoverable resources (Fig. 2). Although there are uncertainties in reserves and resources, ongoing fossil fuel subsidies and continuing technological advances ensure that more and more of these fuels will be economically recoverable. As we will show, Earth's paleoclimate record makes it clear that the CO_2 produced by burning all or most of these fossil fuels would lead to a very different planet than the one that humanity knows.

Our evaluation of a fossil fuel emissions limit is not based on climate models but rather on observational evidence of global climate change as a function of global temperature and on the fact that climate stabilization requires long-term planetary energy balance. We use measured global temperature and Earth's measured energy imbalance to determine the atmospheric CO_2 level required to stabilize climate at today's global temperature, which is near the upper end of the global temperature range in the current interglacial period (the Holocene). We then examine climate impacts during the past few decades of global warming and in paleoclimate records including the Eemian period, concluding that there are already clear indications of undesirable impacts at the current level of warming and that 2°C warming would have major deleterious consequences. We use simple representations of the carbon cycle and global temperature, consistent with observations, to simulate transient global temperature and assess carbon emission scenarios that could keep global climate near the Holocene range. Finally, we discuss likely overshooting of target emissions, the potential for carbon extraction from the atmosphere, and implications for energy and economic policies, as well as intergenerational justice.

Global Temperature and Earth's Energy Balance

Global temperature and Earth's energy imbalance provide our most useful measuring sticks for quantifying global climate change and the changes of global climate forcings that would be required to stabilize global climate. Thus we must first quantify knowledge of these quantities.

Temperature

Temperature change in the past century (Fig. 3; update of figures in [16]) includes unforced variability and forced climate change. The long-term global warming trend is predominantly a forced climate change caused by increased human-made atmospheric gases, mainly CO_2 [1]. Increase of "greenhouse" gases such as CO_2 has little effect on incoming sunlight but makes the atmosphere more opaque at infrared wavelengths, causing infrared (heat) radiation to space to emerge from higher, colder levels, which thus reduces infrared radiation to space. The resulting planetary energy imbalance, absorbed solar energy exceeding heat emitted to space, causes Earth to warm. Observations, discussed below, confirm that Earth is now substantially out of energy balance, so the long-term warming will continue.

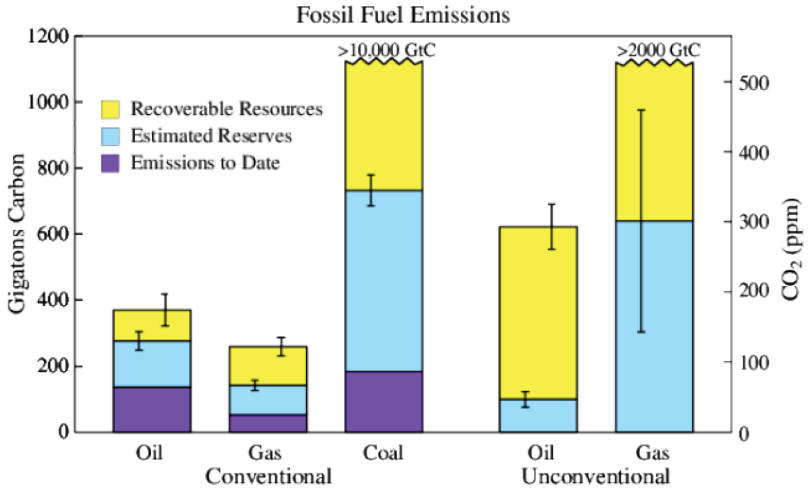

Figure 2. Fossil fuel CO_2 emissions and carbon content (1 ppm atmospheric CO_2 ~ 2.12 GtC). Estimates of reserves (profitable to extract at current prices) and resources (potentially recoverable with advanced technology and/or at higher prices) are the mean of estimates of Energy Information Administration (EIA) [7], German Advisory Council (GAC) [8], and Global Energy Assessment (GEA) [9]. GEA [9] suggests the possibility of >15,000 GtC unconventional gas. Error estimates (vertical lines) are from GEA and probably underestimate the total uncertainty. We convert energy content to carbon content using emission factors of Table 4.2 of [15] for coal, gas and conventional oil, and, also following [15], emission factor of unconventional oil is approximated as being the same as for coal. Total emissions through 2012, including gas flaring and cement manufacture, are 384 GtC; fossil fuel emissions alone are ~370 GtC.
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Global temperature appears to have leveled off since 1998 (Fig. 3a). That plateau is partly an illusion due to the 1998 global temperature spike caused by the El Niño of the century that year. The 11-year (132-month) running mean temperature (Fig. 3b) shows only a moderate decline of the warming rate. The 11-year averaging period minimizes the effect of variability due to the 10–12 year periodicity of solar irradiance as well as irregular El Niño/La Niña warming/cooling in the tropical Pacific Ocean. The current solar cycle has weaker irradiance than the several prior solar cycles, but the decreased irradiance can only partially account for the decreased warming rate [17]. Variability of the El Niño/La Niña cycle, described as a Pacific Decadal Oscillation, largely accounts for the temporary decrease of warming [18], as we discuss further below in conjunction with global temperature simulations.

Assessments of dangerous climate change have focused on estimating a permissible level of global warming. The Intergovernmental Panel on Climate Change [1,19] summarized broad-based assessments with a "burning embers" diagram, which indicated that major problems begin with global warming of 2–3°C. A probabilistic analysis [20], still partly subjective, found a median "dangerous" threshold of 2.8°C, with 95% confidence that the dangerous threshold was 1.5°C or higher. These assessments were relative to global temperature in year 1990, so add 0.6°C to these values to obtain the warming relative to 1880–1920, which is the base period we use in this paper for preindustrial time. The conclusion that humanity could tolerate global warming up to a few degrees Celsius meshed with common sense. After all, people readily tolerate much larger regional and seasonal climate variations.

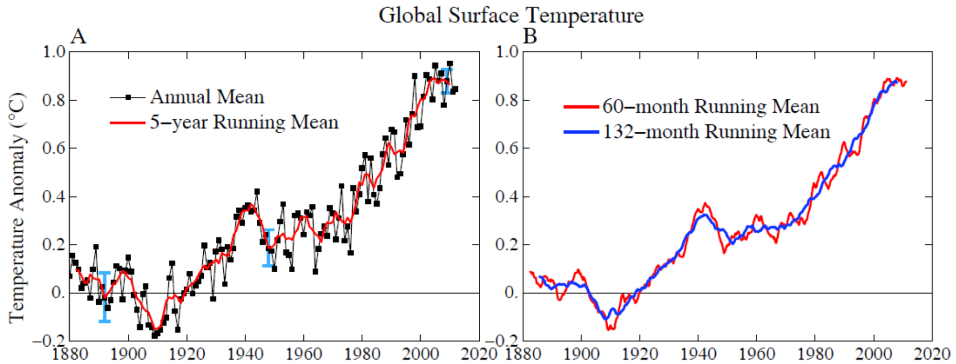

Figure 3. Global surface temperature relative to 1880–1920 mean. B shows the 5 and 11 year means. Figures are updates of [16] using data through August 2013.
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The fallacy of this logic emerged recently as numerous impacts of ongoing global warming emerged and as paleoclimate implications for climate sensitivity became apparent. Arctic sea ice end-of-summer minimum area, although variable from year to year, has plummeted by more than a third in the past few decades, at a faster rate than in most models [21], with the sea ice thickness declining a factor of four faster than simulated in IPCC climate models [22]. The Greenland and Antarctic ice sheets began to shed ice at a rate, now several hundred cubic kilometers per year, which is continuing to accelerate [23–25]. Mountain glaciers are receding rapidly all around the world [26–29] with effects on seasonal freshwater availability of major rivers [30–32]. The hot dry subtropical climate belts have expanded as the troposphere has warmed and the stratosphere cooled [33–36], contributing to increases in the area and intensity of drought [37] and wildfires [38]. The abundance of reef-building corals is decreasing at a rate of 0.5–2%/year, at least in part due to ocean warming and possibly ocean acidification caused by rising dissolved CO_2 [39–41]. More than half of all wild species have shown significant changes in where they live and in the timing of major life events [42–44]. Mega-heatwaves, such as those in Europe in 2003, the Moscow area in 2010, Texas and Oklahoma in 2011, Greenland in 2012, and Australia in 2013 have become more widespread with the increase demonstrably linked to global warming [45–47].

These growing climate impacts, many more rapid than anticipated and occurring while global warming is less than 1°C, imply that society should reassess what constitutes a "dangerous level" of global warming. Earth's paleoclimate history provides a valuable tool for that purpose.

Paleoclimate Temperature

Major progress in quantitative understanding of climate change has occurred recently by use of the combination of data from high resolution ice cores covering time scales of order several hundred thousand years [48–49] and ocean cores for time scales of order one hundred million years [50]. Quantitative insights on global temperature sensitivity to external forcings [51–52] and sea level sensitivity to global temperature [52–53] are crucial to our analyses. Paleoclimate data also provide quantitative information about how nominally slow feedback processes amplify climate sensitivity [51–52,54–56], which also is important to our analyses.

Earth's surface temperature prior to instrumental measurements is estimated via proxy data. We will refer to the surface temperature record in Fig. 4 of a recent paper [52]. Global mean temperature during the Eemian interglacial period (120,000 years ago) is constrained to be 2°C warmer than our pre-industrial (1880–1920) level based on several studies of Eemian climate [52]. The concatenation of modern and instrumental records [52] is based on an estimate that global temperature in the first decade of the 21st century (+0.8°C relative to 1880–1920) exceeded the Holocene mean by 0.25±0.25°C. That estimate was based in part on the fact that sea level is now rising 3.2 mm/yr (3.2 m/millennium) [57], an order of magnitude faster than the rate during the prior several thousand years, with rapid change of ice sheet mass balance over the past few decades [23] and Greenland and Antarctica now losing mass at accelerating rates [23–24]. This concatenation, which has global temperature 13.9°C in the base period 1951–1980, has the first decade of the 21st century slightly (~0.1°C) warmer than the early Holocene maximum. A recent reconstruction from proxy temperature data [55] concluded that global temperature declined about 0.7°C between the Holocene maximum and a pre-industrial minimum before recent warming brought temperature back near the Holocene maximum, which is consistent with our analysis.

Climate oscillations evident in Fig. 4 of Hansen et al. [52] were instigated by perturbations of Earth's orbit and spin axis tilt relative to the orbital plane, which alter the geographical and seasonal distribution of sunlight on Earth [58]. These forcings change slowly, with periods between 20,000 and 400,000 years, and thus climate is able to stay in quasi-equilibrium with these forcings. Slow insolation changes initiated the climate oscillations, but the mechanisms that caused the climate changes to be so large were two powerful amplifying feedbacks: the planet's surface albedo (its reflectivity, literally its whiteness) and atmospheric CO_2 amount. As the planet warms, ice and snow melt, causing the surface to be darker, absorb more sunlight and warm further. As the ocean and soil become warmer they release CO_2 and other greenhouse gases, causing further warming. Together with fast feedbacks processes, via changes of water vapor, clouds, and the vertical temperature profile, these slow amplifying feedbacks were responsible for almost the entire glacial-to-interglacial temperature change [59–62].

The albedo and CO_2 feedbacks amplified weak orbital forcings, the feedbacks necessarily changing slowly over millennia, at the pace of orbital changes. Today, however, CO_2 is under the control of humans as fossil fuel emissions overwhelm natural changes. Atmospheric CO_2 has increased rapidly to a level not seen for at least 3 million years [56,63]. Global warming induced by increasing CO_2 will cause ice to melt and hence sea level to rise as the global volume of ice moves toward the quasi-equilibrium amount that exists for a given global temperature [53]. As ice melts and ice area decreases, the albedo feedback will amplify global warming.

Earth, because of the climate system's inertia, has not yet fully responded to human-made changes of atmospheric composition. The ocean's thermal inertia, which delays some global warming for decades and even centuries, is accounted for in global climate models and its effect is confirmed via measurements of Earth's energy balance (see next section). In addition there are slow climate feedbacks, such as changes of ice sheet size, that occur mainly over centuries and millennia. Slow feedbacks have little effect on the immediate planetary energy balance, instead coming into play in response to temperature change. The slow feedbacks are difficult to model, but paleoclimate data and observations of ongoing changes help provide quantification.

Earth's Energy Imbalance

At a time of climate stability, Earth radiates as much energy to space as it absorbs from sunlight. Today Earth is out of balance because increasing atmospheric gases such as CO_2 reduce Earth's heat radiation to space, thus causing an energy imbalance, as there is less energy going out than coming in. This imbalance causes Earth to warm and move back toward energy balance. The warming and restoration of energy balance take time, however, because of Earth's thermal inertia, which is due mainly to the global ocean.

Earth warmed about 0.8°C in the past century. That warming increased Earth's radiation to space, thus reducing Earth's energy imbalance. The remaining energy imbalance helps us assess how much additional warming is still "in the pipeline". Of course increasing CO_2 is only one of the factors affecting Earth's energy balance, even though it is the largest climate forcing. Other forcings include changes of aerosols, solar irradiance, and Earth's surface albedo.

Determination of the state of Earth's climate therefore requires measuring the energy imbalance. This is a challenge, because the imbalance is expected to be only about 1 W/m^2 or less, so accuracy approaching 0.1 W/m^2 is needed. The most promising

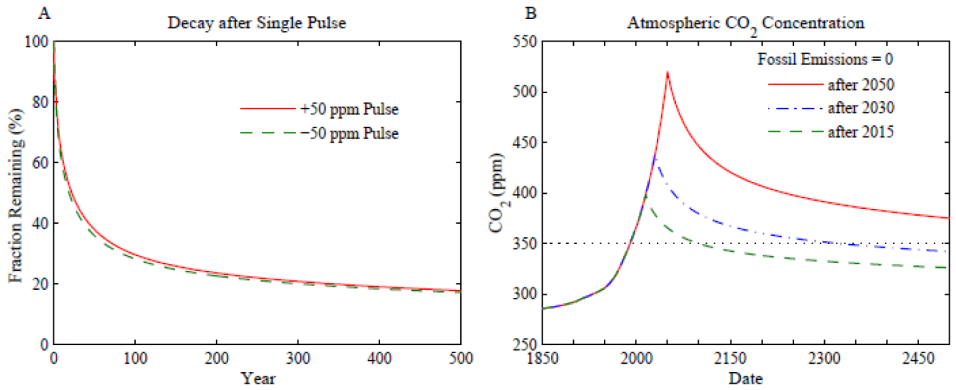

Figure 4. Decay of atmospheric CO_2 perturbations. (A) Instantaneous injection or extraction of CO_2 with initial conditions at equilibrium. (B) Fossil fuel emissions terminate at the end of 2015, 2030, or 2050 and land use emissions terminate after 2015 in all three cases, i.e., thereafter there is no net deforestation.
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approach is to measure the rate of changing heat content of the ocean, atmosphere, land, and ice [64]. Measurement of ocean heat content is the most critical observation, as nearly 90 percent of the energy surplus is stored in the ocean [64–65].

Observed Energy Imbalance

Nations of the world have launched a cooperative program to measure changing ocean heat content, distributing more than 3000 Argo floats around the world ocean, with each float repeatedly diving to a depth of 2 km and back [66]. Ocean coverage by floats reached 90% by 2005 [66], with the gaps mainly in sea ice regions, yielding the potential for an accurate energy balance assessment, provided that several systematic measurement biases exposed in the past decade are minimized [67–69].

Argo data reveal that in 2005–2010 the ocean's upper 2000 m gained heat at a rate equal to 0.41 W/m^2 averaged over Earth's surface [70]. Smaller contributions to planetary energy imbalance are from heat gain by the deeper ocean (+0.10 W/m^2), energy used in net melting of ice (+0.05 W/m^2), and energy taken up by warming continents (+0.02 W/m^2). Data sources for these estimates and uncertainties are provided elsewhere [64]. The resulting net planetary energy imbalance for the six years 2005–2010 is +0.58±0.15 W/m^2.

The positive energy imbalance in 2005–2010 confirms that the effect of solar variability on climate is much less than the effect of human-made greenhouse gases. If the sun were the dominant forcing, the planet would have a negative energy balance in 2005–2010, when solar irradiance was at its lowest level in the period of accurate data, i.e., since the 1970s [64,71]. Even though much of the greenhouse gas forcing has been expended in causing observed 0.8°C global warming, the residual positive forcing overwhelms the negative solar forcing. The full amplitude of solar cycle forcing is about 0.25 W/m^2 [64,71], but the reduction of solar forcing due to the present weak solar cycle is about half that magnitude as we illustrate below, so the energy imbalance measured during solar minimum (0.58 W/m^2) suggests an average imbalance over the solar cycle of about 0.7 W/m^2.

Earth's measured energy imbalance has been used to infer the climate forcing by aerosols, with two independent analyses yielding a forcing in the past decade of about −1.5 W/m^2 [64,72], including the direct aerosol forcing and indirect effects via induced cloud changes. Given this large (negative) aerosol forcing, precise monitoring of changing aerosols is needed [73]. Public reaction to increasingly bad air quality in developing regions [74] may lead to future aerosol reductions, at least on a regional basis. Increase of Earth's energy imbalance from reduction of particulate air pollution, which is needed for the sake of human health, can be minimized via an emphasis on reducing absorbing black soot [75], but the potential to constrain the net increase of climate forcing by focusing on black soot is limited [76].

Energy Imbalance Implications for CO_2 Target

Earth's energy imbalance is the most vital number characterizing the state of Earth's climate. It informs us about the global temperature change "in the pipeline" without further change of climate forcings and it defines how much greenhouse gases must be reduced to restore Earth's energy balance, which, at least to a good approximation, must be the requirement for stabilizing global climate. The measured energy imbalance accounts for all natural and human-made climate forcings, including changes of atmospheric aerosols and Earth's surface albedo.

If Earth's mean energy imbalance today is +0.5 W/m^2, CO_2 must be reduced from the current level of 395 ppm (global-mean annual-mean in mid-2013) to about 360 ppm to increase Earth's heat radiation to space by 0.5 W/m^2 and restore energy balance. If Earth's energy imbalance is 0.75 W/m^2, CO_2 must be reduced to about 345 ppm to restore energy balance [64,75].

The measured energy imbalance indicates that an initial CO_2 target "<350 ppm" would be appropriate, if the aim is to stabilize climate without further global warming. That target is consistent with an earlier analysis [54]. Additional support for that target is provided by our analyses of ongoing climate change and paleoclimate, in later parts of our paper. Specification now of a CO_2 target more precise than <350 ppm is difficult and unnecessary, because of uncertain future changes of forcings including other gases, aerosols and surface albedo. More precise assessments will become available during the time that it takes to turn around CO_2 growth and approach the initial 350 ppm target.

Below we find the decreasing emissions scenario that would achieve the 350 ppm target within the present century. Specifically, we want to know the annual percentage rate at which emissions must be reduced to reach this target, and the dependence of this rate upon the date at which reductions are initiated. This approach is complementary to the approach of estimating cumulative emissions allowed to achieve a given limit on global warming [12].

If the only human-made climate forcing were changes of atmospheric CO_2, the appropriate CO_2 target might be close to the pre-industrial CO_2 amount [53]. However, there are other human forcings, including aerosols, the effect of aerosols on clouds, non-CO_2 greenhouse gases, and changes of surface albedo that will not disappear even if fossil fuel burning is phased out. Aerosol forcings are substantially a result of fossil fuel burning [1,76], but the net aerosol forcing is a sensitive function of various aerosol sources [76]. The indirect aerosol effect on clouds is non-linear [1,76] such that it has been suggested that even the modest aerosol amounts added by pre-industrial humans to an otherwise pristine atmosphere may have caused a significant climate forcing [59]. Thus continued precise monitoring of Earth's radiation imbalance is probably the best way to assess and adjust the appropriate CO_2 target.

Ironically, future reductions of particulate air pollution may exacerbate global warming by reducing the cooling effect of reflective aerosols. However, a concerted effort to reduce non-CO_2 forcings by methane, tropospheric ozone, other trace gases, and black soot might counteract the warming from a decline in reflective aerosols [54,75]. Our calculations below of future global temperature assume such compensation, as a first approximation. To the extent that goal is not achieved, adjustments must be made in the CO_2 target or future warming may exceed calculated values.

Climate Impacts

Determination of the dangerous level of global warming inherently is partly subjective, but we must be as quantitative as possible. Early estimates for dangerous global warming based on the "burning embers" approach [1,19–20] have been recognized as probably being too conservative [77]. A target of limiting warming to 2°C has been widely adopted, as discussed above. We suspect, however, that this may be a case of inching toward a better answer. If our suspicion is correct, then that gradual approach is itself very dangerous, because of the climate system's inertia. It will become exceedingly difficult to keep warming below a target smaller than 2°C, if high emissions continue much longer.

We consider several important climate impacts and use evidence from current observations to assess the effect of 0.8°C warming and paleoclimate data for the effect of larger warming, especially the Eemian period, which had global mean temperature about +2°C relative to pre-industrial time. Impacts of special interest are sea level rise and species extermination, because they are practically irreversible, and others important to humankind.

Sea Level

The prior interglacial period, the Eemian, was at most ~2°C warmer than 1880–1920 (Fig. 3). Sea level reached heights several meters above today's level [78–80], probably with instances of sea level change of the order of 1 m/century [81–83]. Geologic shoreline evidence has been interpreted as indicating a rapid sea level rise of a few meters late in the Eemian to a peak about 9 meters above present, suggesting the possibility that a critical stability threshold was crossed that caused polar ice sheet collapse [84–85], although there remains debate within the research community about this specific history and interpretation. The large Eemian sea level excursions imply that substantial ice sheet melting occurred when the world was little warmer than today.

During the early Pliocene, which was only ~3°C warmer than the Holocene, sea level attained heights as much as 15–25 meters higher than today [53,86–89]. Such sea level rise suggests that parts of East Antarctica must be vulnerable to eventual melting with global temperature increase of a few degrees Celsius. Indeed, satellite gravity data and radar altimetry reveal that the Totten Glacier of East Antarctica, which fronts a large ice mass grounded below sea level, is now losing mass [90].

Greenland ice core data suggest that the Greenland ice sheet response to Eemian warmth was limited [91], but the fifth IPCC assessment [14] concludes that Greenland very likely contributed between 1.4 and 4.3 m to the higher sea level of the Eemian. The West Antarctic ice sheet is probably more susceptible to rapid change, because much of it rests on bedrock well below sea level [92–93]. Thus the entire 3–4 meters of global sea level contained in that ice sheet may be vulnerable to rapid disintegration, although arguments for stability of even this marine ice sheet have been made [94]. However, Earth's history reveals sea level changes of as much as a few meters per century, even though the natural climate forcings changed much more slowly than the present human-made forcing.

Expected human-caused sea level rise is controversial in part because predictions focus on sea level at a specific time, 2100. Sea level on a given date is inherently difficult to predict, as it depends on how rapidly non-linear ice sheet disintegration begins. Focus on a single date also encourages people to take the estimated result as an indication of what humanity faces, thus failing to emphasize that the likely rate of sea level rise immediately after 2100 will be much larger than within the 21st century, especially if CO_2 emissions continue to increase.

Recent estimates of sea level rise by 2100 have been of the order of 1 m [95–96], which is higher than earlier assessments [26], but these estimates still in part assume linear relations between warming and sea level rise. It has been argued [97–98] that continued business-as-usual CO_2 emissions are likely to spur a nonlinear response with multi-meter sea level rise this century. Greenland and Antarctica have been losing mass at rapidly increasing rates during the period of accurate satellite data [23]; the data are suggestive of exponential increase, but the records are too short to be conclusive. The area on Greenland with summer melt has increased markedly, with 97% of Greenland experiencing melt in 2012 [99].

The important point is that the uncertainty is not about whether continued rapid CO_2 emissions would cause large sea level rise, submerging global coastlines – it is about how soon the large changes would begin. The carbon from fossil fuel burning will remain in and affect the climate system for many millennia, ensuring that over time sea level rise of many meters will occur – tens of meters if most of the fossil fuels are burned [53]. That order of sea level rise would result in the loss of hundreds of historical coastal cities worldwide with incalculable economic consequences, create hundreds of millions of global warming refugees from highly-populated low-lying areas, and thus likely cause major international conflicts.

Shifting Climate Zones

Theory and climate models indicate that the tropical overturning (Hadley) atmospheric circulation expands poleward with global warming [33]. There is evidence in satellite and radiosonde data and in observational data for poleward expansion of the tropical circulation by as much as a few degrees of latitude since the 1970s [34–35], but natural variability may have contributed to that expansion [36]. Change in the overturning circulation likely contributes to expansion of subtropical conditions and increased aridity in the southern United States [30,100], the Mediterranean region, South America, southern Africa, Madagascar, and southern Australia. Increased aridity and temperature contribute to increased forest fires that burn hotter and are more destructive [38].

Despite large year-to-year variability of temperature, decadal averages reveal isotherms (lines of a given average temperature) moving poleward at a typical rate of the order of 100 km/decade in the past three decades [101], although the range shifts for specific species follow more complex patterns [102]. This rapid shifting of climate zones far exceeds natural rates of change. Movement has been in the same direction (poleward, and upward in elevation) since about 1975. Wild species have responded to climate change, with three-quarters of marine species shifting their ranges poleward as much as 1000 km [44,103] and more than half of terrestrial species shifting ranges poleward as much as 600 km and upward as much as 400 m [104].

Humans may adapt to shifting climate zones better than many species. However, political borders can interfere with human migration, and indigenous ways of life already have been adversely affected [26]. Impacts are apparent in the Arctic, with melting tundra, reduced sea ice, and increased shoreline erosion. Effects of shifting climate zones also may be important for indigenous Americans who possess specific designated land areas, as well as other cultures with long-standing traditions in South America, Africa, Asia and Australia.

Human Extermination of Species

Biodiversity is affected by many agents including overharvesting, introduction of exotic species, land use changes, nitrogen fertilization, and direct effects of increased atmospheric CO_2 on plant ecophysiology [43]. However, an overriding role of climate change is exposed by diverse effects of rapid warming on animals, plants, and insects in the past three decades.

A sudden widespread decline of frogs, with extinction of entire mountain-restricted species attributed to global warming [105–106], provided a dramatic awakening. There are multiple causes of the detailed processes involved in global amphibian declines and extinctions [107–108], but global warming is a key contributor and portends a planetary-scale mass extinction in the making unless action is taken to stabilize climate while also fighting biodiversity's other threats [109].

Mountain-restricted and polar-restricted species are particularly vulnerable. As isotherms move up the mountainside and poleward, so does the climate zone in which a given species can survive. If global warming continues unabated, many of these species will be effectively pushed off the planet. There are already reductions in the population and health of Arctic species in the southern parts of the Arctic, Antarctic species in the northern parts of the Antarctic, and alpine species worldwide [43].

A critical factor for survival of some Arctic species is retention of all-year sea ice. Continued growth of fossil fuel emissions will cause loss of all Arctic summer sea ice within several decades. In contrast, the scenario in Fig. 5A, with global warming peaking just over 1°C and then declining slowly, should allow summer sea ice to survive and then gradually increase to levels representative of recent decades.

The threat to species survival is not limited to mountain and polar species. Plant and animal distributions reflect the regional climates to which they are adapted. Although species attempt to migrate in response to climate change, their paths may be blocked by human-constructed obstacles or natural barriers such as coast lines and mountain ranges. As the shift of climate zones [110] becomes comparable to the range of some species, less mobile species can be driven to extinction. Because of extensive species interdependencies, this can lead to mass extinctions.

Rising sea level poses a threat to a large number of uniquely evolved endemic fauna living on islands in marine-dominated ecosystems, with those living on low lying islands being especially vulnerable. Evolutionary history on Bermuda offers numerous examples of the direct and indirect impact of changing sea level on evolutionary processes [111–112], with a number of taxa being extirpated due to habitat changes, greater competition, and island inundation [113]. Similarly, on Aldahabra Island in the Indian Ocean, land tortoises were exterminated during sea level high stands [114]. Vulnerabilities would be magnified by the speed of human-made climate change and the potentially large sea level rise [115].

IPCC [26] reviewed studies relevant to estimating eventual extinctions. They estimate that if global warming exceeds 1.6°C above preindustrial, 9–31 percent of species will be committed to extinction. With global warming of 2.9°C, an estimated 21–52 percent of species will be committed to extinction. A comprehensive study of biodiversity indicators over the past decade [116] reveals that, despite some local success in increasing extent of protected areas, overall indicators of pressures on biodiversity including that due to climate change are continuing to increase and indicators of the state of biodiversity are continuing to decline.

Mass extinctions occurred several times in Earth's history [117–118], often in conjunction with rapid climate change. New species evolved over millions of years, but those time scales are almost beyond human comprehension. If we drive many species to extinction we will leave a more desolate, monotonous planet for our children, grandchildren, and more generations than we can imagine. We will also undermine ecosystem functions (e.g., pollination which is critical for food production) and ecosystem resilience (when losing keystone species in food chains), as well as reduce functional diversity (critical for the ability of ecosystems to respond to shocks and stress) and genetic diversity that plays an important role for development of new medicines, materials, and sources of energy.

Coral Reef Ecosystems

Coral reefs are the most biologically diverse marine ecosystem, often described as the rainforests of the ocean. Over a million species, most not yet described [119], are estimated to populate coral reef ecosystems generating crucial ecosystem services for at least 500 million people in tropical coastal areas. These ecosystems are highly vulnerable to the combined effects of ocean acidification and warming.

Acidification arises as the ocean absorbs CO_2, producing carbonic acid [120], thus making the ocean more corrosive to the calcium carbonate shells (exoskeletons) of many marine organisms. Geochemical records show that ocean pH is already outside its range of the past several million years [121–122]. Warming causes coral bleaching, as overheated coral expel symbiotic algae and become vulnerable to disease and mortality [123]. Coral bleaching and slowing of coral calcification already are causing mass mortalities, increased coral disease, and reduced reef carbonate accretion, thus disrupting coral reef ecosystem health [40,124].

Local human-made stresses add to the global warming and acidification effects, all of these driving a contraction of 1–2% per year in the abundance of reef-building corals [39]. Loss of the three-dimensional coral reef frameworks has consequences for all the species that depend on them. Loss of these frameworks also has consequences for the important roles that coral reefs play in supporting fisheries and protecting coastlines from wave stress. Consequences of lost coral reefs can be economically devastating for many nations, especially in combination with other impacts such as sea level rise and intensification of storms.

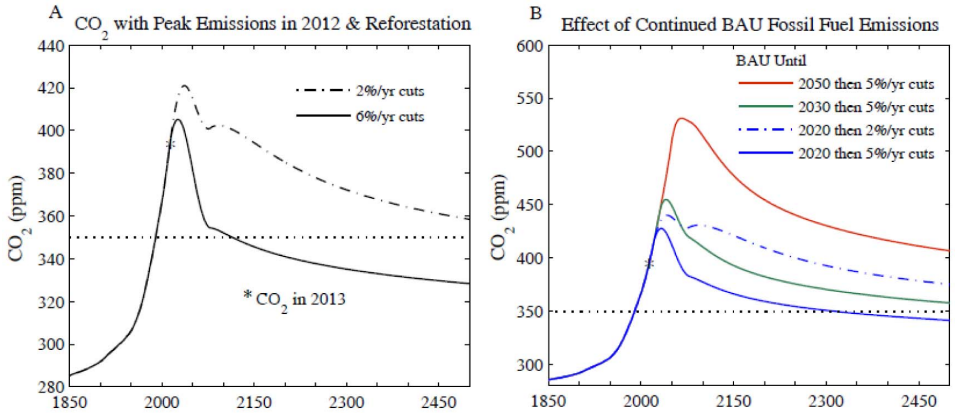

Figure 5. Atmospheric CO_2 if fossil fuel emissions reduced. (A) 6% or 2% annual cut begins in 2013 and 100 GtC reforestation drawdown occurs in 2031–2080, (B) effect of delaying onset of emission reduction.
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Climate Extremes

Changes in the frequency and magnitude of climate extremes, of both moisture and temperature, are affected by climate trends as well as changing variability. Extremes of the hydrologic cycle are expected to intensify in a warmer world. A warmer atmosphere holds more moisture, so precipitation can be heavier and cause more extreme flooding. Higher temperatures, on the other hand, increase evaporation and can intensify droughts when they occur, as can expansion of the subtropics, as discussed above. Global models for the 21st century find an increased variability of precipitation minus evaporation [P-E] in most of the world, especially near the equator and at high latitudes [125]. Some models also show an intensification of droughts in the Sahel, driven by increasing greenhouse gases [126].

Observations of ocean salinity patterns for the past 50 years reveal an intensification of [P-E] patterns as predicted by models, but at an even faster rate. Precipitation observations over land show the expected general increase of precipitation poleward of the subtropics and decrease at lower latitudes [1,26]. An increase of intense precipitation events has been found on much of the world's land area [127–129]. Evidence for widespread drought intensification is less clear and inherently difficult to confirm with available data because of the increase of time-integrated precipitation at most locations other than the subtropics. Data analyses have found an increase of drought intensity at many locations [130–131] The magnitude of change depends on the drought index employed [132], but soil moisture provides a good means to separate the effect of shifting seasonal precipitation and confirms an overall drought intensification [37].

Global warming of ~0.6°C since the 1970s (Fig. 3) has already caused a notable increase in the occurrence of extreme summer heat [46]. The likelihood of occurrence or the fractional area covered by 3-standard-deviation hot anomalies, relative to a base period (1951–1980) that was still within the range of Holocene climate, has increased by more than a factor of ten. Large areas around Moscow, the Mediterranean region, the United States and Australia have experienced such extreme anomalies in the past three years. Heat waves lasting for weeks have a devastating impact on human health: the European heat wave of summer 2003 caused over 70,000 excess deaths [133]. This heat record for Europe was surpassed already in 2010 [134]. The number of extreme heat waves has increased several-fold due to global warming [45–46,135] and will increase further if temperatures continue to rise.

Human Health

Impacts of climate change cause widespread harm to human health, with children often suffering the most. Food shortages, polluted air, contaminated or scarce supplies of water, an expanding area of vectors causing infectious diseases, and more intensely allergenic plants are among the harmful impacts [26]. More extreme weather events cause physical and psychological harm. World health experts have concluded with "very high confidence" that climate change already contributes to the global burden of disease and premature death [26].

IPCC [26] projects the following trends, if global warming continue to increase, where only trends assigned very high confidence or high confidence are included: (i) increased malnutrition and consequent disorders, including those related to child growth and development, (ii) increased death, disease and injuries from heat waves, floods, storms, fires and droughts, (iii) increased cardio-respiratory morbidity and mortality associated with ground-level ozone. While IPCC also projects fewer deaths from cold, this positive effect is far outweighed by the negative ones.

Growing awareness of the consequences of human-caused climate change triggers anxiety and feelings of helplessness [136–137]. Children, already susceptible to age-related insecurities, face additional destabilizing insecurities from questions about how they will cope with future climate change [138–139]. Exposure to media ensures that children cannot escape hearing that their future and that of other species is at stake, and that the window of opportunity to avoid dramatic climate impacts is closing. The psychological health of our children is a priority, but denial of the truth exposes our children to even greater risk.

Health impacts of climate change are in addition to direct effects of air and water pollution. A clear illustration of direct effects of fossil fuels on human health was provided by an inadvertent experiment in China during the 1950–1980 period of central planning, when free coal for winter heating was provided to North China but not to the rest of the country. Analysis of the impact was made [140] using the most comprehensive data file ever compiled on mortality and air pollution in any developing country. A principal conclusion was that the 500 million residents of North China experienced during the 1990s a loss of more than 2.5 billion life years owing to the added air pollution, and an average reduction in life expectancy of 5.5 years. The degree of air pollution in China exceeded that in most of the world, yet

assessments of total health effects must also include other fossil fuel caused air and water pollutants, as discussed in the following section on ecology and the environment.

The Text S1 has further discussion of health impacts of climate change.

Ecology and the Environment

The ecological impact of fossil fuel mining increases as the largest, easiest to access, resources are depleted [141]. A constant fossil fuel production rate requires increasing energy input, but also use of more land, water, and diluents, with the production of more waste [142]. The increasing ecological and environmental impact of a given amount of useful fossil fuel energy is a relevant consideration in assessing alternative energy strategies.

Coal mining has progressively changed from predominantly underground mining to surface mining [143], including mountaintop removal with valley fill, which is now widespread in the Appalachian ecoregion in the United States. Forest cover and topsoil are removed, explosives are used to break up rocks to access coal, and the excess rock is pushed into adjacent valleys, where it buries existing streams. Burial of headwater streams causes loss of ecosystems that are important for nutrient cycling and production of organic matter for downstream food webs [144]. The surface alterations lead to greater storm runoff [145] with likely impact on downstream flooding. Water emerging from valley fills contain toxic solutes that have been linked to declines in watershed biodiversity [146]. Even with mine-site reclamation intended to restore pre-mined surface conditions, mine-derived chemical constituents are found in domestic well water [147]. Reclaimed areas, compared with unmined areas, are found to have increased soil density with decreased organic and nutrient content, and with reduced water infiltration rates [148]. Reclaimed areas have been found to produce little if any regrowth of woody vegetation even after 15 years [149], and, although this deficiency might be addressed via more effective reclamation methods, there remains a likely significant loss of carbon storage [149].

Oil mining has an increasing ecological footprint per unit delivered energy because of the decreasing size of new fields and their increased geographical dispersion; transit distances are greater and wells are deeper, thus requiring more energy input [145]. Useful quantitative measures of the increasing ecological impacts are provided by the history of oil development in Alberta, Canada for production of both conventional oil and tar sands development. The area of land required per barrel of produced oil increased by a factor of 12 between 1955 and 2006 [150] leading to ecosystem fragmentation by roads and pipelines needed to support the wells [151]. Additional escalation of the mining impact occurs as conventional oil mining is supplanted by tar sands development, with mining and land disturbance from the latter producing land use-related greenhouse gas emissions as much as 23 times greater than conventional oil production per unit area [152], but with substantial variability and uncertainty [152–153]. Much of the tar sands bitumen is extracted through surface mining that removes the "overburden" (i.e., boreal forest ecosystems) and tar sand from large areas to a depth up to 100 m, with ecological impacts downstream and in the mined area [154]. Although mined areas are supposed to be reclaimed, as in the case of mountaintop removal, there is no expectation that the ecological value of reclaimed areas will be equivalent to predevelopment condition [141,155]. Landscape changes due to tar sands mining and reclamation cause a large loss of peatland and stored carbon, while also significantly reducing carbon sequestration potential [156]. Lake sediment cores document increased chemical pollution of ecosystems during the past several decades traceable to tar sands development [157] and snow and water samples indicate that recent levels of numerous pollutants exceeded local and national criteria for protection of aquatic organisms [158].

Gas mining by unconventional means has rapidly expanded in recent years, without commensurate understanding of the ecological, environmental and human health consequences [159]. The predominant approach is hydraulic fracturing ("fracking") of deep shale formations via injection of millions of gallons of water, sand and toxic chemicals under pressure, thus liberating methane [155,160]. A large fraction of the injected water returns to the surface as wastewater containing high concentrations of heavy metals, oils, greases and soluble organic compounds [161]. Management of this wastewater is a major technical challenge, especially because the polluted waters can continue to backflow from the wells for many years [161]. Numerous instances of groundwater and river contamination have been cited [162]. High levels of methane leakage from fracking have been found [163], as well as nitrogen oxides and volatile organic compounds [159]. Methane leaks increase the climate impact of shale gas, but whether the leaks are sufficient to significantly alter the climate forcing by total natural gas development is uncertain [164]. Overall, environmental and ecologic threats posed by unconventional gas extraction are uncertain because of limited research, however evidence for groundwater pollution on both local and river basin scales is a major concern [165].

Today, with cumulative carbon emissions ~370 GtC from all fossil fuels, we are at a point of severely escalating ecological and environmental impacts from fossil fuel use and fossil fuel mining, as is apparent from the mountaintop removal for coal, tar sands extraction of oil, and fracking for gas. The ecological and environmental implications of scenarios with carbon emissions of 1000 GtC or greater, as discussed below, would be profound and should influence considerations of appropriate energy strategies.

Summary: Climate Impacts

Climate impacts accompanying global warming of 2°C or more would be highly deleterious. Already there are numerous indications of substantial effects in response to warming of the past few decades. That warming has brought global temperature close to if not slightly above the prior range of the Holocene. We conclude that an appropriate target would be to keep global temperature at a level within or close to the Holocene range. Global warming of 2°C would be well outside the Holocene range and far into the dangerous range.

Transient Climate Change

We must quantitatively relate fossil fuel emissions to global temperature in order to assess how rapidly fossil fuel emissions must be phased down to stay under a given temperature limit. Thus we must deal with both a transient carbon cycle and transient global climate change.

Global climate fluctuates stochastically and also responds to natural and human-made climate forcings [1,166]. Forcings, measured in W/m^2 averaged over the globe, are imposed perturbations of Earth's energy balance caused by changing forcing agents such as solar irradiance and human-made greenhouse gases (GHGs). CO_2 accounts for more than 80% of the added GHG forcing in the past 15 years [64,167] and, if fossil fuel emissions continue at a high level, CO_2 will be the dominant driver of future global temperature change.

We first define our method of calculating atmospheric CO_2 as a function of fossil fuel emissions. We then define our assumptions

about the potential for drawing down atmospheric CO_2 via reforestation and increase of soil carbon, and we define fossil fuel emission reduction scenarios that we employ in our study. Finally we describe all forcings employed in our calculations of global temperature and the method used to simulate global temperature.

Carbon Cycle and Atmospheric CO_2

The carbon cycle defines the fate of CO_2 injected into the air by fossil fuel burning [1,168] as the additional CO_2 distributes itself over time among surface carbon reservoirs: the atmosphere, ocean, soil, and biosphere. We use the dynamic-sink pulse-response function version of the well-tested Bern carbon cycle model [169], as described elsewhere [54,170].

Specifically, we solve equations 3–6, 16–17, A.2.2, and A.3 of Joos et al. [169] using the same parameters and assumptions therein, except that initial (1850) atmospheric CO_2 is assumed to be 285.2 ppm [167]. Historical fossil fuel CO_2 emissions are from Boden et al. [5]. This Bern model incorporates non-linear ocean chemistry feedbacks and CO_2 fertilization of the terrestrial biosphere, but it omits climate-carbon feedbacks, e.g., assuming static global climate and ocean circulation. Therefore our results should be regarded as conservative, especially for scenarios with large emissions.

A pulse of CO_2 injected into the air decays by half in about 25 years as CO_2 is taken up by the ocean, biosphere and soil, but nearly one-fifth is still in the atmosphere after 500 years (Fig. 4A). Eventually, over hundreds of millennia, weathering of rocks will deposit all of this initial CO_2 pulse on the ocean floor as carbonate sediments [168].

Under equilibrium conditions a negative CO_2 pulse, i.e., artificial extraction and storage of some CO_2 amount, decays at about the same rate as a positive pulse (Fig. 4A). Thus if it is decided in the future that CO_2 must be extracted from the air and removed from the carbon cycle (e.g., by storing it underground or in carbonate bricks), the impact on atmospheric CO_2 amount will diminish in time. This occurs because carbon is exchanged among the surface carbon reservoirs as they move toward an equilibrium distribution, and thus, e.g., CO_2 out-gassing by the ocean can offset some of the artificial drawdown. The CO_2 extraction required to reach a given target atmospheric CO_2 level therefore depends on the prior emission history and target timeframe, but the amount that must be extracted substantially exceeds the net reduction of the atmospheric CO_2 level that will be achieved. We clarify this matter below by means of specific scenarios for capture of CO_2.

It is instructive to see how fast atmospheric CO_2 declines if fossil fuel emissions are instantly terminated (Fig. 4B). Halting emissions in 2015 causes CO_2 to decline to 350 ppm at century's end (Fig. 4B). A 20 year delay in halting emissions has CO_2 returning to 350 ppm at about 2300. With a 40 year delay, CO_2 does not return to 350 ppm until after 3000. These results show how difficult it is to get back to 350 ppm if emissions continue to grow for even a few decades.

These results emphasize the urgency of initiating emissions reduction [171]. As discussed above, keeping global climate close to the Holocene range requires a long-term atmospheric CO_2 level of about 350 ppm or less, with other climate forcings similar to today's levels. If emissions reduction had begun in 2005, reduction at 3.5%/year would have achieved 350 ppm at 2100. Now the requirement is at least 6%/year. Delay of emissions reductions until 2020 requires a reduction rate of 15%/year to achieve 350 ppm in 2100. If we assume only 50 GtC reforestation, and begin emissions reduction in 2013, the required reduction rate becomes about 9%/year.

Reforestation and Soil Carbon

Of course fossil fuel emissions will not suddenly terminate. Nevertheless, it is not impossible to return CO_2 to 350 ppm this century. Reforestation and increase of soil carbon can help draw down atmospheric CO_2. Fossil fuels account for ~80% of the CO_2 increase from preindustrial time, with land use/deforestation accounting for 20% [1,170,172–173]. Net deforestation to date is estimated to be 100 GtC (gigatons of carbon) with ±50% uncertainty [172].

Complete restoration of deforested areas is unrealistic, yet 100 GtC carbon drawdown is conceivable because: (1) the human-enhanced atmospheric CO_2 level increases carbon uptake by some vegetation and soils, (2) improved agricultural practices can convert agriculture from a CO_2 ource into a CO_2 sink [174], (3) biomass-burning power plants with CO_2 capture and storage can contribute to CO_2 drawdown.

Forest and soil storage of 100 GtC is challenging, but has other benefits. Reforestation has been successful in diverse places [175]. Minimum tillage with biological nutrient recycling, as opposed to plowing and chemical fertilizers, could sequester 0.4–1.2 GtC/year [176] while conserving water in soils, building agricultural resilience to climate change, and increasing productivity especially in smallholder rain-fed agriculture, thereby reducing expansion of agriculture into forested ecosystems [177–178]. Net tropical deforestation may have decreased in the past decade [179], but because of extensive deforestation in earlier decades [170,172–173,180–181] there is a large amount of land suitable for reforestation [182].

Use of bioenergy to draw down CO_2 should employ feedstocks from residues, wastes, and dedicated energy crops that do not compete with food crops, thus avoiding loss of natural ecosystems and cropland [183–185]. Reforestation competes with agricultural land use; land needs could decline by reducing use of animal products, as livestock now consume more than half of all crops [186].

Our reforestation scenarios assume that today's net deforestation rate (~1 GtC/year; see [54]) will stay constant until 2020, then linearly decrease to zero by 2030, followed by sinusoidal 100 GtC biospheric carbon storage over 2031–2080. Alternative timings do not alter conclusions about the potential to achieve a given CO_2 level such as 350 ppm.

Emission Reduction Scenarios

A 6%/year decrease of fossil fuel emissions beginning in 2013, with 100 GtC reforestation, achieves a CO_2 decline to 350 ppm near the end of this century (Fig. 5A). Cumulative fossil fuel emissions in this scenario are ~129 GtC from 2013 to 2050, with an additional 14 GtC by 2100. If our assumed land use changes occur a decade earlier, CO_2 returns to 350 ppm several years earlier; however that has negligible effect on the maximum global temperature calculated below.

Delaying fossil fuel emission cuts until 2020 (with 2%/year emissions growth in 2012–2020) causes CO_2 to remain above 350 ppm (with associated impacts on climate) until 2300 (Fig. 5B). If reductions are delayed until 2030 or 2050, CO_2 remains above 350 ppm or 400 ppm, respectively, until well after 2500.

We conclude that it is urgent that large, long-term emission reductions begin soon. Even if a 6%/year reduction rate and 500 GtC are not achieved, it makes a huge difference when reductions begin. There is no practical justification for why emissions necessarily must even approach 1000 GtC.

Climate Forcings

Atmospheric CO_2 and other GHGs have been well-measured for the past half century, allowing accurate calculation of their climate forcing. The growth rate of the GHG forcing has declined

moderately since its peak values in the 1980s, as the growth rate of CH_4 and chlorofluorocarbons has slowed [187]. Annual changes of CO_2 are highly correlated with the El Niño cycle (Fig. 6). Two strong La Niñas in the past five years have depressed CO_2 growth as well as the global warming rate (Fig. 3). The CO_2 growth rate and warming rate can be expected to increase as we move into the next El Niño, with the CO_2 growth already reaching 3 ppm/year in mid-2013 [188]. The CO_2 climate forcing does not increase as rapidly as the CO_2 amount because of partial saturation of CO_2 absorption bands [75]. The GHG forcing is now increasing at a rate of almost 0.4 W/m^2 per decade [187].

Solar irradiance variations are sometimes assumed to be the most likely natural driver of climate change. Solar irradiance has been measured from satellites since the late 1970s (Fig. 7). These data are from a composite of several satellite-measured time series. Data through 28 February 2003 are from [189] and Physikalisch Meteorologisches Observatorium Davos, World Radiation Center. Subsequent update is from University of Colorado Solar Radiation & Climate Experiment (SORCE). Data sets are concatenated by matching the means over the first 12 months of SORCE data. Monthly sunspot numbers (Fig. 7) support the conclusion that the solar irradiance in the current solar cycle is significantly lower than in the three preceding solar cycles. Amplification of the direct solar forcing is conceivable, e.g., through effects on ozone or atmospheric condensation nuclei, but empirical data place a factor of two upper limit on the amplification, with the most likely forcing in the range 100–120% of the directly measured solar irradiance change [64].

Recent reduced solar irradiance (Fig. 7) may have decreased the forcing over the past decade by about half of the full amplitude of measured irradiance variability, thus yielding a negative forcing of, say, − 0.12 W/m^2. This compares with a decadal increase of the GHG forcing that is positive and about three times larger in magnitude. Thus the solar forcing is not negligible and might partially account for the slowdown in global warming in the past decade [17]. However, we must (1) compare the solar forcing with the net of other forcings, which enhances the importance of solar change, because the net forcing is smaller than the GHG forcing, and (2) consider forcing changes on longer time scales, which greatly diminishes the importance of solar change, because solar variability is mainly oscillatory.

Human-made tropospheric aerosols, which arise largely from fossil fuel use, cause a substantial negative forcing. As noted above, two independent analyses [64,72] yield a total (direct plus indirect) aerosol forcing in the past decade of about −1.5 W/m^2, half the magnitude of the GHG forcing and opposite in sign. That empirical aerosol forcing assessment for the past decade is consistent with the climate forcings scenario (Fig. 8) that we use for the past century in the present and prior studies [64,190]. Supplementary Table S1 specifies the historical forcings and Table S2 gives several scenarios for future forcings.

Future Climate Forcings

Future global temperature change should depend mainly on atmospheric CO_2, at least if fossil fuel emissions remain high. Thus to provide the clearest picture of the CO_2 effect, we approximate the net future change of human-made non-CO_2 forcings as zero and we exclude future changes of natural climate forcings, such as solar irradiance and volcanic aerosols. Here we discuss possible effects of these approximations.

Uncertainties in non-CO_2 forcings concern principally solar, aerosol and other GHG forcings. Judging from the sunspot numbers (Fig. 7B and [191]) for the past four centuries, the current solar cycle is almost as weak as the Dalton Minimum of the late 18th century. Conceivably irradiance could decline further to the level of the Maunder Minimum of the late 17th century [192–193]. For our simulation we choose an intermediate path between recovery to the level before the current solar cycle and decline to a still lower level. Specifically, we keep solar irradiance fixed at the reduced level of 2010, which is probably not too far off in either direction. Irradiance in 2010 is about 0.1 W/m^2 less than the mean of the prior three solar cycles, a decrease of forcing that

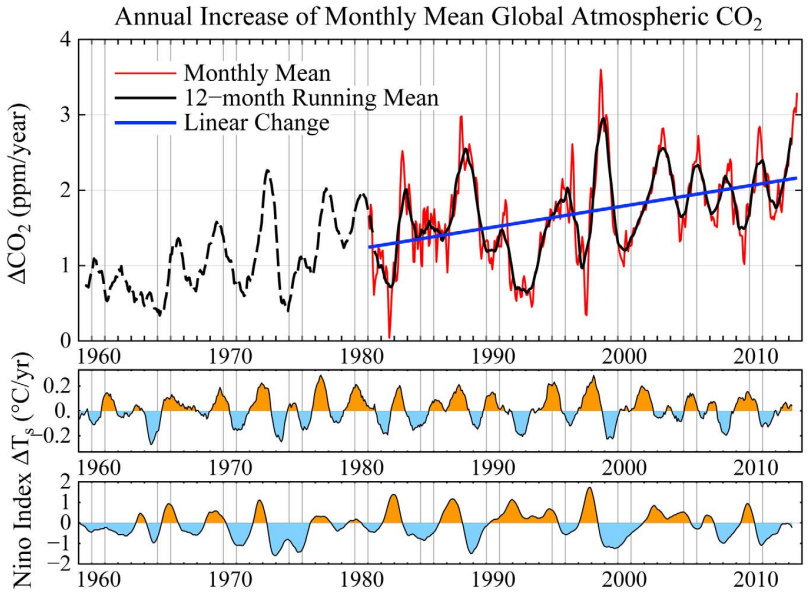

Figure 6. Annual increase of CO_2 based on data from the NOAA Earth System Research Laboratory [188]. Prior to 1981 the CO_2 change is based on only Mauna Loa, Hawaii. Temperature changes in lower diagram are 12-month running means for the globe and Niño3.4 area [16].
doi:10.1371/journal.pone.0081648.g006

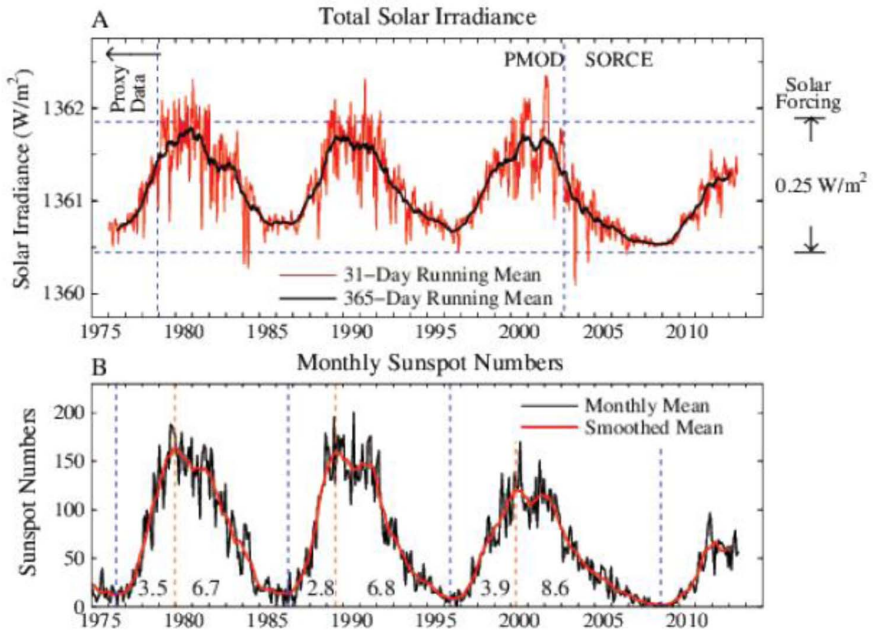

Figure 7. Solar irradiance and sunspot number in the era of satellite data (see text). Left scale is the energy passing through an area perpendicular to Sun-Earth line. Averaged over Earth's surface the absorbed solar energy is ~240 W/m^2, so the full amplitude of measured solar variability is ~0.25 W/m^2.
doi:10.1371/journal.pone.0081648.g007

would be restored by the CO_2 increase within 3–4 years at its current growth rate. Extensive simulations [17,194] confirm that the effect of solar variability is small compared with GHGs if CO_2 emissions continue at a high level. However, solar forcing can affect the magnitude and detection of near-term warming. Also, if rapidly declining GHG emissions are achieved, changes of solar forcing will become relatively more important.

Aerosols present a larger uncertainty. Expectations of decreases in large source regions such as China [195] may be counteracted by aerosol increases other places as global population continues to increase. Our assumption of unchanging human-made aerosols could be substantially off in either direction. For the sake of interpreting on-going and future climate change it is highly desirable to obtain precise monitoring of the global aerosol forcing [73].

Non-CO_2 GHG forcing has continued to increase at a slow rate since 1995 (Fig. 6 in [64]). A desire to constrain climate change may help reduce emissions of these gases in the future. However, it will be difficult to prevent or fully offset positive forcing from increasing N_2O, as its largest source is associated with food production and the world's population is continuing to rise.

On the other hand, we are also probably underestimating a negative aerosol forcing, e.g., because we have not included future volcanic aerosols. Given the absence of large volcanic eruptions in the past two decades (the last one being Mount Pinatubo in 1991), multiple volcanic eruptions would cause a cooling tendency [196] and reduce heat storage in the ocean [197].

Overall, we expect the errors due to our simple approximation of non-CO_2 forcings to be partially off-setting. Specifically, we have likely underestimated a positive forcing by non-CO_2 GHGs, while also likely underestimating a negative aerosol forcing.

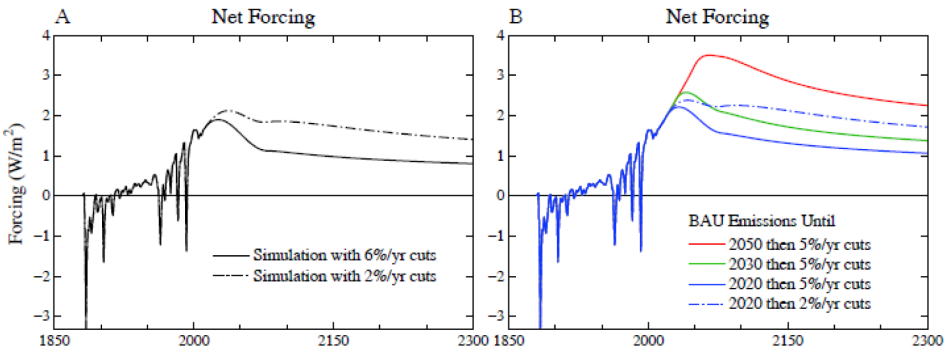

Figure 8. Climate forcings employed in our six main scenarios. Forcings through 2010 are as in [64].
doi:10.1371/journal.pone.0081648.g008

Note that uncertainty in forcings is partly obviated via the focus on Earth's energy imbalance in our analysis. The planet's energy imbalance is an integrative quantity that is especially useful for a case in which some of the forcings are uncertain or unmeasured. Earth's measured energy imbalance includes the effects of all forcings, whether they are measured or not.

Simulations of Future Global Temperature

We calculate global temperature change for a given CO_2 scenario using a climate response function (Table S3) that accurately replicates results from a global climate model with sensitivity 3°C for doubled CO_2 [64]. A best estimate of climate sensitivity close to 3°C for doubled CO_2 has been inferred from paleoclimate data [51–52]. This empirical climate sensitivity is generally consistent with that of global climate models [1], but the empirical approach makes the inferred high sensitivity more certain and the quantitative evaluation more precise. Because this climate sensitivity is derived from empirical data on how Earth responded to past changes of boundary conditions, including atmospheric composition, our conclusions about limits on fossil fuel emissions can be regarded as largely independent of climate models.

The detailed temporal and geographical response of the climate system to the rapid human-made change of climate forcings is not well-constrained by empirical data, because there is no faithful paleoclimate analog. Thus climate models necessarily play an important role in assessing practical implications of climate change. Nevertheless, it is possible to draw important conclusions with transparent computations. A simple response function (Green's function) calculation [64] yields an estimate of global mean temperature change in response to a specified time series for global climate forcing. This approach accounts for the delayed response of the climate system caused by the large thermal inertia of the ocean, yielding a global mean temporal response in close accord with that obtained from global climate models.

Tables S1 and S2 in Supporting Information give the forcings we employ and Table S3 gives the climate response function for our Green's function calculation, defined by equation 2 of [64]. The Green's function is driven by the net forcing, which, with the response function, is sufficient information for our results to be reproduced. However, we also include the individual forcings in Table S1, in case researchers wish to replace specific forcings or use them for other purposes.

Simulated global temperature (Fig. 9) is for CO_2 scenarios of Fig. 5. Peak global warming is ~1.1°C, declining to less than 1°C by mid-century, if CO_2 emissions are reduced 6%/year beginning in 2013. In contrast, warming reaches 1.5°C and stays above 1°C until after 2400 if emissions continue to increase until 2030, even though fossil fuel emissions are phased out rapidly (5%/year) after 2030 and 100 GtC reforestation occurs during 2030–2080. If emissions continue to increase until 2050, simulated warming exceeds 2°C well into the 22nd century.

Increased global temperature persists for many centuries after the climate forcing declines, because of the thermal inertia of the ocean [198]. Some temperature reduction is possible if the climate forcing is reduced rapidly, before heat has penetrated into the deeper ocean. Cooling by a few tenths of a degree in Fig. 9 is a result mainly of the 100 GtC biospheric uptake of CO_2 during 2030–2080. Note the longevity of the warming, especially if emissions reduction is as slow as 2%/year, which might be considered to be a rapid rate of reduction.

The temporal response of the real world to the human-made climate forcing could be more complex than suggested by a simple response function calculation, especially if rapid emissions growth continues, yielding an unprecedented climate forcing scenario. For example, if ice sheet mass loss becomes rapid, it is conceivable that the cold fresh water added to the ocean could cause regional surface cooling [199], perhaps even at a point when sea level rise has only reached a level of the order of a meter [200]. However, any uncertainty in the surface thermal response this century due to such phenomena has little effect on our estimate of the dangerous level of emissions. The long lifetime of the fossil fuel carbon in the climate system and the persistence of ocean warming for millennia [201] provide sufficient time for the climate system to achieve full response to the fast feedback processes included in the 3°C climate sensitivity.

Indeed, the long lifetime of fossil fuel carbon in the climate system and persistence of the ocean warming ensure that "slow" feedbacks, such as ice sheet disintegration, changes of the global vegetation distribution, melting of permafrost, and possible release of methane from methane hydrates on continental shelves, would also have time to come into play. Given the unprecedented rapidity of the human-made climate forcing, it is difficult to establish how soon slow feedbacks will become important, but clearly slow feedbacks should be considered in assessing the "dangerous" level of global warming, as discussed in the next section.

Danger of Initiating Uncontrollable Climate Change

Our calculated global warming as a function of CO_2 amount is based on equilibrium climate sensitivity 3°C for doubled CO_2. That is the central climate sensitivity estimate from climate models [1], and it is consistent with climate sensitivity inferred from Earth's climate history [51–52]. However, this climate sensitivity includes only the effects of fast feedbacks of the climate system, such as water vapor, clouds, aerosols, and sea ice. Slow feedbacks, such as change of ice sheet area and climate-driven changes of greenhouse gases, are not included.

Slow Climate Feedbacks and Irreversible Climate Change

Excluding slow feedbacks was appropriate for simulations of the past century, because we know the ice sheets were stable then and our climate simulations used observed greenhouse gas amounts that included any contribution from slow feedbacks. However, we must include slow feedbacks in projections of warming for the 21st century and beyond. Slow feedbacks are important because they affect climate sensitivity and because their instigation is related to the danger of passing "points of no return", beyond which irreversible consequences become inevitable, out of humanity's control.

Antarctic and Greenland ice sheets present the danger of change with consequences that are irreversible on time scales important to society [1]. These ice sheets required millennia to grow to their present sizes. If ice sheet disintegration reaches a point such that the dynamics and momentum of the process take over, at that point reducing greenhouse gases may be unable to prevent major ice sheet mass loss, sea level rise of many meters, and worldwide loss of coastal cities – a consequence that is irreversible for practical purposes. Interactions between the ocean and ice sheets are particularly important in determining ice sheet changes, as a warming ocean can melt the ice shelves, the tongues of ice that extend from the ice sheets into the ocean and buttress the large land-based ice sheets [92,202–203]. Paleoclimate data for sea level change indicate that sea level changed at rates of the order of a meter per century [81–83], even at times when the forcings driving climate change were far weaker than the human-

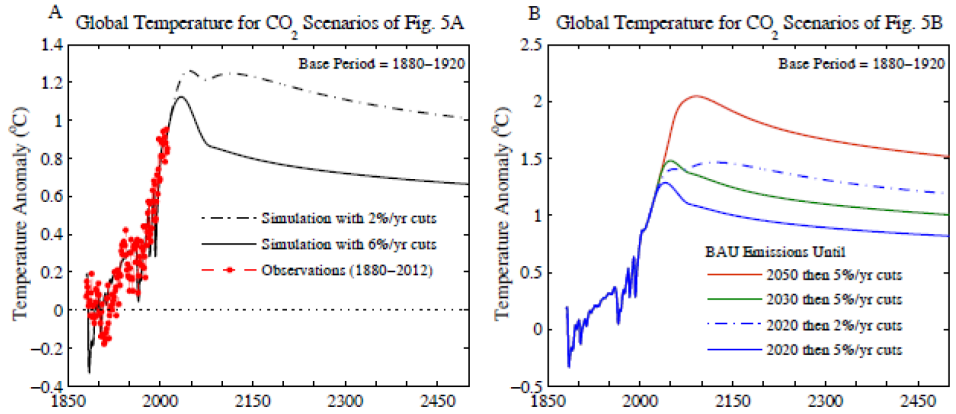

Figure 9. Simulated global temperature relative to 1880–1920 mean for CO_2 scenarios of Figure 5.
doi:10.1371/journal.pone.0081648.g009

made forcing. Thus, because ocean warming is persistent for centuries, there is a danger that large irreversible change could be initiated by excessive ocean warming.

Paleoclimate data are not as helpful for defining the likely rate of sea level rise in coming decades, because there is no known case of growth of a positive (warming) climate forcing as rapid as the anthropogenic change. The potential for unstable ice sheet disintegration is controversial, with opinion varying from likely stability of even the (marine) West Antarctic ice sheet [94] to likely rapid non-linear response extending up to multi-meter sea level rise [97–98]. Data for the modern rate of annual ice sheet mass changes indicate an accelerating rate of mass loss consistent with a mass loss doubling time of a decade or less (Fig. 10). However, we do not know the functional form of ice sheet response to a large persistent climate forcing. Longer records are needed for empirical assessment of this ostensibly nonlinear behavior.

Greenhouse gas amounts in the atmosphere, most importantly CO_2 and CH_4, change in response to climate change, i.e., as a feedback, in addition to the immediate gas changes from human-caused emissions. As the ocean warms, for example, it releases CO_2 to the atmosphere, with one principal mechanism being the simple fact that the solubility of CO_2 decreases as the water temperature rises [204]. We also include in the category of slow feedbacks the global warming spikes, or "hyperthermals", that have occurred a number of times in Earth's history during the course of slower global warming trends. The mechanisms behind these hyperthermals are poorly understood, as discussed below, but they are characterized by the injection into the surface climate system of a large amount of carbon in the form of CH_4 and/or CO_2 on the time scale of a millennium [205–207]. The average rate of injection of carbon into the climate system during these hyperthermals was slower than the present human-made injection of fossil fuel carbon, yet it was faster than the time scale for removal of carbon from the surface reservoirs via the weathering process [3,208], which is tens to hundreds of thousands of years.

Methane hydrates – methane molecules trapped in frozen water molecule cages in tundra and on continental shelves – and organic matter such as peat locked in frozen soils (permafrost) are likely mechanisms in the past hyperthermals, and they provide another climate feedback with the potential to amplify global warming if large scale thawing occurs [209–210]. Paleoclimate data reveal instances of rapid global warming, as much as 5–6°C, as a sudden additional warming spike during a longer period of gradual warming [see Text S1]. The candidates for the carbon injected into the climate system during those warmings are methane hydrates on continental shelves destabilized by sea floor warming [211] and carbon released from frozen soils [212]. As for the present, there are reports of methane release from thawing permafrost on land [213] and from sea-bed methane hydrate deposits [214], but amounts so far are small and the data are snapshots that do not prove that there is as yet a temporal increase of emissions.

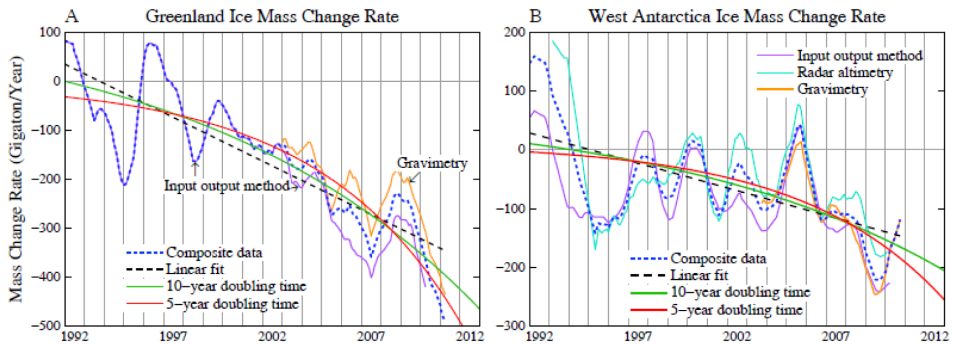

Figure 10. Annual Greenland and West Antarctic ice mass changes as estimated via alternative methods. Data were read from Figure 4 of Shepherd et al. [23] and averaged over the available records.
doi:10.1371/journal.pone.0081648.g010

There is a possibility of rapid methane hydrate or permafrost emissions in response to warming, but that risk is largely unquantified [215]. The time needed to destabilize large methane hydrate deposits in deep sediments is likely millennia [215]. Smaller but still large methane hydrate amounts below shallow waters as in the Arctic Ocean are more vulnerable; the methane may oxidize to CO_2 in the water, but it will still add to the long-term burden of CO_2 in the carbon cycle. Terrestrial permafrost emissions of CH_4 and CO_2 likely can occur on a time scale of a few decades to several centuries if global warming continues [215]. These time scales are within the lifetime of anthropogenic CO_2, and thus these feedbacks must be considered in estimating the dangerous level of global warming. Because human-made warming is more rapid than natural long-term warmings in the past, there is concern that methane hydrate or peat feedbacks could be more rapid than the feedbacks that exist in the paleoclimate record.

Climate model studies and empirical analyses of paleoclimate data can provide estimates of the amplification of climate sensitivity caused by slow feedbacks, excluding the singular mechanisms that caused the hyperthermal events. Model studies for climate change between the Holocene and the Pliocene, when Earth was about 3°C warmer, find that slow feedbacks due to changes of ice sheets and vegetation cover amplified the fast feedback climate response by 30–50% [216]. These same slow feedbacks are estimated to amplify climate sensitivity by almost a factor of two for the climate change between the Holocene and the nearly ice-free climate state that existed 35 million years ago [54].

Implication for Carbon Emissions Target

Evidence presented under Climate Impacts above makes clear that 2°C global warming would have consequences that can be described as disastrous. Multiple studies [12,198,201] show that the warming would be very long lasting. The paleoclimate record and changes underway in the Arctic and on the Greenland and Antarctic ice sheets with only today's warming imply that sea level rise of several meters could be expected. Increased climate extremes, already apparent at 0.8°C warming [46], would be more severe. Coral reefs and associated species, already stressed with current conditions [40], would be decimated by increased acidification, temperature and sea level rise. More generally, humanity and nature, the modern world as we know it, is adapted to the Holocene climate that has existed more than 10,000 years. Warming of 1°C relative to 1880–1920 keeps global temperature close to the Holocene range, but warming of 2°C, to at least the Eemian level, could cause major dislocations for civilization.

However, distinctions between pathways aimed at ~1°C and 2°C warming are much greater and more fundamental than the numbers 1°C and 2°C themselves might suggest. These fundamental distinctions make scenarios with 2°C or more global warming far more dangerous; so dangerous, we suggest, that aiming for the 2°C pathway would be foolhardy.

First, most climate simulations, including ours above and those of IPCC [1], do not include slow feedbacks such as reduction of ice sheet size with global warming or release of greenhouse gases from thawing tundra. These exclusions are reasonable for a ~1°C scenario, because global temperature barely rises out of the Holocene range and then begins to subside. In contrast, global warming of 2°C or more is likely to bring slow feedbacks into play. Indeed, it is slow feedbacks that cause long-term climate sensitivity to be high in the empirical paleoclimate record [51–52]. The lifetime of fossil fuel CO_2 in the climate system is so long that it must be assumed that these slow feedbacks will occur if temperature rises well above the Holocene range.

Second, scenarios with 2°C or more warming necessarily imply expansion of fossil fuels into sources that are harder to get at, requiring greater energy using extraction techniques that are increasingly invasive, destructive and polluting. Fossil fuel emissions through 2012 total ~370 GtC (Fig. 2). If subsequent emissions decrease 6%/year, additional emissions are ~130 GtC, for a total ~500 GtC fossil fuel emissions. This 130 GtC can be obtained mainly from the easily extracted conventional oil and gas reserves (Fig. 2), with coal use rapidly phased out and unconventional fossil fuels left in the ground. In contrast, 2°C scenarios have total emissions of the order of 1000 GtC. The required additional fossil fuels will involve exploitation of tar sands, tar shale, hydrofracking for oil and gas, coal mining, drilling in the Arctic, Amazon, deep ocean, and other remote regions, and possibly exploitation of methane hydrates. Thus 2°C scenarios result in more CO_2 per unit useable energy, release of substantial CH_4 via the mining process and gas transportation, and release of CO_2 and other gases via destruction of forest "overburden" to extract subterranean fossil fuels.

Third, with our ~1°C scenario it is more likely that the biosphere and soil will be able to sequester a substantial portion of the anthropogenic fossil fuel CO_2 carbon than in the case of 2°C or more global warming. Empirical data for the CO_2 "airborne fraction", the ratio of observed atmospheric CO_2 increase divided by fossil fuel CO_2 emissions, show that almost half of the emissions is being taken up by surface (terrestrial and ocean) carbon reservoirs [187], despite a substantial but poorly measured contribution of anthropogenic land use (deforestation and agriculture) to airborne CO_2 [179,216]. Indeed, uptake of CO_2 by surface reservoirs has at least kept pace with the rapid growth of emissions [187]. Increased uptake in the past decade may be a consequence of a reduced rate of deforestation [217] and fertilization of the biosphere by atmospheric CO_2 and nitrogen deposition [187]. With the stable climate of the ~1°C scenario it is plausible that major efforts in reforestation and improved agricultural practices [15,173,175–177], with appropriate support provided to developing countries, could take up an amount of carbon comparable to the 100 GtC in our ~1°C scenario. On the other hand, with warming of 2°C or more, carbon cycle feedbacks are expected to lead to substantial additional atmospheric CO_2 [218–219], perhaps even making the Amazon rainforest a source of CO_2 [219–220].

Fourth, a scenario that slows and then reverses global warming makes it possible to reduce other greenhouse gases by reducing their sources [75,221]. The most important of these gases is CH_4, whose reduction in turn reduces tropospheric O_3 and stratospheric H_2O. In contrast, chemistry modeling and paleoclimate records [222] show that trace gases increase with global warming, making it unlikely that overall atmospheric CH_4 will decrease even if a decrease is achieved in anthropogenic CH_4 sources. Reduction of the amount of atmospheric CH_4 and related gases is needed to counterbalance expected forcing from increasing N_2O and decreasing sulfate aerosols.

Now let us compare the 1°C (500 GtC fossil fuel emissions) and the 2°C (1000 GtC fossil fuel emissions) scenarios. Global temperature in 2100 would be close to 1°C in the 500 GtC scenario, and it is less than 1°C if 100 GtC uptake of carbon by the biosphere and soil is achieved via improved agricultural and forestry practices (Fig. 9). In contrast, the 1000 GtC scenario, although nominally designed to yield a fast-feedback climate response of ~ 2°C, would yield a larger eventual warming because of slow feedbacks, probably at least 3°C.

Danger of Uncontrollable Consequences

Inertia of the climate system reduces the near-term impact of human-made climate forcings, but that inertia is not necessarily our friend. One implication of the inertia is that climate impacts "in the pipeline" may be much greater than the impacts that we presently observe. Slow climate feedbacks add further danger of climate change running out of humanity's control. The response time of these slow feedbacks is uncertain, but there is evidence that some of these feedbacks already are underway, at least to a minor degree. Paleoclimate data show that on century and millennial time scales the slow feedbacks are predominately amplifying feedbacks.

The inertia of energy system infrastructure, i.e., the time required to replace fossil fuel energy systems, will make it exceedingly difficult to avoid a level of atmospheric CO_2 that would eventually have highly undesirable consequences. The danger of uncontrollable and irreversible consequences necessarily raises the question of whether it is feasible to extract CO_2 from the atmosphere on a large enough scale to affect climate change.

Carbon Extraction

We have shown that extraordinarily rapid emission reductions are needed to stay close to the 1°C scenario. In absence of extraordinary actions, it is likely that growing climate disruptions will lead to a surge of interest in "geo-engineering" designed to minimize human-made climate change [223]. Such efforts must remove atmospheric CO_2, if they are to address direct CO_2 effects such as ocean acidification as well as climate change. Schemes such as adding sulfuric acid aerosols to the stratosphere to reflect sunlight [224], an attempt to mask one pollutant with another, is a temporary band-aid for a problem that will last for millennia; besides it fails to address ocean acidification and may have other unintended consequences [225].

Potential for Carbon Extraction

At present there are no proven technologies capable of large-scale air capture of CO_2. It has been suggested that, with strong research and development support and industrial scale pilot projects sustained over decades, costs as low as ~$500/tC may be achievable [226]. Thermodynamic constraints [227] suggest that this cost estimate may be low. An assessment by the American Physical Society [228] argues that the lowest currently achievable cost, using existing approaches, is much greater ($600/tCO$_2$ or $2200/tC).

The cost of capturing 50 ppm of CO_2, at $500/tC (~$135/tCO$_2$), is ~$50 trillion (1 ppm CO_2 is ~2.12 GtC), but more than $200 trillion for the price estimate of the American Physical Society study. Moreover, the resulting atmospheric CO_2 reduction will ultimately be less than 50 ppm for the reasons discussed above. For example, let us consider the scenario of Fig. 5B in which emissions continue to increase until 2030 before decreasing at 5%/year – this scenario yields atmospheric CO_2 of 410 ppm in 2100. Using our carbon cycle model we calculate that if we extract 100 ppm of CO_2 from the air over the period 2030–2100 (10/7 ppm per year), say storing that CO_2 in carbonate bricks, the atmospheric CO_2 amount in 2100 will be reduced 52 ppm to 358 ppm, i.e., the reduction of airborne CO_2 is about half of the amount extracted from the air and stored. The estimated cost of this 52 ppm CO_2 reduction is $100–400 trillion.

The cost of CO_2 capture and storage conceivably may decline in the future. Yet the practicality of carrying out such a program with alacrity in response to a climate emergency is dubious. Thus it may be appropriate to add a CO_2 removal cost to the current price of fossil fuels, which would both reduce ongoing emissions and provide resources for future cleanup.

Responsibility for Carbon Extraction

We focus on fossil fuel carbon, because of its long lifetime in the carbon cycle. Reversing the effects of deforestation is also important and there will need to be incentives to achieve increased carbon storage in the biosphere and soil, but the crucial requirement now is to limit the amount of fossil fuel carbon in the air.

The high cost of carbon extraction naturally raises the question of responsibility for excess fossil fuel CO_2 in the air. China has the largest CO_2 emissions today (Fig. 11A), but the global warming effect is closely proportional to cumulative emissions [190]. The United States is responsible for about one-quarter of cumulative emissions, with China next at about 10% (Fig. 11B). Cumulative responsibilities change rather slowly (compare Fig. 10 of 190). Estimated per capita emissions (Fig. 12) are based on population estimates for 2009–2011.

Various formulae might be devised to assign costs of CO_2 air capture, should removal prove essential for maintaining acceptable climate. For the sake of estimating the potential cost, let us assume that it proves necessary to extract 100 ppm of CO_2 (yielding a reduction of airborne CO_2 of about 50 ppm) and let us assign each country the responsibility to clean up its fraction of cumulative emissions. Assuming a cost of $500/tC (~$135/tCO$_2$) yields a cost of $28 trillion for the United States, about $90,000 per individual. Costs would be slightly higher for a UK citizen, but less for other nations (Fig. 12B).

Cost of CO_2 capture might decline, but the cost estimate used is more than a factor of four smaller than estimated by the American Physical Society [228] and 50 ppm is only a moderate reduction. The cost should also include safe permanent disposal of the captured CO_2, which is a substantial mass. For the sake of scaling the task, note that one GtC, made into carbonate bricks, would produce the volume of ~3000 Empire State buildings or ~1200 Great Pyramids of Giza. Thus the 26 ppm assigned to the United States, if made into carbonate bricks, would be equivalent to the stone in 165,000 Empire State buildings or 66,000 Great Pyramids of Giza. This is not intended as a practical suggestion: carbonate bricks are not a good building material, and the transport and construction costs would be additional.

The point of this graphic detail is to make clear the magnitude of the cleanup task and potential costs, if fossil fuel emissions continue unabated. More useful and economic ways of removing CO_2 may be devised with the incentive of a sufficient carbon price. For example, a stream of pure CO_2 becomes available for capture and storage if biomass is used as the fuel for power plants or as feedstock for production of liquid hydrocarbon fuels. Such clean energy schemes and improved agricultural and forestry practices are likely to be more economic than direct air capture of CO_2, but they must be carefully designed to minimize undesirable impacts and the amount of CO_2 that can be extracted on the time scale of decades will be limited, thus emphasizing the need to limit the magnitude of the cleanup task.

Policy Implications

Human-made climate change concerns physical sciences, but leads to implications for policy and politics. Conclusions from the physical sciences, such as the rapidity with which emissions must be reduced to avoid obviously unacceptable consequences and the long lag between emissions and consequences, lead to implications in social sciences, including economics, law and ethics. Intergov-

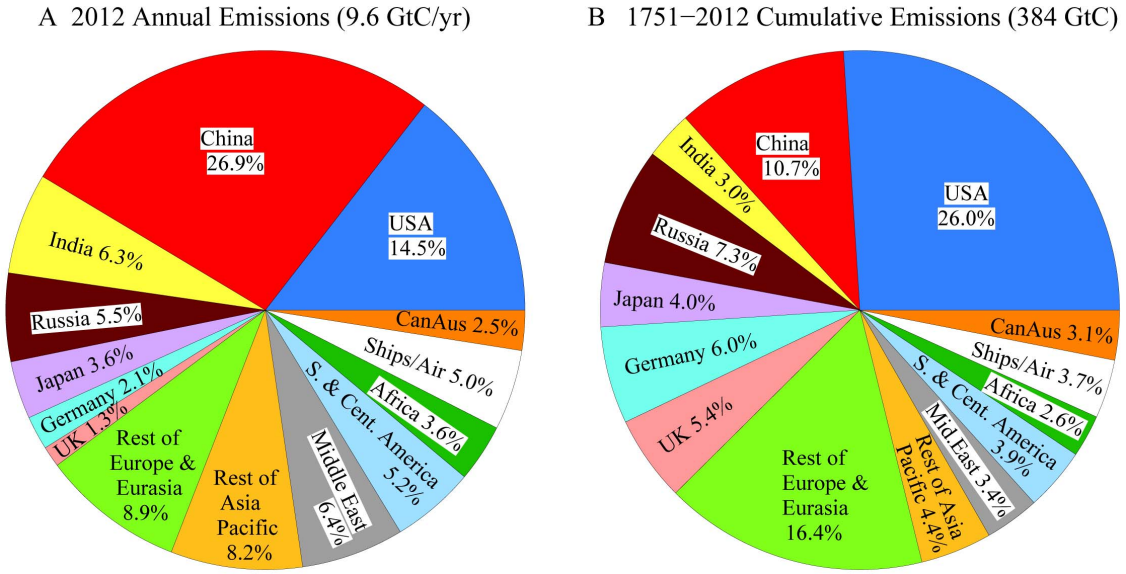

Figure 11. Fossil fuel CO_2 emissions. (A) 2012 emissions by source region, and (B) cumulative 1751–2012 emissions. Results are an update of Fig. 10 of [190] using data from [5].
doi:10.1371/journal.pone.0081648.g011

ernmental climate assessments [1,14] purposely are not policy prescriptive. Yet there is also merit in analysis and discussion of the full topic through the objective lens of science, i.e., "connecting the dots" all the way to policy implications.

Energy and Carbon Pathways: A Fork in the Road

The industrial revolution began with wood being replaced by coal as the primary energy source. Coal provided more concentrated energy, and thus was more mobile and effective. We show data for the United States (Fig. 13) because of the availability of a long data record that includes wood [229]. More limited global records yield a similar picture [Fig. 14], the largest difference being global coal now at ~30% compared with ~20% in the United States. Economic progress and wealth generation were further spurred in the twentieth century by expansion into liquid and gaseous fossil fuels, oil and gas being transported and burned more readily than coal. Only in the latter part of the twentieth century did it become clear that long-lived combustion products from fossil fuels posed a global climate threat, as formally acknowledged in the 1992 Framework Convention on Climate Change [6]. However, efforts to slow emissions of the principal atmospheric gas driving climate change, CO_2, have been ineffectual so far (Fig. 1).

Consequently, at present, as the most easily extracted oil and gas reserves are being depleted, we stand at a fork in the road to our energy and carbon future. Will we now feed our energy needs by pursuing difficult to extract fossil fuels, or will we pursue energy policies that phase out carbon emissions, moving on to the post fossil fuel era as rapidly as practical?

This is not the first fork encountered. Most nations agreed to the Framework Convention on Climate Change in 1992 [6]. Imagine if a bloc of countries favoring action had agreed on a common gradually rising carbon fee collected within each of country at domestic mines and ports of entry. Such nations might place equivalent border duties on products from nations not having a carbon fee and they could rebate fees to their domestic industry for export products to nations without an equivalent carbon fee. The legality of such a border tax adjustment under international trade law is untested, but is considered to be plausibly consistent with trade principles [230]. As the carbon fee gradually rose and as additional nations, for their own benefit, joined this bloc of nations, development of carbon-free energies and energy efficiency would have been spurred. If the carbon fee had begun in 1995, we

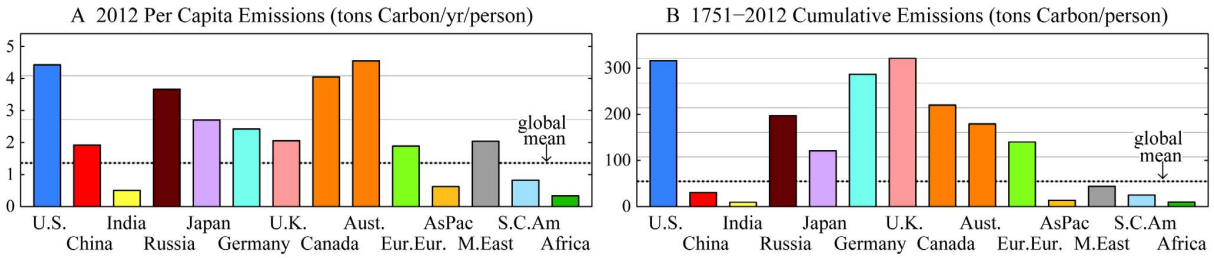

Figure 12. Per capita fossil fuel CO_2 emissions. Countries, regions and data sources are the same as in Fig. 11. Horizontal lines are the global mean and multiples of the global mean.
doi:10.1371/journal.pone.0081648.g012

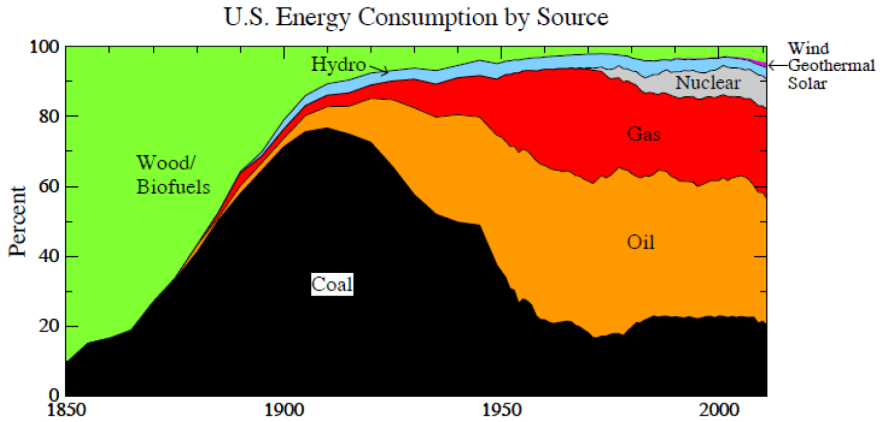

Figure 13. United States energy consumption [229].
doi:10.1371/journal.pone.0081648.g013

calculate that global emissions would have needed to decline 2.1%/year to limit cumulative fossil fuel emissions to 500 GtC. A start date of 2005 would have required a reduction of 3.5%/year for the same result.

The task faced today is more difficult. Emissions reduction of 6%/year and 100 GtC storage in the biosphere and soils are needed to get CO_2 back to 350 ppm, the approximate requirement for restoring the planet's energy balance and stabilizing climate this century. Such a pathway is exceedingly difficult to achieve, given the current widespread absence of policies to drive rapid movement to carbon-free energies and the lifetime of energy infrastructure in place.

Yet we suggest that a pathway is still conceivable that could restore planetary energy balance on the century time scale. That path requires policies that spur technology development and provide economic incentives for consumers and businesses such that social tipping points are reached where consumers move rapidly to energy conservation and low carbon energies. Moderate overshoot of required atmospheric CO_2 levels can possibly be counteracted via incentives for actions that more-or-less naturally sequester carbon. Developed countries, responsible for most of the excess CO_2 in the air, might finance extensive efforts in developing countries to sequester carbon in the soil and in forest regrowth on marginal lands as described above. Burning sustainably designed biofuels in power plants, with the CO_2 captured and sequestered, would also help draw down atmospheric CO_2. This pathway would need to be taken soon, as the magnitude of such carbon extractions is likely limited and thus not a solution to unfettered fossil fuel use.

The alternative pathway, which the world seems to be on now, is continued extraction of all fossil fuels, including development of unconventional fossil fuels such as tar sands, tar shale, hydro-fracking to extract oil and gas, and exploitation of methane hydrates. If that path (with 2%/year growth) continues for 20 years and is then followed by 3%/year emission reduction from 2033 to 2150, we find that fossil fuel emissions in 2150 would total 1022 GtC. Extraction of the excess CO_2 from the air in this case would be very expensive and perhaps implausible, and warming of the ocean and resulting climate impacts would be practically irreversible.

Economic Implications: Need for a Carbon Fee

The implication is that the world must move rapidly to carbon-free energies and energy efficiency, leaving most remaining fossil fuels in the ground, if climate is to be kept close to the Holocene range and climate disasters averted. Is rapid change possible?

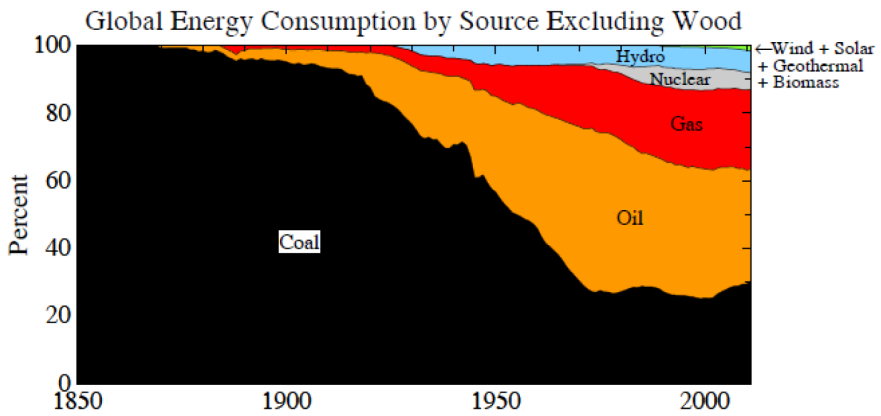

Figure 14. World energy consumption for indicated fuels, which excludes wood [4].
doi:10.1371/journal.pone.0081648.g014

The potential for rapid change can be shown by examples. A basic requirement for phasing down fossil fuel emissions is abundant carbon-free electricity, which is the most rapidly growing form of energy and also has the potential to provide energy for transportation and heating of buildings. In one decade (1977–1987), France increased its nuclear power production 15-fold, with the nuclear portion of its electricity increasing from 8% to 70% [231]. In one decade (2001–2011) Germany increased the non-hydroelectric renewable energy portion of its electricity from 4% to 19%, with fossil fuels decreasing from 63% to 61% (hydroelectric decreased from 4% to 3% and nuclear power decreased from 29% to 18%) [231].

Given the huge task of replacing fossil fuels, contributions are surely required from energy efficiency, renewable energies, and nuclear power, with the mix depending on local preferences. Renewable energy and nuclear power have been limited in part by technical challenges. Nuclear power faces persistent concerns about safety, nuclear waste, and potential weapons proliferation, despite past contributions to mortality prevention and climate change mitigation [232]. Most renewable energies tap diffuse intermittent sources often at a distance from the user population, thus requiring large-scale energy storage and transport. Developing technologies can ameliorate these issues, as discussed below. However, apparent cost is the constraint that prevents nuclear and renewable energies from fully supplanting fossil fuel electricity generation.

Transition to a post-fossil fuel world of clean energies will not occur as long as fossil fuels appear to the investor and consumer to be the cheapest energy. Fossil fuels are cheap only because they do not pay their costs to society and receive large direct and indirect subsidies [233]. Air and water pollution from fossil fuel extraction and use have high costs in human health, food production, and natural ecosystems, killing more than 1,000,000 people per year and affecting the health of billions of people [232,234], with costs borne by the public. Costs of climate change and ocean acidification, already substantial and expected to grow considerably [26,235], also are borne by the public, especially by young people and future generations.

Thus the essential underlying policy, albeit not sufficient, is for emissions of CO_2 to come with a price that allows these costs to be internalized within the economics of energy use. Because so much energy is used through expensive capital stock, the price should rise in a predictable way to enable people and businesses to efficiently adjust lifestyles and investments to minimize costs. Reasons for preference of a carbon fee or tax over cap-and-trade include the former's simplicity and relative ease of becoming global [236]. A near-global carbon tax might be achieved, e.g., via a bi-lateral agreement between China and the United States, the greatest emitters, with a border duty imposed on products from nations without a carbon tax, which would provide a strong incentive for other nations to impose an equivalent carbon tax. The suggestion of a carbon fee collected from fossil fuel companies with all revenues distributed to the public on a per capita basis [237] has received at least limited support [238].

Economic analyses indicate that a carbon price fully incorporating environmental and climate damage would be high [239]. The cost of climate change is uncertain to a factor of 10 or more and could be as high as ~$1000/tCO$_2$ [235,240]. While the imposition of such a high price on carbon emissions is outside the realm of short-term political feasibility, a price of that magnitude is not required to engender a large change in emissions trajectory.

An economic analysis indicates that a tax beginning at $15/tCO$_2$ and rising $10/tCO$_2$ each year would reduce emissions in the U.S. by 30% within 10 years [241]. Such a reduction is more than 10 times as great as the carbon content of tar sands oil carried by the proposed Keystone XL pipeline (830,000 barrels/day) [242]. Reduced oil demand would be nearly six times the pipeline capacity [241], thus the carbon fee is far more effective than the proposed pipeline.

A rising carbon fee is the *sine qua non* for fossil fuel phase out, but not enough by itself. Investment is needed in RD&D (research, development and demonstration) to help renewable energies and nuclear power overcome obstacles limiting their contributions. Intermittency of solar and wind power can be alleviated with advances in energy storage, low-loss smart electric grids, and electrical vehicles interacting with the grid. Most of today's nuclear power plants have half-century-old technology with light-water reactors [243] utilizing less than 1% of the energy in the nuclear fuel and leaving unused fuel as long-lived nuclear "waste" requiring sequestration for millennia. Modern light-water reactors can employ convective cooling to eliminate the need for external cooling in the event of an anomaly such as an earthquake. However, the long-term future of nuclear power will employ "fast" reactors, which utilize ~99% of the nuclear fuel and can "burn" nuclear waste and excess weapons material [243]. It should be possible to reduce the cost of nuclear power via modular standard reactor design, but governments need to provide a regulatory environment that supports timely construction of approved designs. RD&D on carbon capture and storage (CCS) technology is needed, especially given our conclusion that the current atmospheric CO_2 level is already in the dangerous zone, but continuing issues with CCS technology [7,244] make it inappropriate to construct fossil fuel power plants with a promise of future retrofit for carbon capture. Governments should support energy planning for housing and transportation, energy and carbon efficiency requirements for buildings, vehicles and other manufactured products, and climate mitigation and adaptation in undeveloped countries.

Economic efficiency would be improved by a rising carbon fee. Energy efficiency and alternative low-carbon and no-carbon energies should be allowed to compete on an equal footing, without subsidies, and the public and business community should be made aware that the fee will continually rise. The fee for unconventional fossil fuels, such as oil from tar sands and gas from hydrofracking, should include carbon released in mining and refining processes, e.g., methane leakage in hydrofracking [245–249]. If the carbon fee rises continually and predictably, the resulting energy transformations should generate many jobs, a welcome benefit for nations still suffering from long-standing economic recession. Economic modeling shows that about 60% of the public, especially low-income people, would receive more money via a per capita 100% dispersal of the collected fee than they would pay because of increased prices [241].

Fairness: Intergenerational Justice and Human Rights

Relevant fundamentals of climate science are clear. The physical climate system has great inertia, which is due especially to the thermal inertia of the ocean, the time required for ice sheets to respond to global warming, and the longevity of fossil fuel CO_2 in the surface carbon reservoirs (atmosphere, ocean, and biosphere). This inertia implies that there is additional climate change "in the pipeline" even without further change of atmospheric composition. Climate system inertia also means that, if large-scale climate change is allowed to occur, it will be exceedingly long-lived, lasting for many centuries.

One implication is the likelihood of intergenerational effects, with young people and future generations inheriting a situation in which grave consequences are assured, practically out of their

control, but not of their doing. The possibility of such intergenerational injustice is not remote – it is at our doorstep now. We have a planetary climate crisis that requires urgent change to our energy and carbon pathway to avoid dangerous consequences for young people and other life on Earth.

Yet governments and industry are rushing into expanded use of fossil fuels, including unconventional fossil fuels such as tar sands, tar shale, shale gas extracted by hydrofracking, and methane hydrates. How can this course be unfolding despite knowledge of climate consequences and evidence that a rising carbon price would be economically efficient and reduce demand for fossil fuels? A case has been made that the absence of effective governmental leadership is related to the effect of special interests on policy, as well as to public relations efforts by organizations that profit from the public's addiction to fossil fuels [237,250].

The judicial branch of governments may be less subject to pressures from special financial interests than the executive and legislative branches, and the courts are expected to protect the rights of all people, including the less powerful. The concept that the atmosphere is a public trust [251], that today's adults must deliver to their children and future generations an atmosphere as beneficial as the one they received, is the basis for a lawsuit [252] in which it is argued that the U.S. government is obligated to protect the atmosphere from harmful greenhouse gases.

Independent of this specific lawsuit, we suggest that intergenerational justice in this matter derives from fundamental rights of equality and justice. The Universal Declaration of Human Rights [253] declares "All are equal before the law and are entitled without any discrimination to equal protection of the law." Further, to consider a specific example, the United States Constitution provides all citizens "equal protection of the laws" and states that no person can be deprived of "life, liberty or property without due process of law". These fundamental rights are a basis for young people to expect fairness and justice in a matter as essential as the condition of the planet they will inhabit. We do not prescribe the legal arguments by which these rights can be achieved, but we maintain that failure of governments to effectively address climate change infringes on fundamental rights of young people.

Ultimately, however, human-made climate change is more a matter of morality than a legal issue. Broad public support is probably needed to achieve the changes needed to phase out fossil fuel emissions. As with the issue of slavery and civil rights, public recognition of the moral dimensions of human-made climate change may be needed to stir the public's conscience to the point of action.

A scenario is conceivable in which growing evidence of climate change and recognition of implications for young people lead to massive public support for action. Influential industry leaders, aware of the moral issue, may join the campaign to phase out emissions, with more business leaders becoming supportive as they recognize the merits of a rising price on carbon. Given the relative ease with which a flat carbon price can be made international [236], a rapid global emissions phasedown is feasible. As fossil fuels are made to pay their costs to society, energy efficiency and clean energies may reach tipping points and begin to be rapidly adopted.

Our analysis shows that a set of actions exists with a good chance of averting "dangerous" climate change, if the actions begin now. However, we also show that time is running out. Unless a human "tipping point" is reached soon, with implementation of effective policy actions, large irreversible climate changes will become unavoidable. Our parent's generation did not know that their energy use would harm future generations and other life on the planet. If we do not change our course, we can only pretend that we did not know.

Discussion

We conclude that an appropriate target is to keep global temperature within or close to the temperature range in the Holocene, the interglacial period in which civilization developed. With warming of 0.8°C in the past century, Earth is just emerging from that range, implying that we need to restore the planet's energy balance and curb further warming. A limit of approximately 500 GtC on cumulative fossil fuel emissions, accompanied by a net storage of 100 GtC in the biosphere and soil, could keep global temperature close to the Holocene range, assuming that the net future forcing change from other factors is small. The longevity of global warming (Fig. 9) and the implausibility of removing the warming if it is once allowed to penetrate the deep ocean emphasize the urgency of slowing emissions so as to stay close to the 500 GtC target.

Fossil fuel emissions of 1000 GtC, sometimes associated with a 2°C global warming target, would be expected to cause large climate change with disastrous consequences. The eventual warming from 1000 GtC fossil fuel emissions likely would reach well over 2°C, for several reasons. With such emissions and temperature tendency, other trace greenhouse gases including methane and nitrous oxide would be expected to increase, adding to the effect of CO_2. The global warming and shifting climate zones would make it less likely that a substantial increase in forest and soil carbon could be achieved. Paleoclimate data indicate that slow feedbacks would substantially amplify the 2°C global warming. It is clear that pushing global climate far outside the Holocene range is inherently dangerous and foolhardy.

The fifth IPCC assessment Summary for Policymakers [14] concludes that to achieve a 50% chance of keeping global warming below 2°C equivalent CO_2 emissions should not exceed 1210 GtC, and after accounting for non-CO_2 climate forcings this limit on CO_2 emissions becomes 840 GtC. The existing drafts of the fifth IPCC assessment are not yet approved for comparison and citation, but the IPCC assessment is consistent with studies of Meinshausen et al. [254] and Allen et al. [13], hereafter M2009 and A2009, with which we can make comparisons. We will also compare our conclusions with those of McKibben [255]. M2009 and A2009 appear together in the same journal with the two lead authors on each paper being co-authors on the other paper. McKibben [255], published in a popular magazine, uses quantitative results of M2009 to conclude that most remaining fossil fuel reserves must be left in the ground, if global warming this century is to be kept below 2°C. McKibben [255] has been very successful in drawing public attention to the urgency of rapidly phasing down fossil fuel emissions.

M2009 use a simplified carbon cycle and climate model to make a large ensemble of simulations in which principal uncertainties in the carbon cycle, radiative forcings, and climate response are allowed to vary, thus yielding a probability distribution for global warming as a function of time throughout the 21st century. M2009 use this distribution to infer a limit on total (fossil fuel+net land use) carbon emissions in the period 2000–2049 if global warming in the 21st century is to be kept below 2°C at some specified probability. For example, they conclude that the limit on total 2000–2049 carbon emissions is 1440 $GtCO_2$ (393 GtC) to achieve a 50% chance that 21st century global warming will not exceed 2°C.

A2009 also use a large ensemble of model runs, varying uncertain parameters, and conclude that total (fossil fuel+net land use) carbon emissions of 1000 GtC would most likely yield a peak

CO_2-induced warming of 2°C, with 90% confidence that the peak warming would be in the range 1.3–3.9°C. They note that their results are consistent with those of M2009, as the A2009 scenarios that yield 2°C warming have 400–500 GtC emissions during 2000–2049; M2009 find 393 GtC emissions for 2°C warming, but M2009 included a net warming effect of non-CO_2 forcings, while A2009 neglected non-CO_2 forcings.

McKibben [255] uses results of M2009 to infer allowable fossil fuel emissions up to 2050 if there is to be an 80% chance that maximum warming in the 21st century will not exceed 2°C above the pre-industrial level. M2009 conclude that staying under this 2°C limit with 80% probability requires that 2000–2049 emissions must be limited to 656 $GtCO_2$ (179 GtC) for 2007–2049. McKibben [255] used this M2009 result to determine a remaining carbon budget (at a time not specified exactly) of 565 $GtCO_2$ (154 GtC) if warming is to stay under 2°C. Let us update this analysis to the present: fossil fuel emissions in 2007–2012 were 51 GtC [5], so, assuming no net emissions from land use in these few years, the M2009 study implies that the remaining budget at the beginning of 2013 was 128 GtC.

Thus, coincidentally, the McKibben [255] approach via M2009 yields almost exactly the same remaining carbon budget (128 GtC) as our analysis (130 GtC). However, our budget is that required to limit warming to about 1°C (there is a temporary maximum during this century at about 1.1–1.2°C, Fig. 9), while McKibben [255] is allowing global warming to reach 2°C, which we have concluded would be a disaster scenario! This apparently vast difference arises from three major factors.

First, we assumed that reforestation and improved agricultural and forestry practices can suck up the net land use carbon of the past. We estimate net land use emissions as 100 GtC, while M2009 have land use emissions almost twice that large (~180 GtC). We argue elsewhere (see section 14 in Supporting Information of [54]) that the commonly employed net land use estimates [256] are about a factor of two larger than the net land use carbon that is most consistent with observed CO_2 history. However, we need not resolve that long-standing controversy here. The point is that, to make the M2009 study equivalent to ours, negative land use emissions must be included in the 21st century equal to earlier positive land use emissions.

Second, we have assumed that future net change of non-CO_2 forcings will be zero, while M2009 have included significant non-CO_2 forcings. In recent years non-CO_2 GHGs have provided about 20% of the increase of total GHG climate forcing.

Third, our calculations are for a single fast-feedback equilibrium climate sensitivity, 3°C for doubled CO_2, which we infer from paleoclimate data. M2009 use a range of climate sensitivities to compute a probability distribution function for expected warming, and then McKibben [255] selects the carbon emission limit that keeps 80% of the probability distribution below 2°C.

The third factor is a matter of methodology, but one to be borne in mind. Regarding the first two factors, it may be argued that our scenario is optimistic. That is true, but both goals, extracting 100 GtC from the atmosphere via improved forestry and agricultural practices (with possibly some assistance from CCS technology) and limiting additional net change of non-CO_2 forcings to zero, are feasible and probably much easier than the principal task of limiting additional fossil fuel emissions to 130 GtC.

We noted above that reforestation and improving agricultural and forestry practices that store more carbon in the soil make sense for other reasons. Also that task is made easier by the excess CO_2 in the air today, which causes vegetation to take up CO_2 more efficiently. Indeed, this may be the reason that net land use emissions seem to be less than is often assumed.

As for the non-CO_2 forcings, it is noteworthy that greenhouse gases controlled by the Montreal Protocol are now decreasing, and recent agreement has been achieved to use the Montreal Protocol to phase out production of some additional greenhouse gases even though those gases do not affect the ozone layer. The most important non-CO_2 forcing is methane, whose increases in turn cause tropospheric ozone and stratospheric water vapor to increase. Fossil fuel use is probably the largest source of methane [1], so if fossil fuel use begins to be phased down, there is good basis to anticipate that all three of these greenhouse gases could decrease, because of the approximate 10-year lifetime of methane.

As for fossil fuel CO_2 emissions, considering the large, long-lived fossil fuel infrastructure in place, the science is telling us that policy should be set to reduce emissions as rapidly as possible. The most fundamental implication is the need for an across-the-board rising fee on fossil fuel emissions in order to allow true free market competition from non-fossil energy sources. We note that biospheric storage should not be allowed to offset further fossil fuel emissions. Most fossil fuel carbon will remain in the climate system more than 100,000 years, so it is essential to limit the emission of fossil fuel carbon. It will be necessary to have incentives to restore biospheric carbon, but these must be accompanied by decreased fossil fuel emissions.

A crucial point to note is that the three tasks [limiting fossil fuel CO_2 emissions, limiting (and reversing) land use emissions, limiting (and reversing) growth of non-CO_2 forcings] are interactive and reinforcing. In mathematical terms, the problem is non-linear. As one of these climate forcings increases, it increases the others. The good news is that, as one of them decreases, it tends to decrease the others. In order to bestow upon future generations a planet like the one we received, we need to win on all three counts, and by far the most important is rapid phasedown of fossil fuel emissions.

It is distressing that, despite the clarity and imminence of the danger of continued high fossil fuel emissions, governments continue to allow and even encourage pursuit of ever more fossil fuels. Recognition of this reality and perceptions of what is "politically feasible" may partially account for acceptance of targets for global warming and carbon emissions that are well into the range of "dangerous human-made interference" with climate. Although there is merit in simply chronicling what is happening, there is still opportunity for humanity to exercise free will. Thus our objective is to define what the science indicates is needed, not to assess political feasibility. Further, it is not obvious to us that there are physical or economic limitations that prohibit fossil fuel emission targets far lower than 1000 GtC, even targets closer to 500 GtC. Indeed, we suggest that rapid transition off fossil fuels would have numerous near-term and long-term social benefits, including improved human health and outstanding potential for job creation.

A world summit on climate change will be held at United Nations Headquarters in September 2014 as a preliminary to negotiation of a new climate treaty in Paris in late 2015. If this treaty is analogous to the 1997 Kyoto Protocol [257], based on national targets for emission reductions and cap-and-trade-with-offsets emissions trading mechanisms, climate deterioration and gross intergenerational injustice will be practically guaranteed. The palpable danger that such an approach is conceivable is suggested by examination of proposed climate policies of even the most forward-looking of nations. Norway, which along with the other Scandinavian countries has been among the most ambitious and successful of all nations in reducing its emissions, nevertheless approves expanded oil drilling in the Arctic and development of tar sands as a majority owner of Statoil [258–259]. Emissions

foreseen by the Energy Perspectives of Statoil [259], if they occur, would approach or exceed 1000 GtC and cause dramatic climate change that would run out of control of future generations. If, in contrast, leading nations agree in 2015 to have internal rising fees on carbon with border duties on products from nations without a carbon fee, a foundation would be established for phaseover to carbon free energies and stable climate.

Supporting Information

Table S1
(ODS)

Table S2
(ODS)

Table S3
(ODS)

Text S1
(DOC)

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Author Contributions

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Atmospheric Chemistry and Physics Discussions

Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2 °C global warming is highly dangerous

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Abstract

There is evidence of ice melt, sea level rise to +5–9 m, and extreme storms in the prior interglacial period that was less than 1 °C warmer than today. Human-made climate forcing is stronger and more rapid than paleo forcings, but much can be learned by combining insights from paleoclimate, climate modeling, and on-going observations. We argue that ice sheets in contact with the ocean are vulnerable to non-linear disintegration in response to ocean warming, and we posit that ice sheet mass loss can be approximated by a doubling time up to sea level rise of at least several meters. Doubling times of 10, 20 or 40 years yield sea level rise of several meters in 50, 100 or 200 years. Paleoclimate data reveal that subsurface ocean warming causes ice shelf melt and ice sheet discharge. Our climate model exposes amplifying feedbacks in the Southern Ocean that slow Antarctic bottom water formation and increase ocean temperature near ice shelf grounding lines, while cooling the surface ocean and increasing sea ice cover and water column stability. Ocean surface cooling, in the North Atlantic as well as the Southern Ocean, increases tropospheric horizontal temperature gradients, eddy kinetic energy and baroclinicity, which drive more powerful storms. We focus attention on the Southern Ocean's role in affecting atmospheric CO_2 amount, which in turn is a tight control knob on global climate. The millennial (500–2000 year) time scale of deep ocean ventilation affects the time scale for natural CO_2 change, thus the time scale for paleo global climate, ice sheet and sea level changes. This millennial carbon cycle time scale should not be misinterpreted as the ice sheet time scale for response to a rapid human-made climate forcing. Recent ice sheet melt rates have a doubling time near the lower end of the 10–40 year range. We conclude that 2 °C global warming above the preindustrial level, which would spur more ice shelf melt, is highly dangerous. Earth's energy imbalance, which must be eliminated to stabilize climate, provides a crucial metric.

1 Introduction

Humanity is rapidly extracting and burning fossil fuels without full understanding of the consequences. Current assessments place emphasis on practical effects such as increasing extremes of heat waves, droughts, heavy rainfall, floods, and encroaching seas (IPCC, 2014; USNCA, 2014). These assessments and our recent study (Hansen et al., 2013a) conclude that there is an urgency to slow carbon dioxide (CO_2) emissions, because the longevity of the carbon in the climate system (Archer, 2005) and persistence of the induced warming (Solomon et al., 2010) may lock in unavoidable highly undesirable consequences.

Despite these warnings, global CO_2 emissions continue to increase as fossil fuels remain the primary energy source. The argument is made that it is economically and morally responsible to continue fossil fuel use for the sake of raising living standards, with expectation that humanity can adapt to climate change and find ways to minimize effects via advanced technologies.

We suggest that this viewpoint fails to appreciate the nature of the threat posed by ice sheet instability and sea level rise. If the ocean continues to accumulate heat and increase melting of marine-terminating ice shelves of Antarctica and Greenland, a point will be reached at which it is impossible to avoid large scale ice sheet disintegration with sea level rise of at least several meters. The economic and social cost of losing functionality of all coastal cities is practically incalculable. We suggest that a strategic approach relying on adaptation to such consequences is unacceptable to most of humanity, so it is important to understand this threat as soon as possible.

We examine events late in the last interglacial period warmer than today, called Marine Isotope Stage (MIS) 5e in studies of ocean sediment cores, Eemian in European climate studies, and sometimes Sangamonian in American literature (see Sect. 5 for timescale diagram of Marine Isotope Stages). Accurately known changes of Earth's astronomical configuration altered the seasonal and geographical distribution of incoming radiation during the Eemian. Resulting global warming was due to feedbacks that am-

plified the orbital forcing. While the Eemian is not an analog of future warming, it is useful for investigating climate feedbacks, the response of polar ice sheets to polar warming, and the interplay between ocean circulation and ice sheet melt.

Our study relies on a large body of research by the scientific community. After introducing evidence concerning late Eemian climate change, we analyze relevant climate processes in three stages. First we carry our IPCC-like climate simulations, but with growing freshwater sources in the North Atlantic and Southern Oceans. Second we use paleoclimate data to extract information on key processes identified by the modeling. Third we use modern data to show that these processes are already spurring climate change today.

2 Evidence concerning Eemian climate

We first discuss geologic evidence of late-Eemian sea level rise and storms. We then discuss ocean core data that help define a rapid cooling event in the North Atlantic that marks the initial descent from interglacial conditions toward global ice age conditions. This rapid end-Eemian cooling occurs at ∼ 118 ky b2k in ocean cores with uncertainty ∼ 2 ky, and is identified by Chapman and Shackleton (1999) as cold event C26.

C26 is the cold phase of Dansgaard–Oeschger climate oscillation D–O 26 in the NGRIP (North Greenland Ice Core Project) ice core (NGRIP, 2004). C26 begins with a sharp cooling at 119.14 ky b2k on the GICC05modelext time scale (Rasmussen et al., 2014). The GICC05 time scale is based on annual layer counting in Greenland ice cores for the last 60 ky and on an ice flow-model extension for earlier times. An alternative time scale is provided by Antarctic ice core chronology AICC2012 (Bazin et al., 2013; Veres et al., 2013) on which Greenland ice core records have been synchronized via global markers such as oscillations of atmospheric CH_4 amount. C26 on Greenland is at 116.72 ky b2k on the AICC2012 time scale. Figure S1 in the Supplement shows the difference between GICC05 and AICC2012 times scales versus time.

This age uncertainty for C26 is consistent with the ice core 2σ error estimate of 3.2 ky at Eemian time (Bazin et al., 2013). Despite this absolute age uncertainty, we can use Greenland data synchronized to the AICC2012 time scale to determine the relative timing of Greenland and Antarctic climate changes (Sect. 5) to an accuracy of a few decades (Bazin et al., 2013).

2.1 Eemian sea level

Eemian sea level is of special interest because Eemian climate was at most ∼ 2 °C warmer than pre-industrial climate, thus at most ∼ 1 °C warmer than today. Indeed, based on multiple data and model sources Masson-Delmotte et al. (2013) suggest that peak Eemian temperature was only a few tenths of a degree warmer than today. The Eemian period thus provides an indication of sea level change that can be expected if global temperature reaches and maintains a level moderately higher than today. Eemian sea level reached heights several meters above today's level (Chen et al., 1991; Neumann and Hearty, 1996; Hearty et al., 2007; Kopp et al., 2009; Dutton and Lambeck, 2012; O'Leary et al., 2013). Although climate forcings were weak and changed slowly during the Eemian, there were probably instances in the Eemian with sea level change of the order of 1 m century^{-1} (Rohling et al., 2008; W. Thompson et al., 2011; Blanchon et al., 2009).

Hearty et al. (2007) used shoreline stratigraphy, field information, and geochronological data from 15 sites around the world to construct a composite curve of Eemian sea level change. Their reconstruction has sea level rising in the early Eemian to +2–3 m ("+" indicates above today's sea level). Mid-Eemian sea level may have fallen a few meters to a level near today's sea level. Sea level rose rapidly in the late Eemian when it cut multiple bioerosional notches in older limestone in the Bahamas and elsewhere at +6–9 m. These brief upward shifts of sea level were interpreted as evidence of rapid ice melt events.

This sea level behavior may be surprising at first glance, and it is easy to question specific details because of the difficulties in sea level reconstructions, including the

effect of regional glacio-isostatic adjustment (GIA) of Earth's crust as ice sheets grow and decay. Indeed, rapid late-Eemian sea level rise is unexpected, because seasonal insolation anomalies favored growth of Northern Hemisphere ice at that time. However, the basic conclusion that arises from global studies is a sea level elevation difference of 3–5 m between late and early Eemian. We will show in the remainder of this paper that there is now substantial supporting evidence for these sea level change features and a rational interpretation.

Assessed chronology of sea level change depends on ages estimated for fossil corals. The analytic uncertainty of uranium radioactive decay (U-series) ages is about 1 ky (Edwards et al., 2003; Scholz and Mangini, 2007), but often undetectable diagenetic effects can increase the error (Bard et al., 1992; Thompson and Goldstein, 2005). The growth position of corals is a good, though not comprehensive, indicator of sea level, because sea level had to be higher than the reef at the time of coral growth. However, some corals grow at a range of depths, which adds uncertainty. Furthermore, if sea level rises too fast, corals tend to "give up" or founder, only recording minimum sea level (Neumann and MacIntyre, 1985), and if sea level falls corals are exposed, die, and thus stop recording sea level. Mobile carbonate sediments that mantle limestone platforms such as Bermuda and the Bahamas record rapid sea level change effectively, because the sediments respond and cement quickly, thus preserving sea level change evidence.

Hearty and Kindler (1993), White et al. (1998) and Wilson et al. (1998) describe evidence in fossil Bahamian reefs of a mid-Eemian regressive-transgressive cycle (sea level fall and rise). They estimated a sea level fall from +4 m to approximately today's level, and then a rise to at least +6 m. U-series dating defined the period of fall and rise as a maximum of 1500 years covering ~ 125 to 124 ky b2k, and the high stand lasting until ~ 119 ky b2k. Such rapid sea level change requires ice sheet growth and melt, regional lithospheric adjustment, or both.

Blanchon et al. (2009) used a sequence of coral reef crests from northeast Yucatan peninsula, Mexico, to investigate sea level change with a higher temporal precision

than possible with U-series dating alone. They used coral reef "back-stepping", i.e., the fact that the location of coral reef building moves shoreward as sea level rises, to infer sea level change. They found that in the latter half of the Eemian there was a point at which sea level jumped by 2–3 m within an "ecological" period, i.e., within several decades. From U-series dating they estimated that this period of rapid sea level rise occurred at about 121 ky b2k. W. Thompson et al. (2011) reexamined Eemian coral reef data from the Bahamas with a method that corrected uranium-thorium ages for diagenic disturbances. They confirmed a mid-Eemian sea level minimum, putting sea level at +4 m at 123 ky b2k, at +6 m at 119 ky b2k, and at 0 m at some time in between, again noting that coral reefs only record minimum sea level.

Despite general consistency among these studies, considerable uncertainty remains about details of Eemian sea level change. Sources of uncertainty include post-depositional effects of GIA and local tectonics. Global models of GIA of Earth's crust to loading and unloading of ice sheets are used increasingly to improve assessments of past sea level change. Although GIA models contain uncertain parameters, they provide a useful indication of possible displacement of geological sea level indicators. O'Leary et al. (2013) provide a new perspective on Eemian sea level change using over 100 well-dated U-series coral reefs at 28 sites along the 1400 km west coast of Australia and incorporating GIA corrections on regional sea level. In agreement with Hearty et al. (2007), their analyses suggest that sea level was relatively stable at 3–4 m in most of the Eemian, followed by a rapid (< 1000 yr) late-Eemian sea level rise to about +9 m. U-series dating of the corals has the sea level rise begin at 119 ky b2k and peak sea level at 118.1 ± 1.4 ky b2k. This dating of peak sea level is consistent with the estimate of Hearty and Neumann (2001) of ~ 118 ky b2k as the time of rapid climate changes and extreme storminess.

End-Eemian sea level rise would seem to be a paradox, because orbital forcing then favored growth of Northern Hemisphere ice sheets. We will find evidence, however, that the sea level rise and increased storminess are consistent, and likely related to events in the Southern Ocean.

2.2 Evidence of end-Eemian storms in Bahamas and Bermuda

Late-Eemian sea level rise was followed by rapid sea level fall at the end of MIS 5e (Neumann and Hearty, 1996; Stirling et al., 1998; McCulloch and Esat, 2000; Lambeck and Chappell, 2001; Lea et al., 2002). Geologic data suggest that this sea level oscillation was accompanied by increased temperature gradients and storminess in the North Atlantic region. Here we summarize evidence for end-Eemian storminess, based mainly on geological studies of Neumann and Hearty (1996), Hearty (1997), Hearty et al. (1998), Hearty and Neumann (2001) and Hearty et al. (2007) in Bermuda and the Bahamas. In following sections we examine data from ocean sediment cores relevant to climate events in this period and then make global climate simulations, which help us suggest causal connections among end-Eemian events.

The Bahama Banks are low-lying carbonate platforms that are exposed during glacials and largely flooded during interglacial high stands. From a tectonic perspective, the platforms are relatively stable, but may have experienced minor GIA effects. When flooded during MIS 5e sea level rise, enormous volumes of aragonitic oolitic grains were generated across the shallow high energy banks, shoals, ridges, and dunes, where storm deposits indurated rapidly upon subaerial exposure, preserving rock evidence of brief, high-energy events. The preserved stratigraphic, sedimentary and geomorphic features attest to the energy of the late-Eemian Atlantic Ocean and point to a turbulent end-Eemian transition.

In the Bahama Islands, extensive oolitic sand ridges with a distinctive landward-pointing V-shape are common, each standing in relief across several kilometers of low area (Hearty et al., 1998). Termed “chevron ridges” from their characteristic V-shape, these beach ridges are found on broad, low lying platforms or ramps throughout the Atlantic-facing, deep-water margins of the Bahamas. Hearty et al. (1998) examined 35 areas with chevron ridges across the Bahamas, which all point in a southwest direction (S65° W) with no apparent relation to the variable configuration of the coastline.

The lightly indurated ooid sand ridges are several kilometers long and appear to have originated from the action of long-period waves from a northeasterly Atlantic source. The chevron ridges contain bands of beach fenestrae, formed by air bubbles trapped in fine ooid sand inundated by water and quickly indurated. The internal sedimentary structures including the beach fenestrae and scour structures (Tormey, 2015) show that the chevrons were rapidly emplaced by water rather than wind (Hearty et al., 1998). These landforms were deposited near the end of a sea level high stand, when sea level was just beginning to fall, otherwise they would have been reworked subsequently by stable or rising seas. Some chevrons contain multiple smaller ridges “nested” in a seaward direction (Hearty et al., 1998), providing further evidence that sea level was falling fast enough to strand and preserve older chevrons as distinct landforms.

Fine-grained carbonate ooids cement rapidly, sometimes within decades to a century, if left immobile (Taft et al., 1968; Curran et al., 2008). Additional evidence of the rapid emplacement of the sand ridges is inferred from burial of large trees and fronds in living positions (Neumann and Hearty, 1996; Hearty and Olson, 2011). Fenestrae are abundant primarily in the youngest 5e beds throughout the eastern margin of the Bahamas.

Older ridges adjacent to the chevron ridges have wave runup deposits that reach heights nearly 40 m above present sea level, far above the reach of a quiescent 5e sea surface. Such elevated beach fenestrae are considered to result from runup of very large waves (Wanless and Dravis, 1989). These stratigraphically youngest deposits on the shore-parallel ridges are 1-5 m thick fenestrae-filled seaward-sloping tabular beds of stage 5e age that mantle older MIS 5e dune deposits (Neumann and Moore, 1975; Chen at al., 1991; Neumann and Hearty, 1996; Tormey, 2015). Runup beds reach more than a kilometer from the present coast, mantling the eastern flanks of stage 5e ridges (Hearty et al., 1998). Bain and Kindler (1994) suggested the fenestrae could be rain-generated, but the fenestrae at high elevations are widespread and exclusive to the late 5e deposits. They are not commonly found in older dune ridges (Hearty et al., 1998).

Enormous boulders tossed onto an older Pleistocene landscape (Hearty, 1997; Hearty et al., 1998; Hearty and Neumann, 2001) provide a metric of powerful waves at the end of stage 5e. Giant displaced boulders (Fig. 1) were deposited in north Eleuthera, Bahamas near chevron ridges and runup deposits (Hearty, 1997). The boulders are composed of recrystallized oolitic-peloidal limestone of MIS 9 or 11 age (300–400 ky; Kindler and Hearty, 1996; Hearty, 1998). The boulders rest on oolitic sediments and fossils typical of MIS 5e, and thus were deposited after most of the interglacial had passed. The maximum age of boulder emplacement is ~115–120 ky based on their stratigraphy and association with regressive stage 5e marine, eolian and fossil land snail (*Cerion*) deposits (Hearty, 1997; Hearty et al., 1998). Hearty (1997) reasoned that the boulders were emplaced during the latest substage 5e highstand, while sea level remained high, because even larger waves would have been required at times of lower sea level during MIS sub-stages 5c and 5a in order to lift the boulders over the cliffs.

The boulders must have been transported to their present position by waves, as two of the largest ones (Fig. 1) are located on the crest of the island's ridge, eliminating the possibility that they were moved downward by gravity (Hearty, 1998) or are the karstic remnants of some ancient landscape. A tsunami conceivably deposited the boulders, but the area is not near a tectonic plate boundary. The coincidence of a tsunami at the end-Eemian moment is improbable given the absence of evidence of tsunamis at other times in the Bahamas and the lack of evidence of tsunamis on the Atlantic Coastal Plain of the United States. The proximity of run-up deposits and nested chevron ridges across a broad front of Bahamian islands is clear evidence of a sustained series of high-energy wave events.

The remarkable size of the boulders in north Eleuthera becomes more comprehensible upon realization that numerous boulders larger than 10 m^3 have been thrown up on Eleuthera Island by storms during the Holocene (Hearty, 1997). The mass and volume of the Holocene boulders (the largest ~90 m^3, Table 4 of Hearty, 1997) are about 10× smaller than the MIS 5e boulders (Table 2 of Hearty, 1997). Hearty (1998) notes that the

large 5e and Holocene boulders are all located at the apex of a narrowing horseshoe-shaped submerged embayment (Fig. 2 of Hearty, 1997). Long period ocean waves are funneled into this embayment, generating huge surge and splash even today as they impact the cliffs near the Glass Window Bridge.

Movement of these sediments, including chevrons, run-up deposits and boulders, required a potent sustained energy source. Anticipating our interpretation in terms of powerful storms driven by an unusually warm tropical ocean and strong zonal temperature gradients in the North Atlantic, we must ask whether there should not be evidence of comparable end-Eemian storms in Bermuda. Indeed, there are seaward sloping planar beds rising to about +20 m along several kilometers of the north coast of Bermuda (Land et al., 1967; Vacher and Rowe, 1997; Hearty et al., 1998). These beds, from the latest stage 5e, are filled with beach fenestrae in platy grains and thick air-filled laminations, in marked contrast to older stage 5 sedimentary structures that underlie them (Hearty et al., 1998). Meter-scale, subtidal cross beds comprise the seaward facies of the elevated beach beds, reflecting an interval of exceptional wave energy on the normally tranquil, shallow and broad north shore platform of Bermuda.

Given the geologic evidence of high seas and storminess from Bermuda and the Bahamas, Hearty and Neumann (2001) suggested "Steeper pressure, temperature, and moisture gradients adjacent to warm tropical waters could presumably spawn larger and more frequent cyclonic storms in the North Atlantic than those seen today." We now seek further evidence related to the question of whether powerful end-Eemian storms in the North Atlantic may have dispersed long-period, well-organized waves to the southwest.

2.3 End-Eemian evidence from North Atlantic sediment cores

Sediment cores from multiple locations provide information not only on ocean temperature and circulation changes (Fig. 2), but also changes on ice sheet destabilization inferred from ice rafted debris. Comparison of data from different sites is affected by inaccuracy in absolute dating and use of different age models. Dating of sediments is

usually based on tuning to the time scale of Earth orbital variations (Martinson et al., 1987) or "wiggle-matching" to another record (Sirocko et al., 2005), which limits accuracy to several ky. Temporal resolution is limited by bioturbation of sediments; thus resolution varies with core location and climate (Keigwin and Jones, 1994). For example, high deposition rates during ice ages at the Bermuda Rise yield a resolution of a few decades, but low sedimentation rates during the Eemian yield a resolution of a few centuries (Lehman et al., 2002). Lateral transport of sedimentary material prior to deposition complicates data interpretation and can introduce uncertainty, as argued specifically regarding data from the Bermuda Rise (Ohkouchi et al., 2002; Engelbrecht and Sachs, 2005).

Adkins et al. (1997) analyzed sediment core (MD95-2036, 34° N, 58° W) from the Bermuda Rise using an age model based on Martinson et al. (1987) orbital tuning with the MIS stage 5/6 transition set at 131 ky b2k and the stage 5d/5e transition at 114 ky b2k. They found that oxygen isotope δ^{18}O of planktonic (near-surface dwelling) foraminifera and benthic (deep ocean) foraminifera both attain full interglacial values at ∼ 128 ky b2k and remain nearly constant for ∼ 10 ky (their Fig. 2). Adkins et al. (1997) infer that: "Late within isotope stage 5e (∼ 118 ky b2k), there is a rapid shift in oceanic conditions in the western North Atlantic. . . " They find in the sediments at that point an abrupt increase of clays indicative of enhanced land-based glacier melt and an increase of high nutrient "southern source waters". The latter change implies a shutdown or diminution of NADW formation that allows Antarctic Bottom Water (AABW) to push into the deep North Atlantic Ocean (Duplessy et al., 1988; Govin et al., 2009). Adkins et al. (1997) continue: "The rapid deep and surface hydrographic changes found in this core mark the end of the peak interglacial and the beginning of climate deterioration towards the semi-glacial stage 5d. Before and immediately after this event, signaling the impeding end of stage 5e, deep-water chemistry is similar to modern NADW." This last sentence refers to a temporary rebound to near interglacial conditions. In Sect. 5 we use accurately synchronized Greenland and Antarctic ice cores, which also reveal

this temporary end-Eemian climate rebound, to interpret the glacial inception and its relation to ice melt and late-Eemian sea level rise.

Ice rafted debris (IRD) found in ocean cores provides a useful climate diagnostic tool (Heinrich, 1988; Hemming, 2004). Massive ice rafting ("Heinrich") events are often associated with decreased NADW production and shutdown or slowdown of the Atlantic Meridional Overturning Circulation (AMOC) (Broecker, 2002; Barrieiro et al., 2008; Srokosz et al., 2012). However, ice rafting occurs on a continuum of scales, and significant IRD is found in the cold phase of all the 24 Dansgaard–Oeschger (D–O) climate oscillations first identified in Greenland ice cores (Dansgaard et al., 1993). D–O events exhibit rapid warming on Greenland of at least several degrees within a few decades or less, followed by cooling over a longer period. Chapman and Shackleton (1999) found IRD events in the NEAP18K core for all D–O events (C19–C24) within the core interval that they studied, and they also labeled two additional events (C25 and C26). C26 did not produce identifiable IRD at the NEAP18K site, but it was added to the series because of its strong surface cooling.

Lehman et al. (2002) quantify the C26 cooling event using the same Bermuda Rise core (MD95-2036) and age model as Adkins et al. (1997). Based on the alkenone paleo-temperature technique (Sachs and Lehman, 1999), Lehman et al. (2002) find a sharp sea surface temperature (SST) decrease of ∼ 3 °C (their Fig. 1) at ∼ 118 ky BP, coinciding with the end-Eemian shoulder of the benthic δ^{18}O plateau that defines stage 5e in the deep ocean. The SST partially recovered after several centuries, but C26 marked the start of a long slide into the depths of stage 5d cold, as ice sheets grew and sea level fell ∼ 50 m in 10 ky (Lambeck and Chappell, 2001; Rohling et al., 2009). Lehman et al. (2002) wiggle-match the MD95-2036 and NEAP18K cores, finding a simple adjustment to the age model of Chapman and Shackleton (1999) that maximizes correlation of the benthic δ^{18}O records with the Adkins et al. (1997) δ^{18}O record. Specifically, they adjust the NEAP time scale by +4 ky before the MIS 5b δ^{18}O minimum and by +2 ky after it, which places C26 cooling at 118 ky b2k in both records.

They give preference to the Adkins et al. (1997) age scale because it employs a ^{230}Th-based time scale between 100 and 130 ky b2k.

We do not assert that the end-Eemian C-26 cooling was necessarily at 118 ky b2k, but we suggest that the strong rapid cooling observed in several sediment cores in this region of the subtropical and midlatitude North Atlantic Drift at about this time were all probably the same event. Such a large cooling lasting for centuries would not likely be confined to a small region. The dating models in several other studies place the date of the end-Eemian shoulder of the deep ocean δ^{18}O and an accompanying surface cooling event in the range 116–118 ky b2k.

Kandiano et al. (2004) and Bauch and Kandiano (2007) analyze core M23414 (53° N, 17° W), west of Ireland, finding a major SST end-Eemian cooling that they identify as C26 and place at 117 ky b2k. The 1 ky change in the timing of this event compared with Lehman et al. (2002), is due to a minor change in the age model, specifically, Bauch and Kandiano say: "The original age model of MD95-2036 (Lehman et al., 2002) has been adjusted to our core M23414 by alignment of the 4 per mil level in the benthic δ^{18}O records (at 130 ka in M23414) and the prominent C24 event in both cores." Bauch and Erlenkeuser (2008) and H. Bauch et al. (2012) examine ocean cores along the North Atlantic Current including its continuation into the Nordic seas. They find that in the Greenland-Iceland-Norwegian (GIN) Sea, unlike middle latitudes, the Eemian was warmest near the end of the interglacial period. The age model employed by Bauch and Erlenkeuser (2008) has the Eemian about 2 ky younger than the Adkins et al. (1997) age model, Bauch and Erlenkeuser (2008) having the benthic δ^{18}O plateau at ~ 116–124 ky BP (their Fig. 6). Rapid cooling they illustrate there at ~ 116.6 ky BP for core M23071 on the Voring Plateau (67° N, 3° E) likely corresponds to the C26 end-Eemian cooling event.

Identification of end-Eemian cooling in ocean cores is hampered by the fact that Eemian North Atlantic climate was more variable than in the Holocene (Fronval and Jansen, 1996). There were at least three cooling events within the Eemian, each with minor increases in IRD, which are labeled C27, C27a and C27b by Oppo et al. (2006);

see their Fig. 2 for core site ODP-980 in the eastern North Atlantic (55° N, 15° W) near Ireland. High (sub-centennial) resolution cores in the Eirik drift region (MD03-2664, 57° N,49° W) near the southern tip of Greenland reveal an event with rapid cooling accompanied by reduction in NADW production (Irvali et al., 2012; Galaasen et al., 2014), which they place at ~ 117 ky b2k. However, their age scale has the benthic δ^{18}O shoulder at ~ 115 ky b2k (Fig. S1 in the Supplement, Galaasen et al., 2014), so that event may have been C27b with C26 being stronger cooling that occurred thereafter.

2.4 Eemian timing consistency with insolation anomalies

Glacial-interglacial climate cycles are affected by insolation change, as shown persuasively by Hays et al. (1976) and discussed in Sect. 5.1. Each "termination" (Broecker, 1984) of glacial conditions in the past several hundred thousand years coincided with a large positive warm-season insolation anomaly at the latitude of North American and Eurasian ice sheets (Raymo, 1997; Paillard, 2001). The explanation is that positive summer insolation anomalies (negative in winter) favor increased summer melting and reduced winter snowfall, thus shrinking ice sheets.

Termination timing is predicted better by high Northern Hemisphere late spring (April–May–June) insolation than by summer anomalies. For example, Raymo (1997) places Terminations I and II (preceding the Holocene and Eemian) midpoints at 13.5 and 128–131 ky b2k. Late spring insolation maxima are at 13.2 and 129.5 ky b2k (Fig. 4a). The AICC2012 ice core chronology (Bazin et al., 2013) places Termination II at 128.5 ky b2k, with 2σ uncertainty 3.2 ky. Late spring irradiance maximizes warm-season ice melt by producing the earliest feasible warm-season ice sheet darkening via snow melt and snow recrystallization (Hansen et al., 2007b).

Late Eemian sea level rise is seemingly a paradox, because glacial-interglacial sea level change is mainly a result of the growth and decay of Northern Hemisphere ice sheets. Northern warm-season insolation anomalies were negative and declining in the latter part of the Eemian (Fig. 3a), so Northern Hemisphere ice sheets should have been growing. We suggest that the explanation for a mid-Eemian sea level minimum is

a substantial late-Eemian collapse of the Antarctic ice sheet facilitated by the positive warm-season insolation anomaly on Antarctica and the Southern Ocean during the late Eemian (Fig. 3b).

Persuasive presentation of this interpretation requires analysis of relevant climate mechanisms with a global model as well as a detailed discussion of paleoclimate data. We will show that these analyses in turn help to explain ongoing climate change today, with implications for continuing climate change this century.

3 Simulations of 1850–2300 climate change

We make simulations for 1850–2300 with radiative forcings that were used for IPCC (2007, 2013) studies. This allows comparison with simulations made for prior studies.

3.1 Climate model

Simulations are made with an improved version of a coarse-resolution model that allows long runs at low cost, GISS (Goddard Institute for Space Studies) model E-R. The atmosphere model is the documented modelE (Schmidt et al., 2006). The ocean is based on the Russell et al. (1995) model that conserves water and salt mass, has a free surface with divergent flow, uses a linear upstream scheme for advection, allows flow through 12 sub-resolution straits, has background diffusivity $0.3\,\mathrm{cm^2\,s^{-1}}$, $4^\circ \times 5^\circ$ resolution and 13 layers that increase in thickness with depth.

However, the ocean model includes simple but significant changes, compared with the version documented in simulations by Miller et al. (2014). First, an error in the calculation of neutral surfaces in the Gent–McWilliams (GM, Gent and McWilliams, 1990) mesoscale eddy parameterization was corrected; the resulting increased slope of neutral surfaces provides proper leverage to the restratification process and correctly orients eddy stirring along those surfaces.

Second, the calculation of eddy diffusivity K_{meso} for GM following Visbeck et al. (1997) was simplified to use a length scale independent of the density structure (J. Marshall, personal communication, 2014):

$$K_{\mathrm{meso}} = C/[T_{\mathrm{eady}} \times f(\mathrm{latitude})] \quad (1)$$

where $C = (27.9\,\mathrm{km})^2$, Eady growth rate $1/T_{\mathrm{eady}} = \{|S \times N|\}$, S is the neutral surface slope, N the Brunt–Vaisala frequency, $\{\,\}$ signifies averaging over the upper D meters of ocean depth, $D = \min(\max(\mathrm{depth}, 400\,\mathrm{m}), 1000\,\mathrm{m})$, and $f(\mathrm{latitude}) = \max(0.1, \sin(|\,\mathrm{latitude}\,|))$ to qualitatively mimic the larger values of the Rossby radius of deformation at low latitudes. These choices for K_{meso}, whose simplicity is congruent with the use of a depth-independent eddy diffusivity and the use of $1/T_{\mathrm{eady}}$ as a metric of eddy energy, result in the zonal average diffusivity shown in Fig. 4.

Third, the so-called nonlocal terms in the KPP mixing parameterization (Large et al., 1994) were activated. All of these modifications tend to increase the ocean stratification, and in particular the Southern Ocean state is improved by the GM modifications. However, as is apparent in Fig. 4, drift in the Southern Ocean state leads to a modest reduction of the eddy diffusivities over the first 500 years of spin-up. Overall realism of the ocean circulation is improved, but significant model deficiencies remain, as we will describe.

The simulated Atlantic Meridional Overturning Circulation (AMOC) has maximum flux that varies within the range ~ 14–18 Sv in the model control run (Figs. 5 and 6). AMOC strength in recent observations is 17.5 ± 1.6 Sv (Baringer et al., 2013; Srokosz et al., 2012), based on eight years (2004–2011) data for an in situ mooring array (Rayner et al., 2011; Johns et al., 2011).

Ocean model control run initial conditions are climatology for temperature and salinity (Levitus and Boyer, 1994; Levitus et al., 1994); atmospheric composition is that of 1880 (Hansen et al., 2011). Overall model drift from control run initial conditions is moderate (see Fig. S2 for planetary energy imbalance and global temperature), but there is drift in the North Atlantic circulation. The AMOC circulation cell initially is confined to the

upper 3 km at all latitudes (1st century in Figs. 5 and 6), but by the 5th century the cell reaches deeper at high latitudes.

Atmospheric and surface climate in the present model is similar to the documented modelE-R, but because of changes to the ocean model we provide several diagnostics in the Supplement. A notable flaw in the simulated surface climate is the unrealistic double precipitation maximum in the tropical Pacific (Fig. S3). This double ITCZ (intertropical convergence zone) occurs in many models and is related to the difficulty of producing realistic stratus clouds in the Eastern Tropical Pacific. Another flaw is unrealistic hemispheric sea ice, with too much sea ice in the Northern Hemisphere and too little in the Southern Hemisphere (Figs. S4 and S5). Excessive Northern Hemisphere sea ice might be caused by deficient poleward heat transport in the Atlantic Ocean (Fig. S6). However, the AMOC has realistic strength and Atlantic meridional heat transport is only slightly below observations at high latitudes (Fig. S6). Thus we suspect that the problem may lie in sea ice parameterizations or deficient dynamical transport of ice out of the Arctic. The deficient Southern Hemisphere sea ice, at least in part, is likely related to excessive poleward (southward) transport of heat by the simulated global ocean (Fig. S6), which is related to deficient northward transport of heat in the modeled Atlantic Ocean (Fig. S6).

A key characteristic of the model and the real world is the response time: how fast does the surface temperature adjust to a climate forcing, i.e., an imposed perturbation of the planet's energy balance? ModelE-R response is about 40 % in five years (Fig. 7) and 60 % in 100 years, with the remainder requiring many centuries. Hansen et al. (2011) concluded that most ocean models, including modelE-R, mix a surface temperature perturbation downward too efficiently and thus have a slower surface response than the real world. The basis for this conclusion was empirical analysis using climate response functions, with 50, 75 and 90 % response at year 100 for climate simulations (Hansen et al., 2011). Earth's measured energy imbalance in recent years and global temperature change in the past century revealed that the response function with

75 % response in 100 years provided a much better fit with observations than the other choices.

Durack et al. (2012) compared observations of how rapidly surface salinity changes are mixed into the deeper ocean with the large number of global models in the CMIP3 (Climate Model Intercomparison Project), reaching a similar conclusion, that the models mix too rapidly.

Our present ocean model has a faster response on 10–75 year time scales than the old model (Fig. 7), but the change is small. Although the climate response time in our model is comparable to that in many other ocean models (Hansen et al., 2011), we believe that it is likely slower than the response in the real world on time scales of a few decades and longer. A too slow surface response could result from excessive small scale mixing. We will suggest, after the studies below, that excessive mixing has other consequences, e.g., causing the effect of freshwater stratification on slowing AABW formation and growth of Antarctic sea ice cover to occur 1–2 decades later than in the real world. Similarly, excessive mixing may make the AMOC in the model less sensitive to freshwater forcing than the real world AMOC.

3.2 Experiment definition: exponentially increasing fresh water

Freshwater injection is specified as 360 Gt yr^{-1} (1 mm sea level) in 2003–2015, then growing with 5, 10 or 20 year doubling time (Fig. 8). Injection ends when input to global sea level reaches 1 or 5 m. The sharp cut-off aids separation of immediate forcing effects and feedbacks.

We do not argue for this specific input function, but we suggest that rapid meltwater increase is likely if GHGs continue to grow rapidly. Greenland and Antarctica have outlet glaciers occupying canyons with bedrock below sea level well back into the ice sheet (Fretwell et al., 2013; Morlighem et al., 2014; Pollard et al., 2015). Feedbacks, including ice sheet darkening due to surface melt (Hansen et al., 2007b; Robinson et al., 2012; Tedesco et al., 2013; Box et al., 2012) and lowering and thus warming of the near-coastal ice sheet surface, make increasing ice melt likely. Paleoclimate

data reveal instances of sea level rise of several meters in a century (Fairbanks, 1989; Deschamps et al., 2012). Those cases involved ice sheets at lower latitudes, but 21st century climate forcing is larger and increasing much more rapidly.

Radiative forcings are those of Hansen et al. (2007c), based on data through 2003 and IPCC scenario A1B for later GHGs. A1B is an intermediate IPCC scenario over the century, but on the high side early this century (Fig. 2, Hansen et al., 2007c). We add freshwater to the North Atlantic (ocean area within 52–72° N and 15° E–65° N) or Southern Ocean (ocean south of 60° S), or equally divided between the two oceans. Ice sheet discharge (icebergs plus meltwater) is mixed as fresh water with mean temperature −15 °C into top three ocean layers (Fig. S7).

3.3 Simulated surface temperature and energy balance

We present surface temperature and planetary energy balance first, thus providing a global overview. Then we examine changes in ocean circulation and compare results with prior studies.

Temperature change in 2065, 2080 and 2096 for 10 year doubling time (Fig. 9) should be thought of as results when sea level rise reaches 0.6, 1.7 and 5 m, because the dates depend on initial freshwater flux. Actual current freshwater flux may be about a factor of four higher than assumed in these initial runs, as we will discuss, and thus effects may occur ∼ 20 years earlier. A sea level rise of 5 m in a century is about the most extreme in the paleo record (Fairbanks, 1989; Deschamps et al., 2012), but the assumed 21st century climate forcing is also more rapidly growing than any known natural forcing.

Meltwater injected on the North Atlantic has larger initial impact, but Southern Hemisphere ice melt has a greater global effect for larger melt as the effectiveness of more meltwater in the North Atlantic begins to decline. The global effect is large long before sea level rise of 5 m is reached. Meltwater reduces global warming about half by the time sea level rise reaches 1.7 m. Cooling due to ice melt more than eliminates A1B warming in large areas of the globe.

The large cooling effect of ice melt does not decrease much as the ice melting rate varies between doubling times of 5, 10 or 20 years (Fig. 10a). In other words, the cumulative ice sheet melt, rather than the rate of ice melt, largely determines the climate impact for the range of melt rates covered by 5, 10 and 20 year doubling times. Thus if ice sheet loss occurs even to an extent of 1.7 m sea level rise (Fig. 10b), a large impact on climate and climate change is predicted.

Greater global cooling occurs for freshwater injected on the Southern Ocean, but the cooling lasts much longer for North Atlantic injection (Fig. 10a). That persistent cooling, mainly at Northern Hemisphere middle and high latitudes (Fig. S8), is a consequence of the sensitivity, hysteresis effects, and long recovery time of the AMOC (Stocker and Wright, 1991; Rahmstorf, 1995 and earlier studies referenced therein). AMOC changes are described below.

When freshwater injection on the Southern Ocean is halted, global temperature jumps back within two decades to the value it would have had without any freshwater addition (Fig. 10a). Quick recovery is consistent with the Southern Ocean-centric picture of the global overturning circulation (Fig. 4, Talley, 2013), as the Southern Meridional Overturning Circulation (SMOC), driven by AABW formation, responds to change of the vertical stability of the ocean column near Antarctica (see Sect. 4) and the ocean mixed layer and sea ice have limited thermal inertia.

Global cooling due to ice melt causes a large increase in Earth's energy imbalance (Fig. 10b), adding about +2 W m^{-2}, which is larger than the imbalance caused by increasing GHGs. Thus, although the cold fresh water from ice sheet disintegration provides a negative feedback on regional and global surface temperature, it increases the planet's energy imbalance, thus providing more energy for ice melt (Hansen, 2005). This added energy is pumped into the ocean.

Increased downward energy flux at the top of the atmosphere is not located in the regions cooled by ice melt. On the contrary, those regions suffer a large reduction of net incoming energy (Fig. 11a). The regional energy reduction is a consequence of increased cloud cover (Fig. 11b) in response to the colder ocean surface. However,

the colder ocean surface reduces upward radiative, sensible and latent heat fluxes, thus causing a large ($\sim 50\,W\,m^{-2}$) increase of energy into the North Atlantic and a substantial but smaller flux into the Southern Ocean (Fig. 11c).

Below we conclude that the principal mechanism by which this ocean heat increases ice melt is via its effect on ice shelves. Discussion requires examination of how the freshwater injections alter the ocean circulation and internal ocean temperature.

3.4 Simulated AMOC

Broecker's articulation of likely effects of freshwater outbursts in the North Atlantic on ocean circulation and global climate (Broecker, 1990; Broecker et al., 1990) spurred quantitative studies with idealized ocean models (Stocker and Wright, 1991) and global atmosphere-ocean models (Manabe and Stouffer, 1995; Rahmstorf 1995, 1996). Scores of modeling studies have since been carried out, many reviewed by Barreiro et al. (2008), and observing systems are being developed to monitor modern changes in the AMOC (Carton and Hakkinen, 2011).

Our climate simulations in this section are 5 member ensembles of runs initiated at 25 year intervals at years 901–1001 of the control run. We chose this part of the control run because the planet is then in energy balance (Fig. S2), although by that time model drift had altered the slow deep ocean circulation. Some model drift away from initial climatological conditions is inevitable, as all models are imperfect, and we carry out the experiments with cognizance of model limitations. However, there is strong incentive to seek basic improvements in representation of physical processes to reduce drift in future versions of the model.

GHGs alone (scenario A1B) slow AMOC by the early 21st century (Fig. 12), but variability among individual runs (Fig. S9) would make definitive detection difficult at present. Freshwater injected onto the North Atlantic or in both hemispheres shuts down the AMOC (Fig. 12, right side). GHG amounts are fixed after 2100 and ice melt is zero, but after two centuries of stable climate forcing the AMOC has not recovered to its

earlier state. This slow recovery was found in the earliest simulations by Manabe and Stouffer (1994) and Rahmstorf (1995, 1996).

Freshwater injection already has a large impact when ice melt is a fraction of 1 m of sea level. By the time sea level rise reaches 59 cm (2065 in the present scenarios), when fresh water flux is 0.48 Sv, the impact on AMOC is already large, consistent with the substantial surface cooling in the North Atlantic (Fig. 9).

3.5 Comparison with prior simulations

AMOC sensitivity to GHG forcing has been examined extensively based on IPCC studies. Schmittner et al. (2005) found that AMOC weakened 25 ± 25 % by the end of the 21st century in 28 simulations of 9 different models forced by the A1B emission scenario. Gregory et al. (2005) found 10–50 % AMOC weakening in 11 models for CO_2 quadrupling (1 % yr^{-1} increase for 140 years), with largest decreases in models with strong AMOCs. Weaver et al. (2007) found a 15–31 % AMOC weakening for CO_2 quadrupling in a single model for 17 climate states differing in initial GHG amount. AMOC in our model weakens 30 % between 1990–2000 and 2090–2100, the period used by Schmittner et al. (2005), for A1B forcing (Fig. S9). Thus our model is more sensitive than the average, but within the range of other models, a conclusion that continues to be valid in comparison with 10 CMIP5 models (Cheng et al., 2013).

AMOC sensitivity to freshwater forcing has not been compared as systematically among models. Several studies find little impact of Greenland melt on AMOC (Huybrechts et al., 2002; Jungclaus et al., 2006; Vizcaino et al., 2008) while others find substantial North Atlantic cooling (Fichefet et al., 2003; Swingedouw et al., 2007; Hu et al., 2009, 2011). Studies with little impact calculated or assumed small ice sheet melt rates, e.g., Greenland contributed only 4 cm of sea level rise in the 21st century in the ice sheet model of Huybrechts et al. (2002). Fichefet et al. (2003), using nearly the same atmosphere-ocean model as Huybrechts et al. (2002) but a more responsive ice sheet model, found AMOC weakening from 20 to 13 Sv late in the 21st century, but separate contributions of ice melt and GHGs to AMOC slowdown were not defined.

Hu et al. (2009, 2011) use the A1B scenario and freshwater from Greenland starting at 1 mm sea level per year increasing 7 % yr^{-1}, similar to our 10 year doubling case. Hu et al. keep the melt rate constant after it reaches 0.3 Sv (in 2050), yielding 1.65 m sea level rise in 2100 and 4.2 m in 2200. Global warming found by Hu et al. (2009, 2010) for scenario A1B resembles our result but is 20–30 % smaller (compare Fig. 2b of Hu et al., 2009 to our Fig. 9), and cooling they obtain from the freshwater flux is moderately less than that in our model. AMOC is slowed about one-third by the latter 21st century in the Hu et al. (2011) 7 % yr^{-1} experiment, comparable to our result.

General consistency holds for other quantities, such as changes of precipitation. Our model yields southward shifting of the Inter-Tropical Convergence Zone (ITCZ) and intensification of the subtropical dry region with increasing GHGs (Fig. S10), as has been reported in modeling studies of Swingedouw et al. (2007, 2009) and others (IPCC, 2013). These effects are intensified by ice melt and cooling in the North Atlantic region (Fig. S10).

A recent 5-model study (Swingedouw et al., 2014) finds a small effect on AMOC for 0.1 Sv Greenland freshwater flux added in 2050 to simulations with a strong GHG forcing. Our larger response is likely due, at least in part, to our freshwater flux reaching several tenths of a Sv.

Freshwater sensitivity in our model is similar to an earlier version of the model used to simulate the 8.2 ky b2k freshwater event associated with demise of the Hudson Bay ice dome (LeGrande et al., 2006). The ~ 50 % AMOC slowdown in that model, in response to forcings of 2.5–5 Sv years indicated by geologic and paleohydraulic studies (e.g., Clarke et al, 2004), is consistent with indications from isotope-enabled analyses of the 8.2 ky event (LeGrande and Schmidt, 2008) and sediment records from the northwest Atlantic (Kleiven et al., 2008). The 1–2 century AMOC recovery time in numerical experiments (LeGrande and Schmidt, 2008) seems consistent with the 160 year duration of the 8.2 ky cooling event (Rasmussen et al., 2013).

3.6 Storm-related model diagnostics

Ice melt in the North Atlantic creates a substantial increment toward higher sea level pressure in the North Atlantic region in all seasons (Fig. 13). In the summer the added surface pressure strengthens and moves northward the Bermuda high pressure system (Fig. S3). Circulation around the high pressure creates strong prevailing northeasterly winds in the North Atlantic at the latitudes of Bermuda and the Bahamas. A1B climate forcing alone (top row of Fig. S11) has only a small impact on the winds, but cold meltwater in the North Atlantic causes a strengthening and poleward shift of the high pressure.

The high pressure in the model is located further east than appropriate for producing the fastest possible winds at the Bahamas. Our coarse resolution (4° × 5°) model, which slightly misplaces the pressure maximum for today's climate, may be partly responsible for the displacement. However, the location of high pressure also depends meltwater placement, which we spread uniformly over all longitudes in the North Atlantic between 65° W and 15° E and on specific location of ocean currents and surface temperature during the Eemian.

Our results at least imply that strong cooling in the North Atlantic from AMOC shutdown does create higher wind speed. It would be useful to carry out more detailed studies with higher resolution climate models including the most realistic possible distribution of meltwater.

The increment in seasonal mean wind speed of the northeasterlies relative to preindustrial conditions is as much as 10–20 %. Such a percentage increase of wind speed in a storm translates into an increase of storm power dissipation by a factor ~ 1.4–2, because wind power dissipation is proportional to the cube of wind speed (Emanuel, 1987, 2005). However, our simulated changes refer to seasonal mean winds averaged over large grid-boxes, not individual storms.

A blocking high pressure system in the North Atlantic creating consistent strong northeasterly flow would provide wave action that may have contributed to the chevron

ridge formation in the Bahamas and Bermuda. This blocking high pressure system could contribute to powerful storm impacts in another way. In combination with the warm tropical conditions that existed in the late Eemian (Cortijo et al., 1999), and are expected in the future if GHGs continue to increase, this blocking high pressure could create a preferred alley for tropical storm tracks.

We assumed, in discussing the relevance of these experiments to Eemian climate, that effects of freshwater injection dominate over changing GHG amount, as seems likely because of the large freshwater effect on SSTs and sea level pressure. However, Eemian CO_2 was actually almost constant at ~275 ppm (Luthi et al., 2008). Thus, to isolate effects better, we now carry out simulations with fixed GHG amount, which helps clarify important feedback processes.

3.7 Pure freshwater experiments

Our pure freshwater experiments are 5 member ensembles starting at years 1001, 1101, 1201, 1301, and 1401 of the control run. Each experiment ran 300 years. Freshwater flux in the initial decade averaged 180 $km^3\,yr^{-1}$ (0.5 mm sea level) in the hemisphere with ice melt and increased with a 10 year doubling time. Freshwater input is terminated when it reaches 0.5 m sea level rise per hemisphere for three 5-member ensembles: two ensembles with injection in the individual hemispheres and one ensemble with input in both hemispheres (1 m total sea level rise). Three additional ensembles were obtained by continuing freshwater injection until hemispheric sea level contributions reached 2.5 m. Here we provide a few model diagnostics central to discussions that follow. Additional results are provided in Figs. S12–S14.

The AMOC shuts down for Northern Hemisphere freshwater input yielding 2.5 m sea level rise (Fig. 14). By year 300, more than 200 years after cessation of all freshwater input, AMOC is still far from full recovery for this large freshwater input. On the other hand, freshwater input of 0.5 m does not cause full shutdown, and AMOC recovery occurs in less than a century.

Global temperature change (Fig. 15) reflects the fundamentally different impact of freshwater forcings of 0.5 and 2.5 m. The response also differs greatly depending on the hemisphere of the freshwater input. The case with freshwater forcing in both hemispheres is shown only in the Supplement because, to a good approximation, the response is simply the sum of the responses to the individual hemispheric forcings (see Figs. S12–S14). The sum of responses to hemispheric forcings moderately exceeds the response to global forcing.

Global cooling continues for centuries for the case with freshwater forcing sufficient to shut down the AMOC (Fig. 15). If the forcing is only 0.5 m of sea level, the temperature recovers in a few decades. However, the freshwater forcing required to reach the tipping point of AMOC shutdown may be less in the real world than in our model, as discussed below. Global cooling due to freshwater input on the Southern Ocean recovers in a few years after freshwater input ceases (Fig. 15), for both the smaller (0.5 m of sea level) and larger (2.5 m) freshwater forcings.

Injection of a large amount of surface freshwater in either hemisphere has a notable impact on heat uptake by the ocean and the internal ocean heat distribution (Fig. 16). Despite continuous injection of a large amount of very cold (−15 °C) water in these pure freshwater experiments, substantial portions of the ocean interior become warmer. Tropical and Southern Hemisphere warming is the well-known effect of reduced heat transport to northern latitudes in response to the AMOC shutdown (Rahmstorf, 1996; Barreiro et al., 2008).

However, deep warming in the Southern Ocean may have greater consequences. Warming is maximum at grounding line depths (~1–2 km) of Antarctic ice shelves (Rignot and Jacobs, 2002). Ice shelves near their grounding lines (Fig. 13 of Jenkins and Doake, 1991) are sensitive to temperature of the proximate ocean, with ice shelf melting increasing 1 m per year for each 0.1 °C temperature increase (Rignot and Jacobs, 2002). The foot of an ice shelf provides most of the restraining force that ice shelves exert on landward ice (Fig. 14 of Jenkins and Doake, 1991), making ice near the grounding line the buttress of the buttress. Pritchard et al. (2012) deduce from

satellite altimetry that ice shelf melt has primary control of Antarctic ice sheet mass loss.

Thus we examine our simulations in more detail (Fig. 17). The pure freshwater experiments add 5 mm sea level in the first decade (requiring an initial 0.346 mm yr^{-1} for 10 year doubling), 10 mm in the second decade, and so on (Fig. 17a). Cumulative freshwater injection reaches 0.5 m in year 68 and 2.5 m in year 90.

AABW formation is reduced ~20 % by year 68 and ~50 % by year 90 (Fig. 17b). When freshwater injection ceases, AABW formation rapidly regains full strength, in contrast to the long delay in reestablishing NADW formation after AMOC shutdown. The response time of the Southern Ocean mixed layer dictates the recovery time for AABW formation. Thus rapid recovery also applies to ocean temperature at depths of ice shelf grounding lines (Fig. 17c).

The rapid response of the SMOC (within a decade) to a change of the density of the Southern Ocean mixed layer implies that the rate of freshwater addition to the mixed layer is the driving factor. We will argue below that our model, because of excessive small scale mixing, probably understates the mixed layer and SMOC sensitivities to freshwater flux change, and in a later section we present evidence that the real world is responding more quickly than the model.

Sea ice cover, accurately monitored from satellites since the late 1970s, is a key diagnostic of the ocean surface layer. Increasing sea ice cover, we show below, is a powerful feedback that amplifies ice shelf melt. Freshwater flux has little effect on our simulated Northern Hemisphere sea ice until the 7th decade of freshwater growth (Fig. 17d), but Southern Hemisphere sea ice is more sensitive, with substantial response in the 5th decade and large response in the 6th decade.

Is 5th decade freshwater flux (2880 Gt yr^{-1}) of relevance to today's world? Yes, we will conclude, the Southern Ocean is already experiencing at least "5th decade" freshwater forcing. We explain the basis of that conclusion below, and then make a climate simulation for the 21st century with more realistic forcings than in our prior simulations.

4 Simulations to 2100 with modified (more realistic) forcings

Recent data imply that current ice melt is larger than assumed in our 1850–2300 climate simulations. Thus we make an additional simulation and use the opportunity to make minor improvements in the radiative forcing.

4.1 Advanced (earlier) freshwater injection

Atmosphere-ocean climate models, including ours, commonly include a fixed freshwater flux from the Greenland and Antarctic ice sheets to the ocean. This flux is chosen to balance snow accumulation in the model's control run, with the rationale that approximate balance is expected between net accumulation and mass loss including icebergs and ice shelf melting. Global warming creates a mass imbalance that we want to investigate. Ice sheet models can calculate the imbalance, but it is unclear how reliably ice sheet models simulate ice sheet disintegration. We forgo ice sheet modeling, instead adding a growing freshwater amount to polar oceans with alternative growth rates and initial freshwater amount estimated from available data.

Change of freshwater flux on the ocean in a warming world with shrinking ice sheets consists of two terms, Term 1 being net ice melt and Term 2 being change of P-E (precipitation minus evaporation) over the relevant ocean. Term 1 includes land based ice mass loss, which can be detected by satellite gravity measurements, loss of ice shelves, and net sea ice mass change. Term 2 is calculated in a climate model forced by changing atmospheric composition, but it is not included in our pure freshwater experiments that have no global warming.

IPCC (2013, Chapter 4) estimated land ice loss in Antarctica that increased from 30 Gt yr^{-1} in 1992–2001 to 147 Gt yr^{-1} in 2002–2011 and in Greenland from 34 to 215 Gt yr^{-1}, with uncertainties discussed by IPCC (2013). Gravity satellite data suggest Greenland ice sheet mass loss ~300–400 Gt yr^{-1} in the past few years (Barletta et al., 2013). A newer analysis of gravity data for 2003–2013 (Velicogna et al., 2014),

discussed in more detail in Sect. 6, finds a Greenland mass loss $280 \pm 58\,\mathrm{Gt\,yr^{-1}}$ and Antarctic mass loss $67 \pm 44\,\mathrm{Gt\,yr^{-1}}$.

One estimate of net ice loss from Antarctica, including ice shelves, is obtained by surveying and adding the mass flux from all ice shelves and comparing this freshwater mass loss with the freshwater mass gain from the continental surface mass budget. Rignot et al. (2013) and Depoorter et al. (2013) independently assessed the freshwater mass fluxes from Antarctic ice shelves. Their respective estimates for the basal melt are 1500 ± 237 and $1454 \pm 174\,\mathrm{Gt\,yr^{-1}}$. Their respective estimates for calving are 1265 ± 139 and $1321 \pm 144\,\mathrm{Gt\,yr^{-1}}$.

This estimated freshwater loss via the ice shelves ($\sim 2800\,\mathrm{Gt\,yr^{-1}}$) is larger than freshwater gain by the Antarctic surface. Vaughan et al. (1999) estimated the net surface mass balance of the continent as +1811 and $+2288\,\mathrm{Gt\,yr^{-1}}$ including precipitation on ice shelves. IPCC (2013) estimates the net Antarctic surface mass balance as $+1983 \pm 122\,\mathrm{Gt\,yr^{-1}}$ excluding ice shelves. Thus comparison of continental freshwater input with ice shelf output suggests a net export of freshwater to the Southern Ocean of several hundred $\mathrm{Gt\,yr^{-1}}$ in recent years. However, substantial uncertainty exists in the difference between these two large numbers.

A remarkable independent evaluation has recently been achieved by Rye et al. (2014) using satellite measured changes of sea level around Antarctica in the period 1992–2011. Sea level along the Antarctic coast rose $2\,\mathrm{mm\,yr^{-1}}$ faster than the regional mean sea level rise in the Southern Ocean south of 50° S, an effect that they conclude is almost entirely a steric adjustment caused by accelerating freshwater discharge from Antarctica. They conclude that an excess freshwater input of $430 \pm 230\,\mathrm{Gt\,yr^{-1}}$, above the rate needed to maintain a steady ocean salinity, is required. Rye et al. (2014) note that these values constitute a lower bound for the actual excess discharge above a "steady salinity" rate, because numerous in situ data, discussed below, indicate that freshening began earlier than 1992.

Term 2, change of P-E over the Southern Ocean relative to its pre-industrial amount, is large in all climate simulations (IPCC, 2013). In our ensemble of runs (using observed GHGs for 1850–2003 and scenario A1B thereafter) the increase of P-E in the decade 2011–2020, relative to the control run, was in the range 3500 to $4000\,\mathrm{Gt\,yr^{-1}}$, as mean precipitation over the Southern Ocean increased $\sim 35\,\mathrm{mm\,yr^{-1}}$ and evaporation decreased $\sim 3\,\mathrm{mm\,yr^{-1}}$.

Increasing ice melt and increasing P-E are climate feedbacks, their growth in recent decades driven by global warming. Our pure freshwater simulations indicate that their sum, at least $4000\,\mathrm{Gt\,yr^{-1}}$, is sufficient to affect ocean circulation, sea ice cover, and surface temperature, which can spur other climate feedbacks. We investigate these feedbacks via climate simulations using improved estimates of freshwater flux from ice melt. P-E is computed by the model.

We take freshwater injection to be $720\,\mathrm{Gt\,yr^{-1}}$ from Antarctica and $360\,\mathrm{Gt\,yr^{-1}}$ in the North Atlantic in 2011, with injection rates at earlier and later times defined by assumption of a 10 year doubling time. Resulting mean freshwater injection around Antarctica in 1992–2011 is $\sim 400\,\mathrm{Gt\,yr^{-1}}$, similar to the estimate of Rye et al. (2014). A recent estimate of $310 \pm 74\,\mathrm{km^3}$ volume loss of floating Antarctic ice shelves in 2003–2012 (Paolo et al., 2015) is not inconsistent, as the radar altimeter data employed for ice shelves does not include contributions from the ice sheet or fast ice tongues at the ice shelf grounding line. Greenland ice sheet mass loss provides most of the assumed $360\,\mathrm{Gt\,yr^{-1}}$ freshwater, and this would be supplemented by shrinking ice shelves (Rignot and Steffen, 2008) and small ice caps in the North Atlantic and west of Greenland (Ohmura, 2009) that are losing mass (Abdalati et al., 2004; Bahr et al., 2009).

We add the freshwater around Antarctica at coastal grid boxes (Fig. S15) guided by the data of Rignot et al. (2013) and Depoorter et al. (2013), the flux in the western hemisphere from the Weddell Sea to the Ross Sea being about three times larger than for the rest of the coastline. Specified freshwater flux around Greenland is similar on the east and west coasts, and small along the north coast (Fig. S15).

4.2 Modified radiative forcings

Actual GHG forcing has grown slower than scenario A1B, because growth of CH_4 and minor gases declined after IPCC scenarios were defined (Fig. 5, Hansen et al., 2013c, update at http://www.columbia.edu/~mhs119/GHGs/). As a simple improvement we decreased the A1B CH_4 scenario during 2003–2013 such that subsequent CH_4 is reduced 100 ppb, thus decreasing the radiative forcing $\sim 0.05\,W\,m^{-2}$.

Stratospheric aerosol forcing to 2014 uses the data set of Sato et al. (1993) as updated at http://www.columbia.edu/~mhs119/StratAer/. Future years have constant aerosol optical depth 0.0052 yielding effective forcing $-0.12\,W\,m^{-2}$, implemented by using fixed 1997 aerosol data. Tropospheric aerosol growth is assumed to slow smoothly, leveling out at $-2\,W\,m^{-2}$ in 2100. Future solar forcing is assumed to have an 11 year cycle with amplitude $0.25\,W\,m^{-2}$. Net forcing exceeds $5\,W\,m^{-2}$ by the end of the 21st century, about three times the current forcing (Fig. 18).

4.3 Climate simulations with modified forcings

Global temperature has a peak at +1.2 °C in the 2040s for the modified forcings (Fig. 19). Ice melt cooling is advanced as global ice melt reaches 1 m of sea level in 2060, 1/3 from Greenland and 2/3 from Antarctica. Actual sea level rise could be less than 1 m, depending on the portion of melt from ice shelves (which has little effect on sea level), but contributions from ocean thermal expansion and mountain glacier melt would probably make global mean sea level rise at least of the order of 1 m.

Global temperature rise resumes in the 2060s after total cessation of the freshwater injection. However, termination of freshwater injection is imposed only for the sake of analyzing climate mechanisms, not with expectation that a sudden halt of ice sheet disintegration is realistic.

Global temperature becomes an unreliable diagnostic of planetary condition as the ice melt rate increases. Global energy imbalance (Fig. 19b) is a more meaningful measure of planetary status as well as an estimate of the climate forcing change required

to stabilize climate. Our calculated present energy imbalance of $\sim 0.8\,W\,m^{-2}$ (Fig. 19b) is larger than the observed $0.58 \pm 0.15\,W\,m^{-2}$ during 2005–2010 (Hansen et al., 2011). The discrepancy is likely accounted for by excessive ocean heat uptake at low latitudes in our model, a problem related to the model's slow surface response time (Fig. 7) that may be caused by excessive small scale ocean mixing.

Large scale regional cooling occurs in the North Atlantic and Southern Oceans by mid-century (Fig. 20) for 10 year doubling of freshwater injection. A 20 year doubling places similar cooling near the end of this century, 40 years earlier than in our prior simulations (Fig. 10), as the factor of four increase of current freshwater from Antarctica is a 40 year advance.

The critical issue is whether human-spurred ice sheet mass loss can be approximated as an exponential process during the next few decades. Such nonlinear behavior depends upon amplifying feedbacks, which, indeed, our climate simulations reveal in the Southern Ocean.

4.4 Southern Ocean feedbacks

Amplifying feedbacks in the Southern Ocean and atmosphere contribute to dramatic climate change in our simulations (Fig. 20). We first summarize the feedbacks to identify processes that must be simulated well to draw valid conclusions. While recognizing the complexity of the global ocean circulation (Lozier, 2012; Lumpkin and Speer, 2007; Marshall and Speer, 2012; Munk and Wunsch, 1998; Orsi et al., 1999; Sheen et al., 2014; Talley, 2013; Wunsch and Ferrari, 2004), we use a simple two-dimensional representation to discuss the feedbacks.

Climate change includes slowdown of AABW formation, indeed shutdown by midcentury if freshwater injection increases with a doubling time as short as 10 years (Fig. 21). Implications of AABW shutdown are so great that we must ask whether the mechanisms are simulated with sufficient realism in our climate model, which has coarse resolution and relevant deficiencies that we have noted. After discussing the feedbacks

here, we examine how well the processes are included in our model (Sect. 4.5). Paleoclimate data (Sect. 5) provides much insight about these processes and modern observations (Sect. 7) show that these feedbacks are already underway.

Large-scale climate processes affecting ice sheets are sketched in Fig. 22. The role of the ocean circulation in the global energy and carbon cycles is captured to a useful extent by the two-dimensional (zonal mean) overturning circulation featuring deep water (NADW) and bottom water (AABW) formation in the polar regions. Marshall and Speer (2012) discuss the circulation based in part on tracer data and analyses by Lumpkin and Speer (2007). Talley (2013) extends the discussion with diagrams clarifying the role of the Pacific and Indian Oceans.

Wunsch (2002) emphasizes that the ocean circulation is driven primarily by atmospheric winds and secondarily by tidal stirring. The energy drawing deep water toward the surface in the Southern Ocean (Fig. 22) is provided by strong circumpolar westerly winds. This complex global thermohaline circulation can be altered by natural and human-made forcings, including freshwater injection from ice sheets, which stimulate powerful feedback processes.

A key feedback concerns the effect of cold freshwater injection on ocean temperature at ice shelf grounding lines. In our "pure freshwater" simulations the freshwater added to the Southern Ocean acts as a lid that reduces ventilation of ocean heat to the atmosphere and space. Warming is largest at depths near ice shelf grounding lines, the portion of the ice shelf that provides most of the restraining force that limits the rate of ice sheet discharge to the ocean (Fig. 14 of Jenkins and Doake, 1991). Melting at ice shelf grounding lines in West Antarctica and Wilkes Basin in East Antarctica has potential to result in rapid, nonlinear sea level rise because these basins have retrograde beds (beds sloping inland), a configuration with potential for unstable grounding line retreat and substantial ice sheet disintegration (Mercer, 1978), as discussed further below. Multiple submarine valleys make much of the Greenland ice sheet vulnerable to thermal forcing by a warming ocean (Morlighem et al., 2014), but with a few exceptions

(Khan et al., 2014) the valleys are prograde and thus rapid nonlinear growth of ice melt is not likely.

Another feedback occurs via the effect of surface and atmospheric cooling on precipitation and evaporation over the Southern Ocean. In climate simulations that do not include increasing freshwater injection in the Southern Ocean (IPCC, 2013), it is found that snowfall on Antarctica increases substantially in the 21st century, thus providing a negative term to sea level change. Frieler et al. (2015) assert that 35 global climate models are consistent in showing that a warming climate will yield increasing Antarctic snow accumulation, but this paleo "affirmation" refers to slowly changing climate in quasi-equilibrium with ocean boundary conditions. In our experiments with growing freshwater injection the increasing sea ice cover and cooling of the Southern Ocean surface and atmosphere cause the increased precipitation to occur over the Southern Ocean, rather than over Antarctica. This feedback not only reduces any increase of snowfall over Antarctica, it also provides a large freshening term to the surface of the Southern Ocean, thus magnifying the direct freshening effect from increasing ice sheet melt.

4.5 Model's ability to simulate these feedbacks

Realistic representation of these feedbacks places requirements on both the atmosphere and ocean components of our climate model. We discuss first the atmosphere, then the ocean.

There are two main requirements on the atmospheric model. First, it must simulate well P-E and changes of P-E, because of its importance for ocean circulation and the amplifying feedback in the Southern Ocean. Precise verification of P-E is difficult to attain, but the ultimate model requirement is that it produce realistic sea surface salinity (SSS) patterns and ongoing changes.

Simulated P-E (Fig. S16b) agrees well with meteorological reanalysis (Fig. 3.4b, IPCC, 2013). Simulated global sea surface salinity (SSS) patterns (Fig. S16a) agree well with global ocean surface salinity patterns (Antonov et al., 2010 and Fig. 3.4a,

IPCC, 2013). SSS trends in our simulation (Fig. S16c), with the Pacific on average becoming fresher while most of the Atlantic and the subtropics in the Southern Hemisphere become saltier, are consistent with observed salinity trends (Durack and Wijffels, 2010). Recent freshening of the Southern Ocean in our simulation is somewhat less than in observed data (IPCC, Figs. 3.4c and 3.4d), implying that the amplifying feedback may be *under*estimated in our simulation. A likely reason for that is discussed below in conjunction with observed sea ice change.

The second requirement is that the atmospheric model simulate well winds and their changes, because these drive the ocean. Thus the model must simulate well atmospheric pressure patterns and changes in response to climate forcings. A test is provided by observed changes of the Southern Annular Mode (SAM), with a decrease of surface pressure near Antarctica and a small increase at mid-latitudes (Marshall, 2003) that D. Thompson et al. (2011) relate to stratospheric ozone loss and increasing GHGs. Our climate forcing (Fig. 18) includes ozone change (Fig. 2, Hansen et al., 2007a) with stratospheric ozone depletion in 1979–1997 and constant ozone thereafter. Our model produces a trend toward the high index polarity of SAM (Fig. S17) similar to observations, although perhaps a slightly smaller change than observed (compare Fig. S17 with Fig. 3 of Marshall, 2003). SAM continues to increase in our model after ozone stabilizes (Fig. S17), suggesting that GHGs may provide a larger portion of the SAM response in our model than in the model study of D. Thompson et al. (2011). It would not be surprising if the stratospheric dynamical response to ozone change were weak in our model, given the coarse resolution and simplified representation of atmospheric drag and dynamical effects in the stratosphere (Hansen et al., 2007a), but that is not a major concern for our present purposes.

The ocean model must be able to simulate realistically the ocean's overturning circulation and its response to forcings including freshwater additions. Heuze et al. (2013, 2015) point out that simulated deep convection in the Southern Ocean is unrealistic in most models, with AABW formation occurring in the open ocean where it rarely occurs in nature. Our present ocean model contains significant improvements (see Sect. 3.1)

compared to the GISS E2-R model that Heuze et al. include in their comparisons. Thus we show (Fig. 23) the maximum mixed layer depth in winter (February in the Northern Hemisphere and August in the Southern Hemisphere) using the same criterion as Heuze et al. to define the mixed layer depth, i.e., the layers with a density difference from the ocean surface layer less than 0.03 kg m^{-3}.

Southern Ocean mixing in the model reaches a depth of ~ 500 m in a wide belt near 60° S stretching west from the southern tip of South America, with similar depths south of Australia. These open ocean mixed layer depths compare favorably with observations shown in Fig. 2a of Heuze et al. (2015), based on data of de Boyer Montegut et al. (2004). There is no open ocean deep convection in our model.

Deep convection occurs only along the coast of Antarctica (Fig. 23). Coastal grid boxes on the continental shelf are a realistic location for AABW formation. Orsi et al. (1999) suggest that most AABW is formed on shelves around the Weddell-Enderby Basin (60 %) and shelves of the Adelie-Wilkes Coast and Ross Sea (40 %). Our model produces mixing down to the shelf in those locations (Fig. 23b), but also on the Amery Ice Shelf near the location where Ohshima et al. (2013) identified AABW production, which they term Cape Darnley Bottom Water.

However, with our coarse 4° × 5° stair step to the ocean bottom the AABW cannot readily slide down the slope to the ocean floor. As a result, the denser water from the shelf mixes into the open ocean grid boxes, making our modeled Southern Ocean less stratified than the real world (cf. temporal drift of Southern Ocean salinity in Fig. S18), because the denser water must move several degrees of latitude horizontally before it can move deeper. Nevertheless, our Southern Ocean is sufficiently stratified to avoid the unrealistic open ocean convection that infects many models (Heuze et al., 2013).

Orsi et al. (1999) estimate the AABW formation rate in several ways, obtaining values in the range 8–12 Sv, larger than our modeled 5–6 Sv (Fig. 21). However, as in most models (Heuze et al., 2015) our SMOC diagnostic (Fig. 21) is the mean (Eulerian) circulation, i.e., excluding eddy-induced transport. Rerun of a 20 year segment of our control run to save eddy-induced changes reveals an increase of SMOC at 72° S by 1–

2 Sv, with negligible change at middle and low latitudes, making our simulated transport close to the range estimated by Orsi et al. (1999).

We conclude that the climate model can potentially simulate Southern Ocean feedbacks that magnify the effect of freshwater injection onto the Southern Ocean: the P-E feedback that wrenches global-warming-enhanced water vapor from the air before it reaches the Antarctic continent and the AABW slowdown that traps deep ocean heat, leaving that heat at levels where it accelerates ice shelf melting. Indeed, we will argue that both of these feedbacks are probably underestimated in our current model.

The model seems less capable in Northern Hemisphere polar regions. Deep convection today is believed to occur mainly in the Greenland-Iceland-Norwegian (GIN) Sea and at the southern end of Baffin Bay (Fig. 2b, Heuze et al., 2015). In our model, perhaps because of excessive sea ice in those regions, open ocean deep convection occurs to the southeast of the southern tip of Greenland and at less deep grid boxes between that location and the United Kingdom (Fig. 23). Mixing reaching the ocean floor on the Siberian Coast in our model (Fig. 23) may be realistic, as coastal polynya are observed on the Siberian continental shelf (D. Bauch et al., 2012). However, the winter mixed layer on the Alaska south coast is unrealistically deep (Fig. 23). These model limitations must be kept in mind in interpreting simulated Northern Hemisphere climate change.

5 Implications of paleoclimate data

Paleoclimate data are essential for understanding the major climate feedbacks. Processes of special importance are: (1) the role of the Southern Ocean in ventilating the deep ocean, affecting CO_2 control of global temperature, and (2) the role of subsurface ocean warming in ice shelf melt, affecting ice sheet disintegration and sea level rise.

5.1 Paleoclimate context

Major glacial-interglacial climate oscillations are spurred by periodic variation of seasonal and geographical insolation (Hays et al., 1976). Insolation anomalies are caused by slow changes of the eccentricity of Earth's orbit, tilt of Earth's spin axis, and precession of the equinoxes, thus the day of year at which Earth is closest to the Sun, with dominant periodicities near 100 000, 40 000 and 20 000 years (Berger, 1978). These periods emerge in long climate records, yet a large fraction of climate variability at any site is stochastic (Wunsch, 2004; Lisiecki and Raymo, 2005). Such behavior is expected for a weakly-forced system characterized by amplifying feedbacks, complex dynamics, and multiple sources of inertia with a range of time scales.

Large glacial-interglacial climate change and stochastic variability are a result of two strong amplifying feedbacks, surface albedo and atmospheric CO_2. Orbit-induced insolation anomalies, per se, cause a climate forcing, i.e., an Earth energy imbalance, only of order 0.1 W m^{-2}, but the persistent regional insolation anomalies spur changes of ice sheet size and GHGs. The albedo and GHG changes arise as slow climate feedbacks, but they are the forcings that maintain a quasi-equilibrium climate state nearly in global radiative balance. Glacial-interglacial albedo and greenhouse forcings are each $\sim$3 W m^{-2} (Fig. 24e, f)[1]. These forcings fully account for glacial-interglacial global temperature change with a climate sensitivity 0.5–1 °C per W m^{-2} (Hansen et al., 2008; Masson-Delmotte et al., 2010; Palaeosens, 2012).

The insolation anomaly peaking at 129.5 ky b2k (Fig. 24a) succeeded in removing ice sheets from North America and Eurasia and in driving atmospheric CO_2 up to

[1]Other parts of Fig. 24 are discussed later, but they are most informative if aligned together. In interpreting Fig. 24, note that long-lived greenhouse gas amounts in ice cores have global relevance, but ice core temperatures are local to Greenland and Antarctica. Also, because our analysis does not depend on absolute temperature, we do not need to convert the temperature proxy, $\delta^{18}O$, into an estimated absolute temperature. We include CH_4 and N_2O in the total GHG climate forcing, but we do not discuss the reasons for CH_4 and N_2O variability (see Schilt et al., 2010), because CO_2 provides $\sim$80 % of the GHG forcing.

~285 ppm, as discussed below. However, smaller climate oscillations within the last glacial cycle are also instructive about ice feedbacks. Some of these oscillations are related to weak insolation anomalies and all are affected by predominately amplifying climate feedbacks.

Insolation anomalies peaking at 107 and 86 ky b2k (Fig. 24a) led to ~40 m sea level rises at rates exceeding 1 m century^{-1} (Stirling et al., 1998; Cutler et al., 2003) in early MIS 5c and 5a (Fig. 24f), but CO_2 did not rise above 250 ppm and interglacial status was not achieved. CO_2 then continued on a 100 ky decline until ~18 ky b2k. Sea level continued its long decline, in concert with CO_2, reaching a minimum at least 120 m below today's sea level (Peltier and Fairbanks, 2006; Lambeck et al., 2014).

Progress achieved by the paleoclimate and oceanographic research communities allows interpretation of the role of the Southern Ocean in the tight relationship between CO_2 and temperature, as well as discussion of the role of subsurface ocean warming in sea level rise. Both topics are needed to interpret end-Eemian climate change and ongoing climate change.

5.2 Southern Ocean and atmospheric CO_2

Reduced atmospheric CO_2 in glacial times, at least in substantial part, results from increased stratification of the Southern Ocean that reduces ventilation of the deep ocean (Toggweiler, 1999; Anderson et al., 2009; Skinner et al., 2010; Tschumi et al., 2011; Burke and Robinson, 2012; Schmitt et al., 2012; Marcott et al., 2014). Today the average "age" of deep water, i.e., the time since it left the ocean surface, is ~1000 years (DeVries and Primeau, 2011), but it was more than twice that old during the last glacial maximum (Skinner et al., 2010). The Southern Ocean dominates exchange between the deep ocean and atmosphere because ~80 % of deep water resurfaces in the Southern Ocean (Lumpkin and Speer, 2007), as westerly circumpolar winds and surface flow draw up deep water (Talley, 2013).

Mechanisms causing more rapid deep ocean ventilation during interglacials include warmer Antarctic climate that increases heat flux into the ocean and buoyancy mixing

that supports upwelling (Watson and Garabato, 2006), poleward shift of the westerlies (Toggweiler et al., 2006), and reduced sea ice (Keeling and Stephens, 2001). Fischer et al. (2010) question whether the latitudinal shift of westerlies is an important contributor; however, the basic point is the empirical fact that a warmer interglacial Southern Ocean produces faster ventilation of the deep ocean via a combination of mechanisms.

Poor ocean ventilation in glacial periods allows carbon to be sequestered via the "biological pump", the rain of organic matter from the surface ocean that affects burial of calcium carbonate in sediments (Sigman and Boyle, 2000). Dust-borne iron fertilization of the biological pump (Martin and Fitzwater, 1988) contributes to millennial and full glacial CO_2 drawdown (Martinez-Garcia et al., 2014). In concert, global cooling drives the simple "solubility pump", as the temperature dependence of CO_2 solubility increases dissolved inorganic carbon (Raven and Falkowski, 1999). The increased acidity of deep water makes it more corrosive to carbonate sediments, thus increasing ocean alkalinity and further lowering atmospheric CO_2 (Boyle, 1988).

Much remains to be learned about glacial-interglacial carbon cycle mechanisms. Carbon isotopes indicate that increased deep ocean ventilation during deglaciation from the last ice age caused a 30–35 ppm CO_2 increase within 2000 years (Schmitt et al., 2012; Tschumi et al., 2011). However, AMOC changes are associated with at least two rapid CO_2 increases of about 10 ppm, as revealed by a high resolution West Antarctic ice core (Marcott et al., 2014). Another indication of possible Atlantic involvement in the carbon cycle is the change of the North Atlantic's Western Boundary Undercurrent during the transition to full glacial conditions at ~70 ky b2k when CO_2 dropped below 200 ppm (Fig. 24); the flow became stronger in the upper 2 km while the deeper circulation weakened (Thornalley et al., 2013). No doubt the terrestrial biosphere also contributes to atmospheric CO_2 change (Archer et al., 2000; Sigman and Boyle, 2000; Kohler et al., 2005; Menviel et al., 2012; Fischer et al., 2015). Nevertheless, it is reasonably clear that sequestration of CO_2 in the glacial ocean is the largest cause of glacial-interglacial CO_2 change, and ocean ventilation occurs mainly via the Southern Ocean.

Southern Ocean ventilation, as the dominant cause of atmospheric CO_2 change, helps explain temperature-CO_2 leads and lags. Temperature and CO_2 rises are almost congruent at ice age terminations (Masson-Delmotte, 2010; Pedro et al., 2012; Parrenin et al., 2013). Southern Ocean temperature is expected to lead, spurring deep ocean ventilation and atmospheric CO_2 increase, with global temperature following. Termination I is dated best and Shakun et al. (2012) have reconstructed global temperature then, finding evidence for this expected order of events.

Correlation of $\delta^{18}O$ and CO_2 over the past 140 ky (Fig. 24c) is 84.4 % with CO_2 lagging by 760 years. For the period 100–20 ky b2k, which excludes the two terminations, the correlation is 77.5 % with CO_2 lagging by 1040 years. Briefer lag for the longer period and longer lag during glacial inception are consistent with the rapid deep ocean ventilation that occurs at terminations.

5.3 CO_2 as climate control knob

CO_2 is the principal determinant of Earth's climate state, the "control knob" that sets global mean temperature (Lacis et al., 2010, 2013). The degree of control is shown by comparison of CO_2 amount with Antarctic temperature for the past 800 000 years (Fig. 25a). Control should be even tighter for global temperature than for Antarctic temperature, because of regional anomalies such as Antarctic temperature overshoot at terminations (Masson-Delmotte, 2006, 2010), but global data are not available.[2]

[2]The tight fit of CO_2 and Antarctic temperature (Fig. 25a) implies an equilibrium Antarctic sensitivity 20 °C for 2× CO_2 (4 W m^{-2}) forcing (200 → 300 ppm forcing is ∼ 2.3 W m^{-2}, Table 1 of Hansen et al., 2000), thus 10 °C global climate sensitivity (Antarctic temperature change is ∼ twice global change) with CO_2 taken as the ultimate control knob, i.e., if snow/ice area and other GHGs are taken to be slaves to CO_2-driven climate change. This implies a conventional climate sensitivity of 4 °C for 2× CO_2, as GHG and albedo forcings are similar for glacial-to-interglacial climate change and non-CO_2 GHGs account for ∼ 20 % of the GHG forcing. The inferred sensitivity is reduced to 2.5–3 °C for 2× CO_2 if, as some studies suggest, global mean

The CO_2 dial must be turned to ∼ 260 ppm to achieve a Holocene-level interglacial. CO_2 ∼ 250 ppm was sufficient for quasi-interglacials in the period 800–450 ky b2k, with sea level 10–25 m lower than in the Holocene (Fig. S18 of Hansen et al., 2008). Interglacials with CO_2 ∼ 280 ppm, i.e., the Eemian and Holsteinian (∼ 400 ky b2k), were warmer than the Holocene and had sea level at least several meters higher than today.

CO_2 and albedo change are closely congruent over the last 800 000 years (Fig. S18 of Hansen et al., 2008). GHG and albedo forcings, which are both amplifying feedbacks that boost each other, are each of amplitude ∼ 3 W m^{-2}. So why do we say that CO_2 is the control knob?

First, CO_2, in addition to being a slow climate feedback, changes independently of climate. Natural CO_2 change includes increase to ∼ 1000 ppm about 50 million years ago (Zachos et al., 2001) as a result of plate tectonics, specifically volcanic emissions associated with movement of the Indian plate across the Tethys Ocean and collision with Asia (Kent and Muttoni, 2008). Humankind, mainly by burning fossil fuels, also moves the CO_2 control knob.

Second, CO_2 is more recalcitrant than snow and ice, i.e., its response time is longer. CO_2 inserted into the climate system, by humans or plate tectonics, remains in the climate system of order 100 000 years before full removal by weathering (Archer, 2005). Even CO_2 exchange between the atmosphere (where it affects climate) and ocean has a lag of the order a millennium (Fig. 24). In contrast, correlations of paleo temperatures and sea level show that lag of sea level change behind temperature is of order a century, not a millennium (Grant et al., 2012).

We suggest that limitations on the speed of ice volume (thus sea level) changes in the paleo record are more a consequence of the pace of orbital changes and CO_2 changes, as opposed to being a result of lethargic ice physics. "Fast" changes of CO_2 have been identified, e.g., an increase of ∼ 10 ppm in about a century at ∼ 39.6 ky b2k (Ahn et al., 2012) and three increases of 10–15 ppm each within 1–2 centuries during

glacial-interglacial temperature change is only about one-third of the Antarctic temperature change (Palaeosens, 2012; Hansen et al., 2013b).

the deglaciation following the last ice age (Marcott et al., 2014), but the magnitude of these CO_2 increases is not sufficient to provide a good empirical test of ice sheet sensitivity to the CO_2 forcing.

Supremacy of SMOC, the Southern Ocean meridional overturning circulation, in affecting the CO_2 control knob and thus glacial-interglacial change is contrary to the idea that AMOC is a prime driver that flips global climate between quasi-stable glacial and interglacial states, yet AMOC retains a significant role. AMOC can affect CO_2 via the volume and residence time of NADW, but its largest effect is probably via its impact on the Southern Ocean. When AMOC is not shut down it cools the Southern Hemisphere, transferring heat from the Southern to the Northern Hemisphere at a rate ~ 1 petawatt, which is $\sim 4\,W\,m^{-2}$ averaged over a hemisphere (Crowley, 1992). However, the Southern Ocean slowly warms when AMOC shuts (or slows) down; the response time is of the order of 1000 years because of the Southern Ocean's large thermal inertia (Stocker and Johnson, 2003). These mechanisms largely account for the nature of the "bipolar seesaw" (Broecker, 1998; Stocker, 1998; Stenni et al., 2011; Landais et al., 2015), including the lag between AMOC slowdown and Antarctic warming.

5.4 Dansgaard–Oeschger events and subsurface ocean warming

The magnitude and rapidity of Greenland climate change during Dansgaard–Oeschger events would deter prediction of human-made climate effects, if D–O events remained a mystery. Instead, however, enough is now understood about D–O events that they provide insight related to the vulnerability of ice shelves and ice sheets, including the role of subsurface ocean warming.

Broecker (2000) inferred from the rapidity of D–O warmings that a reduction of sea ice cover was probably involved. Li et al. (2005, 2010) modeling showed that removal of Nordic Seas ice cover is needed to yield the magnitude of observed Greenland warming. The spatial gradient of D–O warming, with smaller warming in northwest Greenland, agrees with that picture (Guillevic et al., 2013; Buizert et al., 2014). Such sea ice change is consistent with changes in deuterium excess in Greenland ice cores at

D–O transitions, which indicate shifts of Greenland moisture source regions (Masson-Delmotte et al., 2005; Jouzel et al., 2007).

Fluckiger et al. (2006), Alvarez-Solas et al. (2010, 2011, 2013) and Marcott et al. (2011) noted modern and paleo data that point to ocean-ice shelf interaction as key to the ice discharge of accompanying Heinrich events, and they used a range of models to support this interpretation and overturn earlier suggestions of a central role for ice sheets via binge-purge oscillations (MacAyeal, 1993) or outburst flooding from subglacial reservoirs (Alley et al., 2006). Shaffer et al. (2004) and Petersen et al. (2013) conclude that subsurface ocean warming in the North Atlantic takes place during the stadial (cold) phase of all D–O events, and eventually this subsurface warming leads to ice shelf collapse or retreat, ice rafting, sea level rise, and sea ice changes. Rasmussen et al. (2003) examined ocean cores from the southeast Labrador Sea and found that for all 11 Heinrich events "... the icy surface water was overlying a relatively warm, poorly ventilated and nutrient rich intermediate water mass to a water depth of at least 1251 m." Collapse of a Greenland ice shelf fronting the Jakoshavn ice stream during the Younger Dryas cold event has been documented (Rinterknecht et al., 2014), apparently due to subsurface warming beneath the ice shelf leading to rapid discharge of icebergs.

Some D–O details are uncertain, e.g., the relation between changing sea ice cover and changing location of deep water formation (Rahmstorf, 1994) and whether an ice shelf between Greenland and Iceland contributed to the sea ice variability (Petersen et al., 2013). However, ocean-ice interactions emerge as key mechanisms, spurred by subsurface ocean warming, as ocean stratification slows but does not stop northward heat transport by AMOC.

We consider a specific D–O event for the sake of discussing mechanisms. D–O 22 cold phase, labeled C22 in ocean cores and coinciding with Heinrich H8 (Fig. 24), occurred as Northern Hemisphere insolation was rising (Fig. 24a). The North Atlantic surface was cooled by rapid ice discharge; sea level rose more than 40 m, a rate exceeding 1.6 m per century (Cutler et al., 2003). Ice discharge kept the North Atlantic

highly stratified, slowing AMOC. Antarctic warming from a slowed AMOC increases almost linearly with the length of the D–O cold phase (Fig. 3, EPICA Community Members, 2006; Fig. 6, Capron et al., 2010) because of the Southern Ocean's large heat capacity (Stocker and Johnson, 2003). Antarctic warming, aided by the 2500 year D–O 22 event, spurred SMOC enough to raise atmospheric CO_2 40 ppm (Fig. 24c).

As the Antarctic warmed, ocean heat transport to the North Atlantic would have increased, with most heat carried at depths below the surface layer. When the North Atlantic became warm enough at depth, stratification of cold fresh surface water eventually could not be maintained. The warming breakthrough may have included change of NADW formation location (Rahmstorf, 1994) or just large movement of the polar front. Surface warming east of Greenland removed most sea ice and Greenland warmed ~ 10 °C (Capron et al., 2010). As the warm phase of D–O 21 began, AMOC was pumping heat from the Antarctic into the Nordic seas and Earth must have been slightly out of energy balance, cooling to space, so both Antarctica and Greenland slowly cooled. Once the North Atlantic had cooled enough, sea formed east of Greenland again, ice sheets and ice shelves grew, sea level fell, and the polar front moved southward.

Sea level rise associated with D–O events covers a wide range. Sea level increases as large as ~ 40 m were associated with large insolation forcings at 107 and 86 ky b2k (Fig. 24). However, rapid sea level change occurred even when forcing was weak. Roche et al. (2004) conclude from analyses of $\delta^{18}O$ that H4, at a time of little insolation forcing (~ 40 ky b2k, Fig. 24), produced 1.9 ± 1.1 m sea level rise over 250 ± 150 years. Sea level rise as great as 10–15 m occurred in conjunction with some other D–O events during 65–30 ky b2k (Lambeck and Chappell, 2001; Yokoyama et al., 2001; Chappell, 2002).

Questions about possible D–O periodicity and external forcing were raised by a seeming 1470 year periodicity (Schulz, 2002). However, improved dating indicates that such periodicity is an artifact of ice core chronologies and not statistically significant (Ditlevsen et al., 2007) and inspection of Fig. 24b reveals a broad range of time scales. Instead, the data imply a climate system that responds sensitively to even weak forc-

ings and stochastic variability, both of which can spur amplifying feedbacks with a range of characteristic response times.

Two conclusions are especially germane. First, subsurface ocean warming is an effective mechanism for destabilizing ice shelves and thus the ice sheets buttressed by the ice shelves. Second, large rapid sea level rise can occur as a result of melting ice shelves.

However, ice shelves probably were more extensive during glacial times. So are today's ice sheets much more stable? The need to understand ice sheet vulnerability focuses attention on end-Eemian events, when ice sheets were comparable in size to today's ice sheets.

5.5 End-Eemian climate and sea level change

Termination II, ushering in the Eemian, was spurred by a late spring 60° N insolation anomaly peaking at +45 W m^{-2} at 129.5 ky b2k (Fig. 24a), the largest anomaly in at least the past 425 ky (Fig. 3, Hansen et al., 2007b). CO_2 and albedo forcings were mutually reinforcing. CO_2 began to rise before Antarctic $\delta^{18}O$, as deglaciation and warming began in the Northern Hemisphere. Most of the total CO_2 rise was presumably from deep ocean ventilation in the Southern Ocean, aided by meltwater that slowed the AMOC and thus helped to warm the Southern Ocean.

The northern insolation anomaly fell rapidly, becoming negative at 123.8 ky b2k (Fig. 24a). Northern Hemisphere ice sheets must have increased intermittently while Southern Hemisphere ice was still declining, consistent with minor, growing ice rafting events C27, C27a, C27b and C26 and a sea level minimum during 125–121 ky b2k (Sec 2.1). High Eemian climate variability in the Antarctic (Pol et al., 2014) was likely a result of the see-saw relation with North Atlantic events.

CO_2 (Fig. 24c) remained at ~ 270 ppm for almost 15 ky as the positive insolation anomaly on the Southern Ocean (Fig. 24a) kept the deep ocean ventilated. Sea level in the Red Sea analysis (Grant et al., 2012) shown in Fig. 24f seems to be in decline through the Eemian, but that must be a combination of dating and sea level error, as

numerous sea level analyses cited in Sect. 2.1 and others (e.g., Chen at al., 1991; Stirling et al., 1998; Cutler et al., 2003), indicate high sea level throughout the Eemian and allow a possible late-Eemian maximum. Chen et al. (1991), using a U-series dating with 2σ uncertainty ± 1.5 ky, found that the Eemian sea level high stand began between 132 and 129 ky b2k, lasted for 12 ky, and was followed by rapid sea level fall.

We assume that C26, the sharp cooling at 116.72 ky b2k in the NGRIP ice on the AICC2012 time scale, marks the end of fully interglacial Eemian conditions, described as 5e sensu stricto by Bauch and Erlenkeuser (2008). δ^{18}O in Antarctica was approaching a relative minimum (−46.7 per mil at EDML, see Fig. S19 for detail) and CO_2 was slowly declining at 263 ppm. In the next 300 years δ^{18}O increased to −45.2 and CO_2 increased by 13 ppm with lag ∼ 1500 years, which we interpret as see-saw warming of the Southern Ocean in response to the C26-induced AMOC slowdown and resulting increased SMOC ventilation of CO_2.

Freshwater causing the C26 AMOC shutdown could not have been Greenland surface melt. Greenland was already 2000 years into a long cooling trend and the northern insolation anomaly was in the deepest minimum of the last 150 ky (Fig. 24a). Instead C26 was one event in a series, preceded by C27b and followed by C25, each a result of subsurface North Atlantic warming that melted ice shelves, causing ice sheets to discharge ice. Chapman and Shackleton (1999) did not find IRD from C26 in the mid-Atlantic, but Carlson et al. (2008) found a sharp increase in sediments near the southern tip of Greenland that they identified with C26.

We suggest that the Southern Hemisphere was the source for brief late-Eemian sea level rise. The positive warm-season insolation anomaly on the Southern Ocean and AMOC slowdown due to C26 added to Southern Ocean heat, causing ice shelf melt, ice sheet discharge, and sea level rise. Rapid Antarctica ice loss would cool the Southern Ocean and increase sea ice cover, which may have left telltale evidence in ice cores. Indeed, Masson-Delmotte et al. (2011) suggest that abrupt changes of δ^{18}O in the EDML and TALDICE ice cores (those most proximal to the coast) indicate a change in moisture origin, likely due to increased sea ice. Further analysis of Antarctic

data for the late Eemian might help pinpoint the melting and help assess vulnerability of Antarctic ice sheets to ocean warming, but this likely will require higher resolution models with more realistic sea ice distribution and seasonal change than our present model produces.

Terrestrial records in Northern Europe reveal rapid end-Eemian cooling. Sirocko et al. (2005) find cooling of 3 °C in summer and 5–10 °C in winter in southern Germany, annual layering in a dry Eifel maar lake revealing a 468 year period of aridity, dust storms, bushfires, and a decline of thermophilous trees. Similar cooling is found at other German sites and La Grande Pile in France (Kuhl and Litt, 2003). Authors in both cases interpret the changes as due to a southward shift of the polar front in the North Atlantic corresponding to C26. Cooling of this magnitude in northern Europe and increased aridity are found by Brayshaw et al. (2009) and Jackson et al. (2015) in simulations with high resolution climate models forced by AMOC shutdown.

While reiterating dating uncertainties, we note that the cool period with reduced NADW formation identified in recent high resolution ocean core studies for Eirik Drift site MD03-2664 (Fig. 3) near Greenland (Irvali et al., 2012; Galaasen et al., 2014) at ∼ 117 ky b2k has length similar to the 468 year cold stormy period found in a German lake core (Sirocko et al., 2005). The Eirik core data show a brief return to near-Eemian conditions and then a slow decline, similar to the oscillation in the NGRIP ice core at 116.72 ky b2k on the AICC2012 time scale.

The principal site of NADW formation may have moved from the GIN Seas to just south of Greenland at end of the Eemian. Southward shift of NADW formation and the polar front is consistent with the sudden, large end-Eemian cooling in the North Atlantic and northern Europe, while cooling in Southern European was delayed by a few millennia (Brauer et al., 2007). Thus end-Eemian mid-latitude climate was characterized by an increased zonal temperature gradient, an important ingredient for strengthening storms.

6 Impact of ice melt on storms

We can draw some conclusions about the effect of ice melt on winds and severe weather, despite limitations of our current climate model. Principal model limitations are its coarse resolution and unrealistic location of Northern Hemisphere deep water formation, this latter problem being likely related to the model's excessive Northern Hemisphere sea ice cover.

Despite these caveats, we have shown that the model realistically simulates zonal changes of sea level pressure in response to climate forcings. Specifically, the model yields a realistic trend to the positive phase of the Southern Annular Mode (SAM) in response to decrease of stratospheric ozone and increase of other GHGs (Fig. S17).

The modeled response of atmospheric pressure to the cooling effect of ice melt is large scale, tending to be of a zonal nature that should be handled by our model resolution. Freshwater injection onto the North Atlantic and Southern Oceans causes increase of sea level pressure at middle latitudes and decrease at polar latitudes (Figs. 13, S11). These pressure changes have implications for the strength of prevailing winds and for severe weather.

The robust increase of high pressure in the North Atlantic strengthens prevailing northeasterly winds blowing onto the Bahamas (Fig. 13). The Eemian-age chevron beach structures with consistent southwesterly direction throughout windward shores in the Bahamas (Sect. 2.2), with wave runup deposits at elevations as much as 20–40 m above today's sea level and reaching as far as a few kilometers inland, must have been formed by massive storms in the direction of the prevailing winds. Consistent increase of wind speed in the appropriate direction would contribute to creation of long wavelength, deep ocean waves that can scour the ocean floor as they reach the shallow near-shore region. The most extreme events probably required the combined effect of these increased prevailing winds and tropical storms, the latter nurtured by the unusually warm tropical sea surface temperatures in the late Eemian and guided by the strong prevailing winds. On theoretical grounds, it is known that the higher low

latitude sea surface temperatures of the late Eemian (Cortijo et al., 1999) would favor more powerful tropical storms (Emanuel, 1987). The zonal temperature gradient, warmer tropics and cooler high latitudes, was enhanced by low obliquity of Earth's spin axis in the late Eemian. Empirical evidence for intense Eemian storms includes standing forests of 8–10 m trees that were rapidly buried in shelf sand and preserved on Bermuda at elevations several meters above sea level (Hearty and Olson, 2011), as well as other evidence discussed in Sect. 2.2. The late Eemian is typically associated with a massive flux of oolitic shelf sediments mobilized in the offshore shelf environment and further transported by intense winds into enormous land-based dunes that dominate a majority of modern landscapes of the Bahamas archipelago (Hearty and Neumann, 2001).

Shutdown or substantial slowdown of the AMOC, besides possibly contributing to extreme end-Eemian events, will cause a more general increase of severe weather. This is shown by the change of zonal mean temperature and eddy kinetic energy in our simulations with and without ice melt (Fig. 26). Without ice melt, surface warming is largest in the Arctic (Fig. 26, left), resulting in a decrease of lower tropospheric eddy energy. However, the surface cooling from ice melt increases surface and lower tropospheric temperature gradients, and in stark contrast to the case without ice melt, there is a large increase of mid-latitude eddy energy throughout the midlatitude troposphere. The increase of zonal-mean midlatitude baroclinicity that we find (Fig. 26) is in agreement with the localized, N. Atlantic-centered increases in baroclinicity found in the higher resolution simulations of Jackson et al. (2015) and Brayshaw et al. (2009).

Increased baroclinicity produced by a stronger temperature gradient provides energy for more severe weather events. Many of the most memorable and devastating storms in eastern North America and western Europe, popularly known as superstorms, have been winter cyclonic storms, though sometimes occurring in late fall or early spring, that generate near-hurricane force winds and often large amounts of snowfall (Chapter 11, Hansen, 2009). Continued warming of low latitude oceans in coming decades will provide more water vapor to strengthen such storms. If this tropical warming is com-

bined with a cooler North Atlantic Ocean from AMOC slowdown and an increase in midlatitude eddy energy (Fig. 26), we can anticipate more severe baroclinic storms. Increased high pressure due to cooler high latitude ocean (Fig. 13) can make blocking situations more extreme, with a steeper pressure gradient between the storm's low pressure center and the blocking high, thus driving stronger North Atlantic storms.

Large freshwater injection on the North Atlantic Ocean has a different impact on winds than freshwater injection on the Southern Ocean (Fig. 13). In the Southern Ocean the increased meridional temperature gradient increases the strength of the westerlies in all seasons at all longitudes. In the North Atlantic Ocean the increase of sea level pressure in the winter slows the westerlies (Fig. 13). Thus instead of a strong zonal wind that keeps cold polar air locked in the Arctic, there is a tendency for more cold air outbreaks to middle latitudes.

7 Modern data

7.1 Southern Ocean

The Southern Ocean, as the gateway to the global deep ocean, has exerted a powerful control over glacial/interglacial climate. However, the Southern Ocean's control over the Antarctic ice sheet, and thus global sea level, will be of greater concern to humanity.

Our model, due to moderately excessive mixing, may be less sensitive to freshwater forcing than the real world. Yet the model (Fig. 27a) indicates that a slowing of Antarctic Bottom Water Formation should already be underway, a conclusion consistent with transient tracer observations in the Weddell Sea by Huhn et al. (2013), which reveal a 15–21 % reduction in the ventilation of Weddell Sea Bottom Water and Weddell Sea Deep Water over the period 1984–2008.

The Southern Ocean has significant control on release of ocean heat to space. In an extreme case, polynyas form in the dead of Antarctic winter, as upwelling warm water melts the sea ice and raises the air temperature by tens of degrees, increasing

thermal radiation to space, thus serving as a valve that releases ocean heat. Today, as surface meltwater stabilizes the vertical water column, that valve is being partially closed. de Lavergne et al. (2014) relate the absence of large open ocean polynyas in recent decades to surface freshening.

Release of heat to the atmosphere and space, which occurs without the need for large open ocean polynyas, is slowed by increasing sea ice cover in response to increasing ice shelf melt (Bintanja et al., 2013). Schmidtko et al. (2014) and Roemmich et al. (2015) document changes in the Southern Ocean in recent decades, especially warming of Circumpolar Deep Water (CDW), which they and others (Jacobs et al., 2011; Rignot et al., 2013) note is the likely cause of increased ice shelf melt. Observations of ocean surface freshening and freshening of the water column (Rintoul, 2007; Jacobs and Giulivi, 2010) and deep ocean warming (Johnson et al., 2007; Purkey and Johnson, 2013) leave little doubt that these processes are occurring.

Loss of ice shelves that buttress the ice sheets potentially can lead to large sea level rise (Mercer, 1978). The ocean depths with largest warming in response to surface freshening (Fig. 16) encompass ice shelf grounding lines that exert the strongest restraining force (Jenkins and Doake, 1991). The impact of warming CDW varies among ice shelves because of unique geometries and proximity to the CDW current, but eventually a warming ocean will likely affect them all. As ice shelves weaken and ice sheet discharge increases the process is self-amplifying via the increasing freshwater discharge.

Weber et al. (2014) used ocean cores near Antarctica to study the deglacial evolution of the Antarctic ice sheet following the last glacial maximum. They identified eight episodes of large iceberg flux, with the largest flux occurring ~ 14 600 years ago, providing evidence of an Antarctic contribution to Meltwater Pulse 1A, when sea level rose an average of 3–5 m century^{-1} for a few centuries (Fairbanks, 1989). Ice sheets today may not have as much vulnerable ice as they had during the ice age. On the other hand, CO_2 and the global climate forcing are increasing much more rapidly today, and heat is being pumped into the ocean at a high rate via the resulting positive (incoming)

planetary energy imbalance (Hansen et al., 2011; Roemmich et al., 2015) providing ample energy to spur increasing ice melt.

7.2 Surface change today

Ocean surface cooling near Antarctica is emerging now (Fig. 28) and is large by mid-century (Fig. 20) in our simulations. The modeled sea ice increase is delayed relative to observations (Fig. 27b) for reasons noted below. However, freshwater effects already dominate over direct effects of O_3 and other GHGs. D. Thompson et al. (2011) suggested that O_3 depletion may account for Antarctic sea ice growth, but Sigmond and Fyfe (2014) found that all CMIP5 models yield decreasing sea ice in response to observed changes of O_3 and other GHGs. Ferreira et al. (2015) show that O_3 depletion yields a short time scale sea ice increase that is soon overtaken by warming and sea ice decrease with realistic GHG forcing. We conclude that these models are missing the dominant driver of change on the Southern Ocean: freshwater input.

Delay of our modeled sea ice increase relative to observations is probably related to difficulty in maintaining vertical stratification (Fig. S18), which in turn is a result of excess small scale mixing from a large background diapycnal diffusivity ($0.3\,cm^2\,s^{-1}$) used to damp numerical noise, and the noise itself. Also sea ice increase occurred earlier in our experiments with freshwater spread over a broad area rather than being placed only in coastal gridboxes. In the real world half of the freshwater is calving (icebergs) that float some distance before melting, which may increase the effectiveness of the freshwater flux.

Depoorter et al. (2012) show that the proportion of calving varies strongly with location (see their Fig. 1). The Weddell and Ross Sea regions have large freshwater flux that is mainly icebergs. In contrast, the large Amundsen- Bellingshausen freshwater flux is mainly basal melt. This distinctive spatial variation may help account for observed sea ice increasing in the Weddell and Ross Seas, while decreasing in the Amundsen and Bellingshausen Seas. Note also that the Weddell Sea and Ross Sea sectors are respectively the regions where the EDML and TALDICE Antarctic ice cores

are suggestive of expanding sea ice (Masson-Delmotte et al., 2011) at end-Eemian time.

Observations and our model concur in showing a “global warming hole” near the southern tip of Greenland. Drijfhout et al. (2012) find this feature in most models and conclude that it is a precursor of a weakening AMOC. Freshwater injection in our model makes this feature stronger. We note that this feature creates a blocking situation (Fig. 13) that may have consequences such as directing winter cold air outbreaks southward in Eastern North America. This and possible influence on weather patterns in late spring that initiate melt season conditions should be investigated with models that include the most realistic distribution of Greenland freshwater input (e.g., Fig. 1 of Velicogna et al., 2014) as well as melt from ice shelves and small ice caps.

7.3 Ice sheet mass loss and sea level rise

The fundamental question we raise is whether ice sheet melt in response to rapid global warming will be nonlinear and better characterized by a doubling time for its rate of change or whether more linear processes dominate. Hansen (2005, 2007) argued on heuristic grounds that ice sheet disintegration is likely to be nonlinear if climate forcings continue to grow, and that sea level rise of several meters is possible on a time scale of the order of a century. Given current ice sheet melt rates, a 20 year doubling rate produces multi-meter sea level rise in a century, while 10 and 40 year doubling times require 50 and 200 years, respectively.

The IPCC (2013) report increased estimates of sea level rise compared to prior IPCC reports, but scenarios they discuss are close to linear responses to the assumed rising climate forcing. The most extreme climate forcing (RCP8.5, 936 ppm CO_2 in 2100 and GHG forcing $8.5\,W\,m^{-2}$) is estimated to produce 0.74 m sea level rise in 2100 relative to the 1986–2005 mean sea level, with the “likely” range of uncertainty 0.52–0.98 m. IPCC (2013) also discusses semi-empirical estimates of sea level rise, which yield ∼ 0.7–1.5 m for the RCP8.5 scenario, but preference is given to the model-based estimate of 0.52–0.98 m.

Empirical analyses are needed if we doubt the realism of ice sheet models, but semi-empirical analyses lumping multiple processes together may yield a result that is too linear. Sea level rises as a warming ocean expands, as water storage on continents changes (e.g., in aquifers and behind dams), and as glaciers, small ice caps, and the Greenland and Antarctic ice sheets melt. We must isolate the ice sheet contribution, because only the ice sheets threaten multi-meter sea level rise.

Hay et al. (2015) reanalyzed tide-gauge data for 1901–1990 in a probabilistic framework, including isostatic adjustment at each station, finding global sea level rise 1.2 ± 0.2 mm yr^{-1}. Prior tide gauge analyses of 1.6–1.9 mm yr^{-1} were inconsistent with estimates for each process, which did not add up to such a large value (IPCC, 2013). The reduced 20th century sea level rise alters perceptions of near-linear sea level rise (Fig. 13.3, IPCC, 2013). For example, Fig. 29 compares satellite altimetry data for 1993-2015 with 20th century sea level change, the latter obtained by multiplying a tide gauge analysis (Church and White, 2011) by the factor (0.78) required to yield sea level rise 1.2 mm yr^{-1} for 1901–1990. Different tide gauge analyses could alter the shape of this curve, but the trend toward earlier times must be toward zero due to near-constancy of millennial sea level (IPCC, 2013).

Figure 29 reveals an accelerating sea level rise, but it includes the effect of all processes affecting sea level and thus may understate the growth rate for ice sheet melt. Recent analysis of satellite gravity measurements (Velicogna et al., 2014) finds Greenland's mass loss in 2003–2013 to be 280 ± 58 Gt yr^{-1},[3] with mass loss accelerating by 25.4 ± 1.2 Gt yr^{-2}, and Antarctic mass loss 67 ± 44 Gt yr^{-1} accelerating by 11 ± 4 Gt yr^{-2} (Fig. S20). Their analysis, which is the source of the quantitative mass

[3]For comparison, our assumed freshwater injection of 360 Gt yr^{-1} in 2011 with 10 year doubling yields an average mass loss 292 Gt yr^{-1} for 2003–2013. Further, Velicogna et al. (2014) find an ice mass loss of 74 ± 7 Gt yr^{-1} from nearby Canadian glaciers and ice caps with acceleration 10 ± 2 Gt yr^{-2}, and there is an unknown freshwater input from melting ice shelves. Thus our assumed Northern Hemisphere meltwater was conservative.

changes in the remainder of this section, is especially useful because it breaks down the mass changes on Greenland and Antarctica into several regions.

Reliability of the inferred mass loss in 2003–2013 is supported by comparison to surface mass balance studies in regions with little contribution from ice dynamics (Velicogna et al., 2014). Mass loss accelerations over 1992–2011 obtained via the mass budget method (Rignot et al., 2011) for Greenland (21.9 ± 1 Gt yr^{-2}) and Antarctica (14.5 ± 2 Gt yr^{-2}) are similar to results from gravity analysis for 2003–2013. A third approach, based on satellite radar altimetry, is consistent with the other two for mass loss from Greenland and West Antarctica (Shepherd et al., 2012), including the Amundsen Sea sector, which is the dominant contributor to Antarctic ice mass loss (Sutterley et al., 2014). Differences among techniques exist in East Antarctica, but mass changes there are small (Shepherd et al., 2012).

Mass loss acceleration for Greenland implies a doubling time of order 10 years, but this high rate may not continue. Greenland mass loss in 2003–2013 was affected by a tendency in 2007–2012 for summer high pressure over Greenland that contributed to melt acceleration (Fettweis, 2013; Bellflamme et al., 2015), especially in 2012 (Hanna et al., 2013). Extreme 2012 melt was associated an "atmospheric river" of warm moist air (Neff et al., 2014), a rare meteorological situation not representative of near-term expectations. Yet extreme events are a combination of slow climate change and infrequent weather patterns, and additional and more summer extreme events can be anticipated if global warming continues (Hansen et al., 2012).

The Antarctic situation, in contrast, is more threatening than suggested by continental mass loss. Net mass loss combines mass loss via ice streams and regions of net snow accumulation. Queen Maud Land is gaining 63 ± 6 Gt yr^{-1}, accelerating 15 ± 1 Gt yr^{-2}, but this mass gain may be temporary. Our simulations with increasing freshwater input indicate that circum-Antarctic cooling and sea ice increase eventually will limit precipitation reaching the continent.

Amundsen Sea glaciers are a gateway to West Antarctic ice with potential for several meters of sea level. Mass loss of the Amundsen Sea sector was 116 ± 6 Gt yr^{-1} in

2003–2013, growing 13 ± 2 Gt yr^{-2} (Velicogna et al., 2014; Rignot et al., 2014; Sutterley et al., 2014).

Totten glacier in East Antarctica fronts the Aurora Subglacial Basin, which has the potential for ~ 6.7 m of sea level (Greenbaum et al., 2015). Williams et al. (2011) find that warm modified Circumpolar Deep Water is penetrating the continental shelf near Totten beneath colder surface layers. Details of how warmer water reaches the ice shelf are uncertain (Khazendar et al., 2013), but, as in West Antarctica, the inland sloping trough connecting the ocean with the main ice shelf cavity (Greenbaum et al., 2015) makes Totten glacier susceptible to unstable retreat (Goldberg et al., 2009). Cook glacier, further east in East Antarctica, also rests on a submarine inland-sloping bed and fronts ice equivalent to 3–4 m of sea level. The Velicogna et al. (2014) analysis of gravity data for 2003–2013 finds the Totten sector of East Antarctica losing 17 ± 4 Gt yr^{-1}, with the loss accelerating by 4 ± 1 Gt yr^{-2}, and the Victoria/Wilkes sector including Cook glacier losing 16 ± 5 Gt yr^{-1}, with a small deceleration (2 ± 1 Gt yr^{-2}).

Ice mass losses from Greenland, West Antarctica and Totten/Aurora basin in East Antarctica are growing nonlinearly with doubling times of order 10 years. Continued exponential growth at that rate seems unlikely for Greenland, and reduced mass loss in the past two years (Fig. S20) is consistent with a slower growth of the mass loss rate for Greenland. However, if GHGs continue to grow, the amplifying feedbacks in the Southern Ocean, including expanded sea ice and SMOC slowdown likely will continue to grow and facilitate increasing Antarctic mass loss.

7.4 The Anthropocene

The Anthropocene (Crutzen and Stoermer, 2000), the era in which humans have contributed to global climate change, is usually assumed to have begun in the past few centuries. Ruddiman (2003) suggested that it began earlier, with deforestation affecting CO_2 about 8000 years ago. Southern Ocean feedbacks considered in our present paper are relevant to that discussion.

Ruddiman (2003) assumed that 40 ppm of human-made CO_2 was needed to explain a 20 ppm CO_2 increase in the Holocene (Fig. 24c), because CO_2 decreased ~ 20 ppm, on average, during several prior interglacials. Such a large human source should have left an imprint on $\delta^{13}CO_2$ that is not observed in ice core CO_2 (Elsig et al., 2009). Ruddiman (2013) suggests that ^{13}C was taken up in peat formation, but the required peat formation would be large and no persuasive evidence has been presented to support such a dominant role for peat in the glacial carbon cycle.

We suggest that Ruddiman overestimated the anthropogenic CO_2 needed to prevent decline of Antarctic temperature. The CO_2 decline in interglacial periods is a climate feedback: declining Southern Ocean temperature slows the ventilation of the deep ocean, thus sequestering CO_2. Avoidance of the cooling and CO_2 decline requires only human-made CO_2 forcing large enough to counteract the weak natural forcing trend, not the larger feedback-driven CO_2 changes in prior interglacials, because, if the natural forcings are counteracted, the feedback does not occur. The required human-made contribution to atmospheric CO_2 would seem to be at most ~ 20 ppm, but less if human-made CO_2 increased deep ocean ventilation. The smaller requirement on the human source and the low $\delta^{13}C$ content of deep-ocean CO_2 make the Ruddiman hypothesis more plausible, but recent carbon cycle models (Kleinen et al., 2015) have been able to capture CO_2 changes in the Holocene and earlier interglacials without an anthropogenic source.

Even if the Anthropocene began millennia ago, a fundamentally different phase, a Hyper-Anthropocene, was initiated by explosive 20th century growth of fossil fuel use. Human-made climate forcings now overwhelm natural forcings. CO_2, at 400 ppm in 2015, is off the scale in Fig. 24c. CO_2 climate forcing is a reasonable approximation of the net human forcing, because forcing by other GHGs tends to offset negative human forcings, mainly aerosols (IPCC, 2013). Most of the forcing growth occurred in the past several decades, and two-thirds of the 0.9 °C global warming (since 1850) has occurred since 1975 (update of Hansen et al., 2010, available at http://www.columbia.edu/~mhs119/Temperature/).

Our analysis paints a different picture than IPCC (2013) for how this Hyper-Anthropocene phase is likely to proceed if GHG emissions grow at a rate that continues to pump energy at a high rate into the ocean. We conclude that multi-meter sea level rise would become practically unavoidable. Social disruption and economic consequences of such large sea level rise could be devastating. It is not difficult to imagine that conflicts arising from forced migrations and economic collapse might make the planet ungovernable, threatening the fabric of civilization.

This image of our planet with accelerating meltwater includes growing climate chaos and storminess, as meltwater causes cooling around Antarctica and in the North Atlantic while the tropics and subtropics continue to warm. Rising seas and more powerful storms together are especially threatening, providing strong incentive to phase down CO_2 emissions rapidly.

8 Summary implications

Humanity faces near certainty of eventual sea level rise of at least Eemian proportions, 5–9 m, if fossil fuel emissions continue on a business-as-usual course, e.g., IPCC scenario A1B that has $CO_2 \sim 700$ ppm in 2100 (Fig. S21). It is unlikely that coastal cities or low-lying areas such as Bangladesh, European lowlands, and large portions of the United States eastern coast and northeast China plains (Fig. S22) could be protected against such large sea level rise.

Rapid large sea level rise may begin sooner than generally assumed. Amplifying feedbacks, including slowdown of SMOC and cooling of the near-Antarctic ocean surface with increasing sea ice, may spur nonlinear growth of Antarctic ice sheet mass loss. Deep submarine valleys in West Antarctica and the Wilkes Basin of East Antarctica, each with access to ice amounting to several meters of sea level, provide gateways to the ocean. If the Southern Ocean forcing (subsurface warming) of the Antarctic ice sheets continues to grow, it likely will become impossible to avoid sea level rise of several meters, with the largest uncertainty being how rapidly it will occur.

The Greenland ice sheet does not have as much ice subject to rapid nonlinear disintegration, so the speed at which it adds to 21st century sea level rise may be limited. However, even a slower Greenland ice sheet response is expected to be faster than carbon cycle or ocean thermal recovery times. Therefore, if climate forcing continues to grow rapidly, amplifying feedbacks will assure large eventual mass loss. Also with present growth of freshwater injection from Greenland, in combination with increasing North Atlantic precipitation, we already may be on the verge of substantial North Atlantic climate disruption.

Storms conjoin with sea level rise to cause the most devastating coastal damage. End-Eemian and projected 21st century conditions are similar in having warm tropics and increased freshwater injection. Our simulations imply increasing storm strengths for such situations, as a stronger temperature gradient caused by ice melt increases baroclinicity and provides energy for more severe weather events. A strengthened Bermuda High in the warm season increases prevailing northeasterlies that can help account for stronger end-Eemian storms. Weakened cold season sea level pressure south of Greenland favors occurrence of atmospheric blocking that can increase wintertime Arctic cold air intrusions into northern midlatitudes.

Effects of freshwater injection and resulting ocean stratification are occurring sooner in the real world than in our model. We suggest that this is an effect of excessive small scale mixing in our model that limits stratification, a problem that may exist in other models (Hansen et al., 2011). We encourage similar simulations with other models, with special attention to the model's ability to maintain realistic stratification and perturbations. This issue may be addressed in our model with increased vertical resolution, more accurate finite differencing method in ocean dynamics that reduces noise, and use of a smaller background diffusivity.

There are many other practical impacts of continued high fossil fuel emissions via climate change and ocean acidification, including irreplaceable loss of many species, as reviewed elsewhere (IPCC, 2013, 2014; Hansen et al., 2013a). However, sea level rise sets the lowest limit on allowable human-made climate forcing and CO_2, because of the

extreme sensitivity of sea level to ocean warming and the devastating economic and humanitarian impacts of a multi-meter sea level rise. Ice sheet response time is shorter than the time for natural geologic processes to remove CO_2 from the climate system, so there is no morally defensible excuse to delay phase-out of fossil fuel emissions as rapidly as possible.

We conclude that the 2 °C global warming "guardrail", affirmed in the Copenhagen Accord (2009), does not provide safety, as such warming would likely yield sea level rise of several meters along with numerous other severely disruptive consequences for human society and ecosystems. The Eemian, less than 2 °C warmer than pre-industrial Earth, itself provides a clear indication of the danger, even though the orbital drive for Eemian warming differed from today's human-made climate forcing. Ongoing changes in the Southern Ocean, while global warming is less than 1 °C, provide a strong warning, as observed changes tend to confirm the mechanisms amplifying change. Predicted effects, such as cooling of the surface ocean around Antarctica, are occurring even faster than modeled.

Our finding of global cooling from ice melt calls into question whether global temperature is the most fundamental metric for global climate in the 21st century. The first order requirement to stabilize climate is to remove Earth's energy imbalance, which is now about $+0.6\,W\,m^{-2}$, more energy coming in than going out. If other forcings are unchanged, removing this imbalance requires reducing atmospheric CO_2 from ~400 to ~350 ppm (Hansen et al., 2008, 2013a).

The message that the climate science delivers to policymakers, instead of defining a safe "guardrail", is that fossil fuel CO_2 emissions must be reduced as rapidly as practical. Hansen et al. (2013a) conclude that this implies a need for a rising carbon fee or tax, an approach that has the potential to be near-global, as opposed to national caps or goals for emission reductions. Although a carbon fee is the sine qua non for phasing out emissions, the urgency of slowing emissions also implies other needs including widespread technical cooperation in clean energy technologies (Hansen et al., 2013a).

The task of achieving a reduction of atmospheric CO_2 is formidable, but not impossible. Rapid transition to abundant affordable carbon-free electricity is the core requirement, as that would also permit production of net-zero-carbon liquid fuels from electricity. The rate at which CO_2 emissions must be reduced is about $6\,\%\,yr^{-1}$ to reach 350 ppm atmospheric CO_2 by about 2100, under the assumption that improved agricultural and forestry practices could sequester 100 GtC (Hansen et al., 2013a). The amount of CO_2 fossil fuel emissions taken up by the ocean, soil and biosphere has continued to increase (Fig. S23), thus providing hope that it may be possible to sequester more than 100 GtC. Improved understanding of the carbon cycle and non-CO_2 forcings are needed, but it is clear that the essential requirement is to begin to phase down fossil fuel CO_2 emissions rapidly. It is also clear that continued high emissions are likely to lock-in continued global energy imbalance, ocean warming, ice sheet disintegration, and large sea level rise, which young people and future generations would not be able to avoid. Given the inertia of the climate and energy systems, and the grave threat posed by continued high emissions, the matter is urgent and calls for emergency cooperation among nations.

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Figure 1. Two boulders (#1 and #2 of Hearty, 1997) on coastal ridge of North Eleuthera Island, Bahamas. Scale: person in both photos = 1.6 m. Estimated weight of largest boulder (#1, on left) is ~2300 tons.

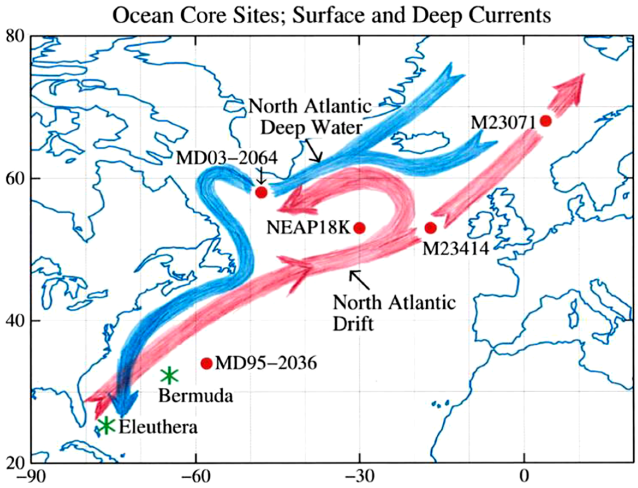

Figure 2. Ocean and ice core sites and simplified sketch of upper ocean North Atlantic Current and North Atlantic Deep Water return flow. In interglacial periods the North Atlantic Current extends further north, allowing the Greenland-Iceland-Norwegian Sea to become an important source of deepwater formation.

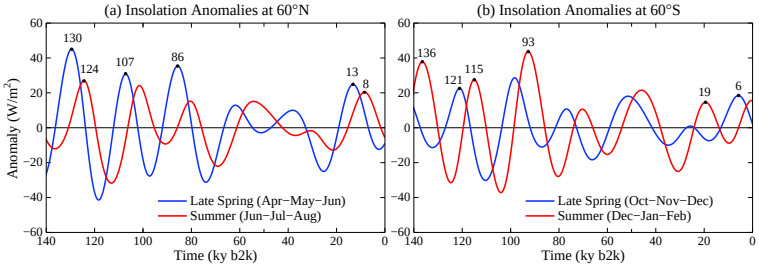

Figure 3. Summer (Jun–Jul–Aug) and late spring (Apr–May–Jun) insolation anomalies at 60° N and summer (Dec–Jan–Feb) and late spring (Oct–Nov–Dec) anomalies at 60° S.

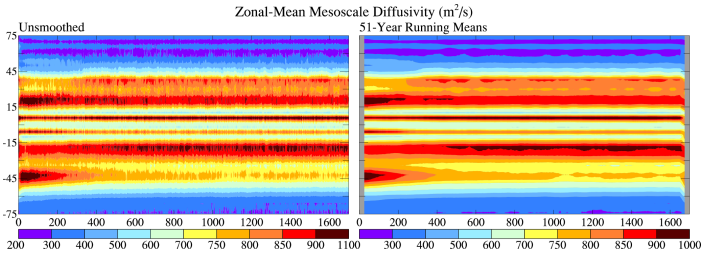

Figure 4. Control run zonal-mean mesoscale diffusivity versus time in 1700 year control run.

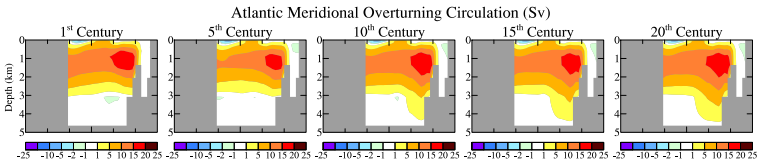

Figure 5. Atlantic Ocean mass stream function for the control run in its 1st, 5th, 10th, 15th and 20th centuries.

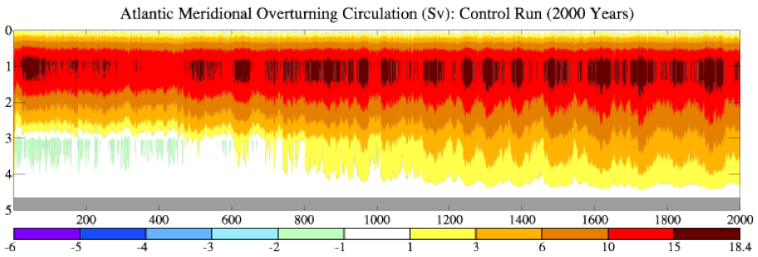

Figure 6. Annual mean Atlantic Ocean mass stream function at 28° N in the model control run.

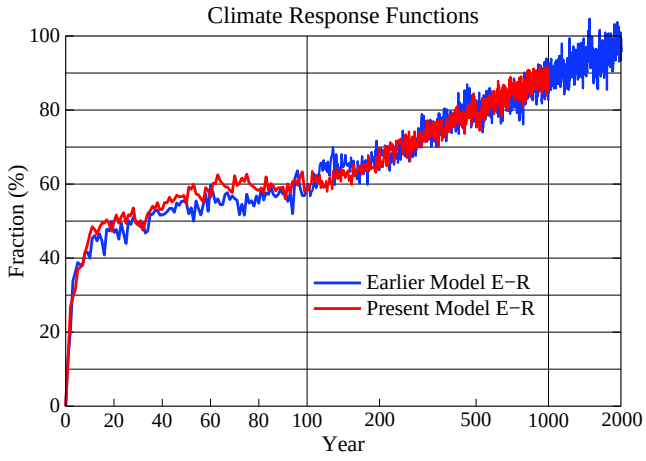

Figure 7. Climate response function, $R(t)$, i.e., the fraction of equilibriums surface temperature response for GISS model E-R based on a 2000 year control run (Hansen et al., 2007a). Forcing was instant CO_2 doubling with fixed ice sheets, vegetation distribution, and other long-lived GHGs.

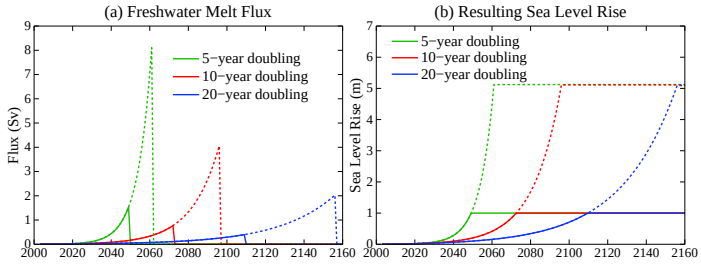

Figure 8. (a) total fresh water flux added in North Atlantic and Southern Oceans, **(b)** resulting sea level rise. Solid lines for 1 m sea level rise, dotted for 5 m. One Sverdrup (Sv) is $10^6\,m^3\,s^{-1}$, which is $\sim 3 \times 10^4\,Gt\,yr^{-1}$.

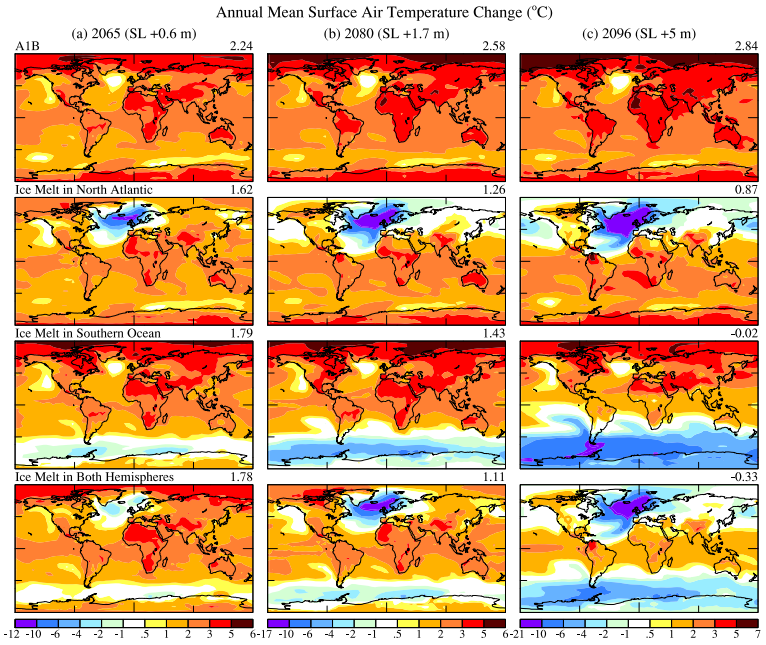

Figure 9. Surface air temperature relative to 1880–1920 in **(a)** 2065, **(b)** 2080, and **(c)** 2096. Top row is IPCC scenario A1B. Ice melt with 10 year doubling is added in other scenarios.

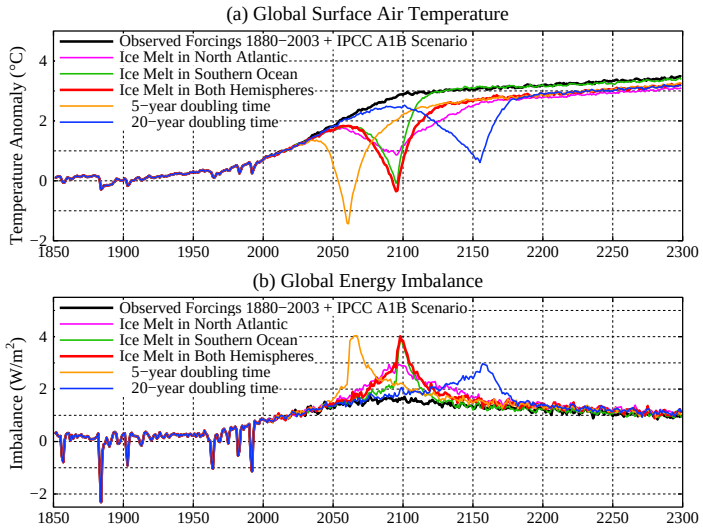

Figure 10. (a) Surface air temperature relative to 1880–1920 for several scenarios. **(b)** Global energy imbalance for the same scenarios.

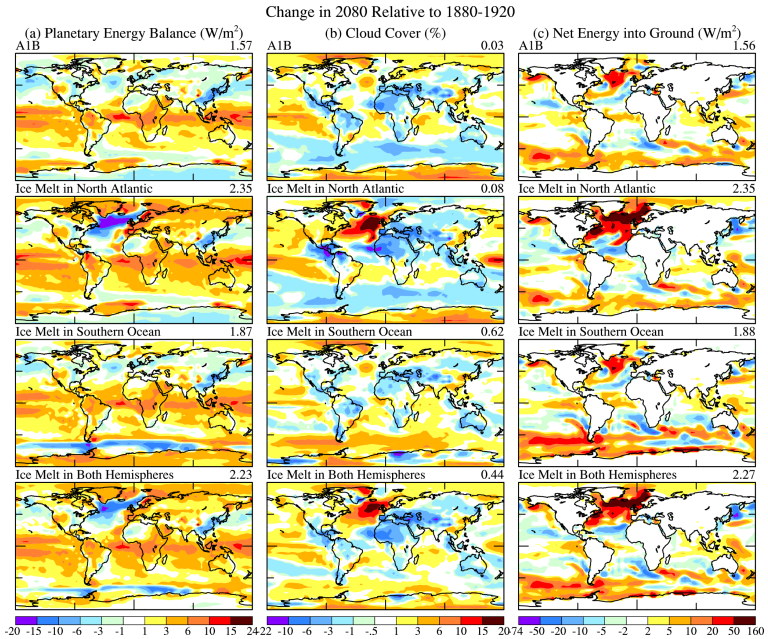

Figure 11. Change in 2078–2082, relative to 1880–1920, of the annual mean **(a)** planetary energy balance, **(b)** cloud cover, and **(c)** net energy into the ground, for the same four scenarios as in Fig. 9.

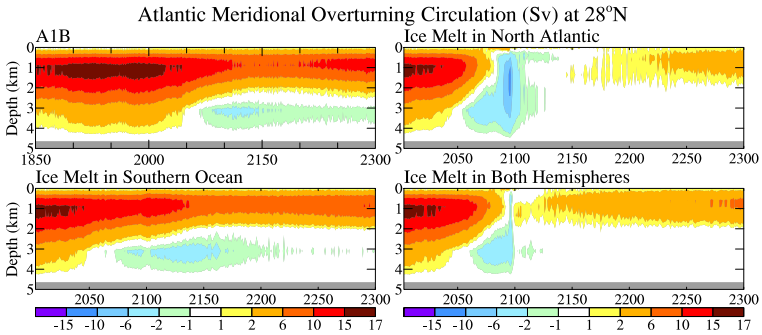

Figure 12. Ensemble-mean AMOC at 28° N versus time for the same four scenarios as in Fig. 9, with ice melt reaching 5 m at the end of the 21st century in the three experiments with ice melt.

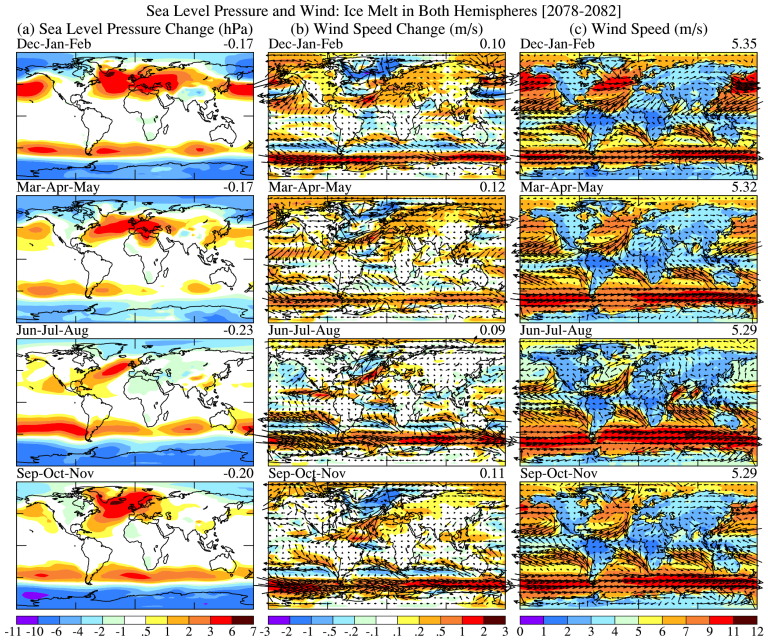

Figure 13. Change of seasonal mean **(a)** sea level pressure and **(b)** wind speed in 2078–2082 relative to 1880–1920, and **(c)** the wind speed itself, all for the scenario with ice melt in both hemispheres.

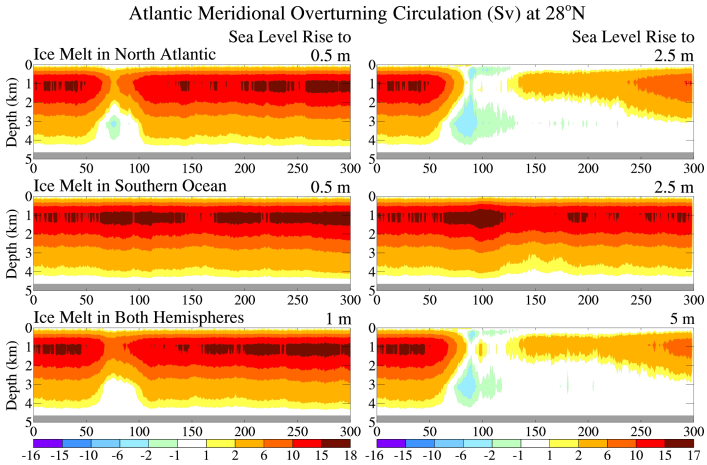

Figure 14. Ensemble-mean AMOC at 28° N versus time for six pure freshwater forcing experiments.

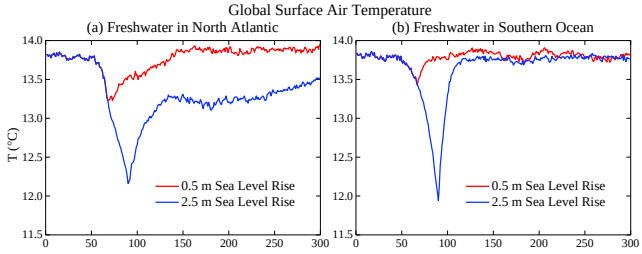

Figure 15. Ensemble-mean global surface air temperature for experiments (years on *x* axis) with freshwater forcing in either the North Atlantic Ocean (left) or the Southern Ocean (right).

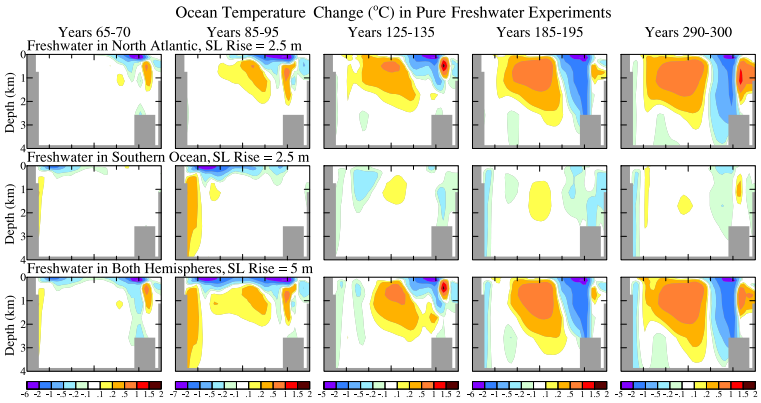

Figure 16. Change of ocean temperature relative to control run due to freshwater input that reaches 2.5 m of global sea level in a hemisphere (thus 5 m sea level rise in the bottom row).

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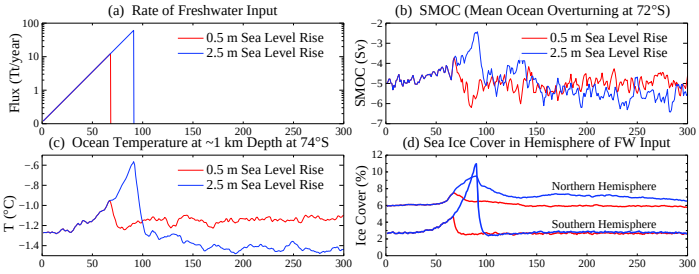

Figure 17. (a) Freshwater input to Southern Ocean (1 Tt = 1000 $km^3\,yr^{-1}$). **(b, c, d)** Simulated overturning strength (Sv) of AABW cell at 72° S, temperature at depth 1.13 km at 74° S, and hemispheric sea ice cover.

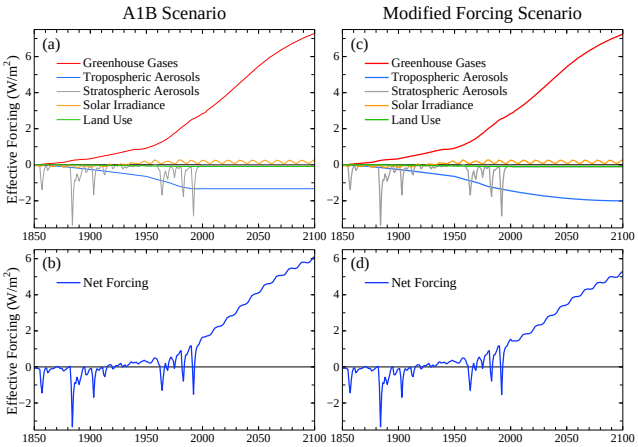

Figure 18. Effective global climate forcings in our climate simulations relative to values in 1850.

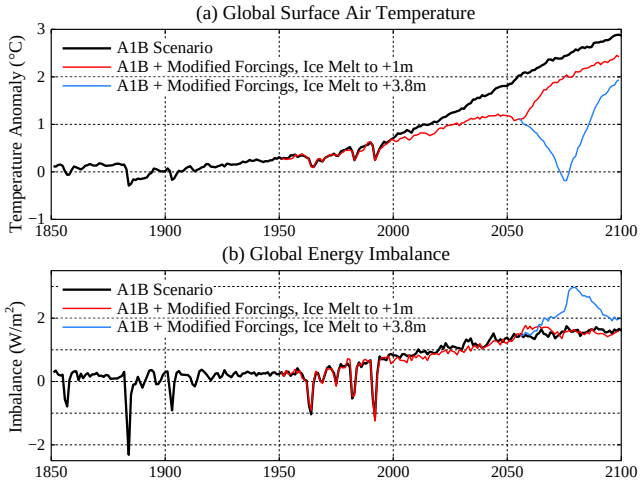

Figure 19. Surface air temperature change relative to 1880–1920 **(a)** and global energy imbalance **(b)** for the modified forcing scenario including cases with global ice melt allowed to reach 1 and 3.8 m.

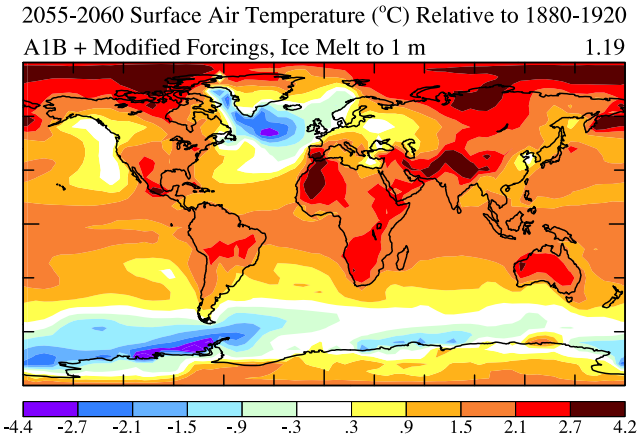

Figure 20. Surface air temperature change relative to 1880–1920 in 2055–2060 with the modified forcings.

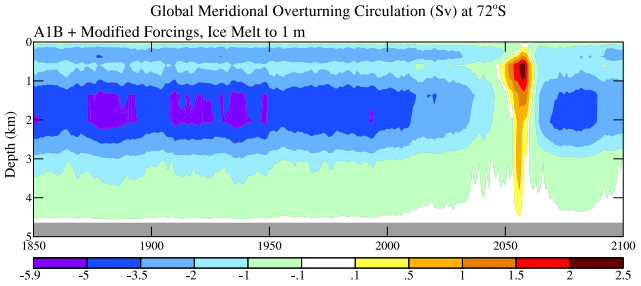

Figure 21. SMOC, ocean overturning strength at 72° S, including only the mean (Eularian) transport (Sect. 4.5). This is the average of a 5-member model ensemble for the modified forcing including advanced ice melt (720 Gt yr^{-1} from Antarctica in 2011) and 10 year doubling.

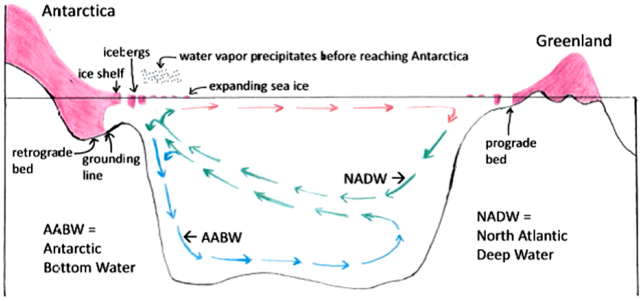

Figure 22. Schematic of stratification and precipitation amplifying feedbacks. Stratification: increased freshwater/iceberg flux increases ocean vertical stratification, reduces AABW formation, traps NADW heat, thus increasing ice shelf melting. Precipitation: increased freshwater/iceberg flux cools ocean mixed layer, increases sea ice area, causing increase of precipitation that falls before it reaches Antarctica, adding to ocean surface freshening and reducing ice sheet growth. A substantial amount of ice in West Antarctica and the Wilkes Basin, East Antarctica is vulnerable because of the reduced stability of retrograde beds.

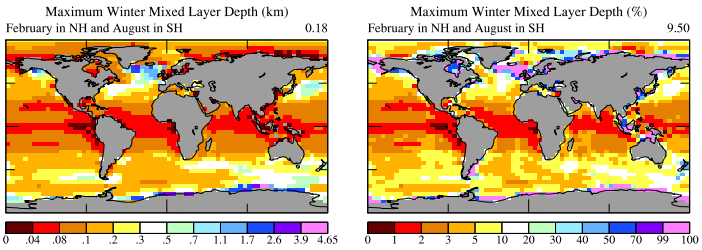

Figure 23. Maximum mixed layer depth (in km, left, and % of ocean depth, right) in February (Northern Hemisphere) and August (Southern Hemisphere) using the mixed layer definition of Heuze et al. (2013).

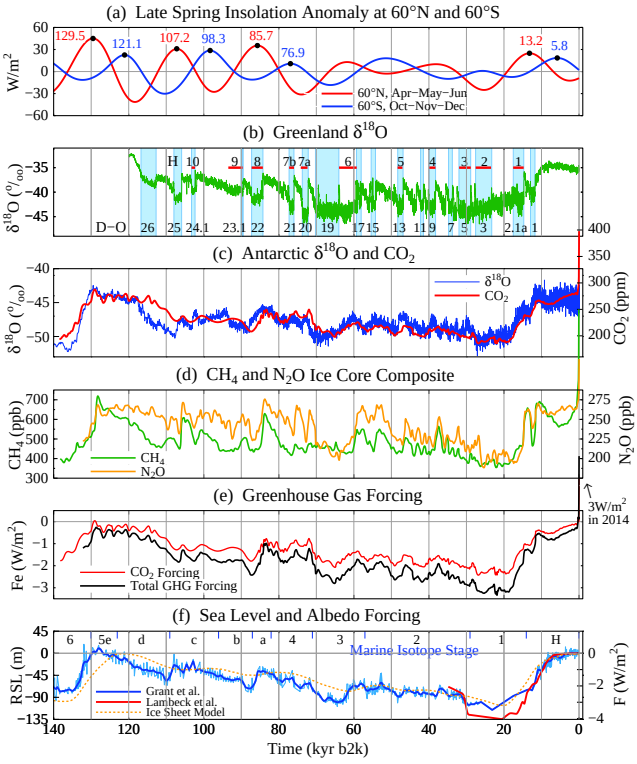

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Figure 24. (a) Late spring insolation anomalies relative to the mean for the past million years, **(b)** $\delta^{18}O_{ice}$ of composite Greenland ice cores (Rassmussen et al., 2014) with Heinrich events of Guillevic et al. (2014), **(c, d)** $\delta^{18}O_{ice}$ of EDML Antarctic ice core (Ruth et al., 2007), multi-ice core CO_2, CH_4, and N_2O based on spline fit with 1000 year cut-off (Schilt et al., 2010), scales are such that CO_2 and $\delta^{18}O$ means coincide and standard deviations have the same magnitude, **(e)** GHG forcings from equations in Table 1 of Hansen et al. (2000), but with the CO_2, CH_4, and N_2O forcings multiplied by factors 1.024, 1.60, and 1.074, respectively, to account for each forcing's "efficacy" (Hansen et al., 2005), with CH_4 including factor 1.4 to account for indirect effect on ozone and stratospheric water vapor, **(f)** sea level data from Grant et al. (2012) and Lambeck et al. (2014) and ice sheet model results from de Boer et al. (2010). Marine isotope stage boundaries from Lisiecki and Raymo (2005). **(b–e)** are on AICC2012 time scale (Bazin et al., 2013),

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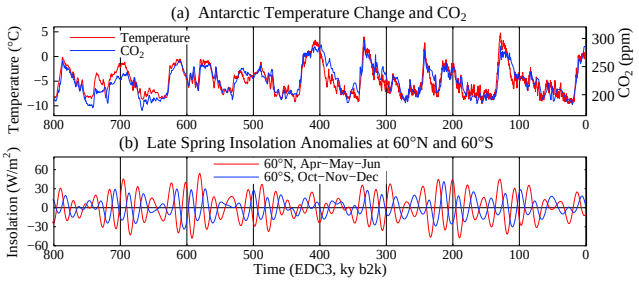

Figure 25. (a) Antarctic (Dome C) temperature relative to last 10 ky (Jouzel et al., 2007) on AICC2012 time scale and CO_2 amount (Luthi et al., 2008). Temperature scale is such that standard deviation of T and CO_2 are equal, yielding ΔT (°C) = 0.114 ΔCO_2 (ppm), **(b)** Late Spring insolation anomalies at 60° N and 60° S.

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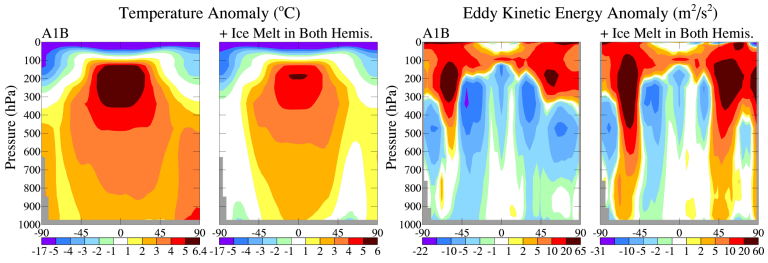

Figure 26. Simulated zonal mean temperature and eddy kinetic energy in 2078–2082 relative to 1880–1920 base period for A1B scenario and A1B plus 2.5 m ice melt in each hemisphere (simulations of Sect. 3).

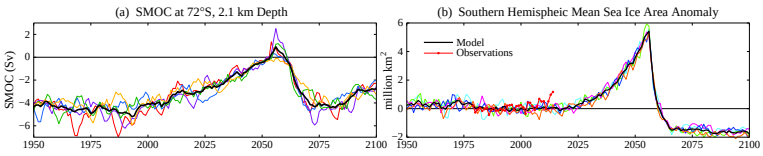

Figure 27. (a) SMOC, the global meridional overturning circulation at 72° S, in climate model runs including freshwater injection around Antarctica at a rate 720 Gt yr^{-1} in 2011, increasing with a 10 year doubling time, and half that amount around Greenland. SMOC diagnostic includes only the mean (Eulerian) term. **(b)** Annual-mean Southern Hemisphere sea ice area anomaly (relative to 1979–2000) in the five runs.

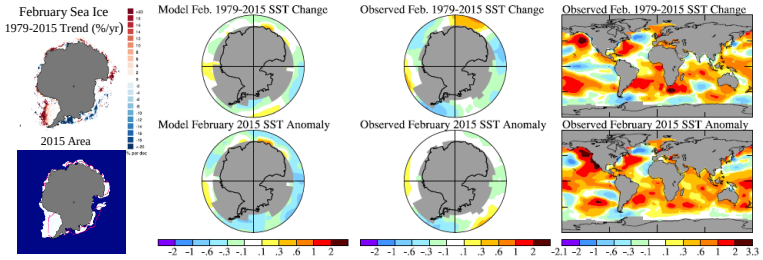

Figure 28. Observed February sea ice extent (left); modeled and observed SST near Antarctica and global. Upper: 1979–2015 change based on local linear trend. Lower: 2015 anomaly relative to 1951–1980. Sea ice data is update of Fetterer et al. (2002), temperature data is update of Hansen et al. (2010).

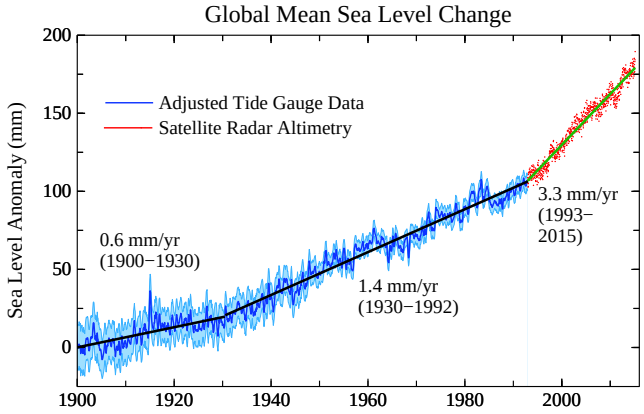

Figure 29. Sea level change based on satellite altimetry data (Nerem et al., 2010, updated at http://sealevel.colorado.edu) and tide gauge data (Church and White, 2011) with the latter change rate multiplied by 0.78, as required to yield a mean 1901–1990 change rate 1.2 mm yr^{-1} (Hay et al., 2015).

Exhibit 3

District court's opinion and order granting leave to amend,
ECF No. 540 (June 1, 2023)

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

EUGENE DIVISION

KELSEY CASCADIA ROSE JULIANA, *et al.*,

Plaintiffs,

v.

UNITED STATES OF AMERICA, *et al.*,

Defendants.

Civ. No. 6:15-cv-01517-AA

OPINION AND ORDER

AIKEN, District Judge:

In this civil rights action, plaintiffs—a group of young people between the ages of eight and nineteen when this lawsuit was filed and "future generations" through their guardian Dr. James Hansen—allege injury from the devastation of climate change and contend that the Constitution guarantees the right to a stable climate system capable of sustaining human life. Plaintiffs maintain that federal defendants have continued to permit, authorize, and subsidize fossil fuel extraction and consumption, despite knowledge that those actions cause catastrophic global warming. This case returns to this Court on remand from the Ninth Circuit Court of Appeals, where plaintiffs demonstrated their "injury in fact" was "fairly traceable" to federal defendants' actions—two of three requirements necessary to establish

standing under Article III. However, the Ninth Circuit reversed with instructions to dismiss plaintiffs' case, holding that plaintiffs failed to demonstrate "redressability"—the third, final requirement to establish Article III standing. The Ninth Circuit determined that plaintiffs did not "surmount the remaining hurdle" to prove that the relief they seek is within the power of an Article III court to provide. *Juliana v. United States*, 947 F.3d 1159, 1171 (9th Cir. 2020). After that court's decision, plaintiffs moved to amend, notifying this Court of an intervening change in controlling law, *Uzuegbunam v. Preczewski*, ___U.S.___, 141 S. Ct. 792 (2021), asserting abrogation of the Ninth Circuit's ruling on redressability. Now, plaintiffs contend that permitting amendment will allow plaintiffs to clear the hurdle the Ninth Circuit identified, so that the case may proceed to a decision on the merits. For the reasons explained, this Court grants plaintiffs' motion for leave to file a second amended complaint. (Doc. 462).

BACKGROUND

In August 2015, plaintiffs brought this action asserting that the federal government has known for decades that carbon dioxide pollution was causing catastrophic climate change and that large-scale emission reduction was necessary to protect plaintiffs' constitutional right to a climate system capable of sustaining human life. (Doc. 7 at 51). As the Ninth Circuit recognized, plaintiffs provided compelling evidence, largely undisputed by federal defendants, that "leaves little basis for denying that climate change is occurring at an increasingly rapid pace." *Juliana*, 947 F.3d at 1166. The substantial evidentiary record supports that since the dawn of the Industrial Age, atmospheric carbon dioxide has "skyrocketed to levels

not seen for almost three million years," with an astonishingly rapid increase in the last forty years. *Id*. at 1166. The Ninth Circuit summarized what plaintiffs' expert evidence establishes: that this unprecedented rise stems from fossil fuel combustion and will "wreak havoc on the Earth's climate if unchecked." *Id*. The problem is approaching "the point of no return," the court stated, finding that the record conclusively demonstrated that the federal government has long understood the risks of fossil fuel use. *See id*. (cataloguing, as early as 1965, urgent warnings and reports from government officials imploring swift nationwide action to reduce carbon emissions before it was too late).

In their first amended complaint, filed in the District Court for the District of Oregon, plaintiffs alleged violations of their substantive rights under the Due Process Clause of the Fifth Amendment; the Fifth Amendment right to equal protection of the law; the Ninth Amendment; and the public trust doctrine. (Doc. 7). Plaintiffs also sought several forms of declaratory relief and an injunction ordering federal defendants to implement a plan to "phase out fossil fuel emissions and draw down excess atmospheric [carbon dioxide]." *Id*. at 94-95.

Federal defendants moved to dismiss for lack of standing, failure to state a cognizable constitutional claim, and failure to state a claim on a public trust theory. (Doc. 27). Adopting the findings and recommendation of Federal Magistrate Judge Thomas Coffin, this Court denied federal defendants' motion, concluding that plaintiffs had standing to sue, raised justiciable questions, and had stated a claim for infringement of a Fifth Amendment due process right:

> In this opinion, this Court simply holds that where a complaint alleges governmental action is affirmatively and substantially damaging the climate system in a way that will cause human deaths, shorten human lifespans, result in widespread damage to property, threaten human food sources, and dramatically alter the planet's ecosystem, it states a claim for a due process violation[.] To hold otherwise would be to say that the Constitution affords no protection against a government's knowing decision to poison the air its citizens breathe or the water its citizens drink. Plaintiffs have adequately alleged infringement of a fundamental right.

Juliana v. United States, 217 F. Supp. 3d 1224, 1250 (D. Or. 2016), *rev'd and remanded*, 947 F.3d 1159 (9th Cir. 2020).

At that stage of litigation, this Court also determined that plaintiffs had stated a viable due process claim arising from federal defendants' failure to regulate third-party emissions and had stated a public trust claim grounded in the Fifth and the Ninth Amendments. *Id*. at 1252, 1259.

Federal defendants moved to certify to the Ninth Circuit for interlocutory appeal[1] this Court's order denying federal defendants' motion to dismiss. Doc. 120. This Court denied the motion to certify. (Doc. 172). Federal defendants petitioned the Ninth Circuit for Writ of Mandamus, contending that this Court's opinion and order denying their motion to dismiss was based on clear error. (Doc. 177). The Ninth Circuit denied the petition, concluding mandamus relief was unwarranted at that stage of litigation, when plaintiffs' claims could be "narrowed" in further proceedings. *See In re United States*, 884 F.3d 830, 833 (9th Cir. 2018).

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[1] A request for permissive interlocutory appeal is governed by 28 U.S.C. § 1292(b), which permits a district court to certify an interlocutory order for immediate appeal if the court is of the opinion that such order: (1) involves a controlling question of law; (2) as to which there is substantial ground for difference of opinion; and (3) that an immediate appeal from the order may materially advance the ultimate termination of the litigation.

Federal defendants then filed several motions so aimed at narrowing plaintiffs' claims, including motions for judgment on the pleadings, doc. 195; a protective order barring discovery, doc. 196; and for summary judgment, doc. 207. This Court denied defendants' motion for a protective order. (Doc. 212). But this Court granted in part and denied in part federal defendants' motions for judgment on the pleadings and for summary judgment, dismissing plaintiffs' Ninth Amendment claim, dismissing the President as a defendant, and narrowing plaintiffs' equal protection claim to a fundamental rights theory. *Juliana v. United States*, 339 F. Supp. 3d 1062 1103 (D. Or. 2018), *rev'd and remanded*, 947 F.3d 1159 (9th Cir. 2020).

Federal defendants unsuccessfully petitioned for mandamus in the Ninth Circuit and twice sought, and were twice denied, a stay of proceedings by the United States Supreme Court. Ultimately, the Ninth Circuit, on November 8, 2018, issued an order inviting this Court to certify for interlocutory review its orders on federal defendants' dispositive motions. *United States v. U.S. Dist. Court for the Dist.* of Or., No. 18-73014. Shortly thereafter, the Ninth Circuit granted federal defendants' petition to appeal.

On interlocutory appeal of this Court's certified orders denying federal defendants' motions for dismissal, judgment on the pleadings, and summary judgment, the Ninth Circuit agreed with this Court's determination that plaintiffs had presented adequate evidence at the pre-trial stage to show particularized, concrete injuries to legally protected interests. That court recounted evidence that one plaintiff was "forced to leave her home because of water scarcity, separating her from relatives on the Navajo Reservation[,]" and another "had to evacuate his coastal

home multiple times because of flooding." *Id*. at 1168. The Ninth Circuit also determined that this Court correctly found plaintiffs had presented sufficient evidence that their alleged injuries are fairly traceable to federal defendants' conduct, citing among its findings that plaintiffs' injuries "are caused by carbon emissions from fossil fuel production, extraction, and transportation" and that federal subsidies "have increased those emissions," with about 25% of fossil fuels extracted in the United States "coming from federal waters and lands," an activity requiring federal government authorization. *Id*. at 1169. The court held, however reluctantly, that plaintiffs failed to show their alleged injuries were substantially likely to be redressed by any order from an Article III court and that plaintiffs therefore lacked standing to bring suit. *Id*. at 1171.

In so holding, the court stated, "There is much to recommend the adoption of a comprehensive scheme to decrease fossil fuel emissions and combat climate change, both as a policy matter in general and a matter of national survival in particular," however, such was "beyond the power of an Article III court to order, design, supervise, or implement." *Id*. at 1171. Ultimately, based on its redressability holding alone, the Ninth Circuit reversed the certified orders of this Court and remanded the case with instructions to dismiss for lack of Article III standing. *Id*. at 1175.

After the Ninth Circuit issued its interlocutory opinion, plaintiffs notified this Court of what they identified as an intervening case in the United States Supreme Court which held that the award of nominal damages was "a form of declaratory relief in a legal system with no general declaratory judgment act" and that a "request for nominal damages alone satisfies the redressability element of standing where a

plaintiff's claim is based on a completed violation of a legal right." *Uzuegbunam*, 141 S. Ct. at 798, 802. Writing for the majority, Justice Thomas explained that, even where a single dollar cannot provide full redress, the ability "to effectuate a *partial remedy*" satisfies the redressability requirement. *Id.* at 801 (quoting *Church of Scientology of Cal. v. United States*, 506 U.S. 9, 13 (1992) (emphasis added).

Plaintiffs contend that the Supreme Court's holding constitutes—as Chief Justice Roberts noted in his dissent—an "expansion of the judicial power" under Article III. *Uzuegbunam*, 141 S. Ct. at 806 (Roberts, C. J. dissenting). According to plaintiffs, the Ninth Circuit was skeptical, but did not decide whether declaratory relief alone would satisfy redressability, where such relief only partially redresses injury. Plaintiffs assert that they should be granted leave to amend to replead factual allegations demonstrating that relief under the under the Declaratory Judgment Act, 28 U.S.C. § 2201, is sufficient to allege redressability, even where a declaration effectuates a partial remedy, as stated in *Uzuegbunam,* which the Ninth Circuit did not have the chance to consider.

LEGAL STANDARD

Federal Rule of Civil Procedure Rule 15 allows a party to amend its pleading "with the opposing party's written consent or the court's leave." The rule instructs that "[t]he court should freely give leave when justice so requires." Fed. R. Civ. P. 15(a)(2). Trial courts have discretion in deciding whether to grant leave to amend, but "[i]n exercising this discretion, a court must be guided by the underlying purpose of Rule 15 to facilitate decision on the merits, rather than on the pleadings or technicalities." *United States v. Webb*, 655 F.2d 977, 979 (9th Cir. 1981) (citing *Conley*

v. Gibson, 355 U.S. 41, 47-48 (1957)). The judicial policy of Rule 15 favoring amendments should be applied with "extreme liberality." *Id.* (citing *Rosenberg Brothers & Co. v. Arnold*, 283 F.2d 406 (9th Cir. 1960) (per curiam). Leave to amend should be granted freely "even if a plaintiff's claims have previously been dismissed." *Hampton v. Steen*, No. 2:12-CV-00470-AA, 2017 WL 11573592, at *2 (D. Or. Nov. 13, 2017) (citing *Lipton v. Pathogenesis Corp.*, 284 F.3d 1027, 1039 (9th Cir. 2002)).

Courts consider four factors when determining whether leave to amend should be granted: 1) prejudice to the opposing party; 2) bad faith; 3) futility of amendment; and 4) undue delay. *Foman v. Davis*, 371 U.S. 178, 182 (1962); *see also Eminence Cap., LLC v. Aspeon, Inc.*, 316 F.3d 1048, 1052 (9th Cir. 2003). Not all factors are equal and only when prejudice or bad faith is shown should leave to amend be denied. *Howey v. United States*, 481 F.2d 1187, 1190-91 (9th Cir. 1973). Leave to amend should not be denied based only on delay, *id.*, particularly when that delay is not caused by the party seeking amendment.

A court may deny leave to amend if the proposed amendment is futile or would be subject to dismissal. *Carrico v. City & Cnty. of San Francisco*, 656 F.3d 1002, 1008 (9th Cir.2011). An amendment is "futile" if the complaint could not be saved by amendment. *United States v. Corinthian Colleges*, 655 F.3d 984, 995 (9th Cir.2011). The court must determine whether the deficiencies in the pleadings "can be cured with additional allegations that are consistent with the challenged pleading and that do not contradict the allegations in the original complaint." *Id.* (quotation marks omitted). A party should be allowed to test his claim on the merits rather than on a motion to amend unless it appears beyond doubt that the proposed amended pleading

would be subject to dismissal. *Roth v. Garcia Marquez*, 942 F.2d 617, 629 (9th Cir.1991).

DISCUSSION

I. Ninth Circuit Mandate Permits Court to Consider Motion to Amend

In its interlocutory opinion, the Ninth Circuit remanded the case to this Court with instructions to dismiss. Plaintiffs maintain that the Ninth Circuit did not state in its instructions whether dismissal was with or without leave to amend, and therefore, this Court should freely grant leave to do so. Federal defendants assert that this Court must dismiss according to the rule of mandate and because any amendment would be futile.[2]

Under the "rule of mandate," a lower court is unquestionably obligated to "execute the terms of a mandate." *United States v. Kellington*, 217 F.3d 1084, 1092 (9th Cir. 2000). Compliance with the rule of mandate "preserv[es] the hierarchical structure of the court system," *Thrasher*, 483 F.3d at 982, and thus constitutes a basic feature of the rule of law in an appellate scheme. But while "the mandate of an appellate court forecloses the lower court from reconsidering matters determined in the appellate court, it 'leaves to the district court any issue not expressly or impliedly

[2] There is no material dispute between the parties whether plaintiffs' amendments are in bad faith, prejudicial to defendants, or unduly delayed. Having considered those factors, this Court finds that none bar plaintiffs' request to amend.

disposed of on appeal.'" *Nguyen v. United States*, 792 F.2d 1500, 1502 (9th Cir. 1986) (quoting *Stevens v. F/V Bonnie Doon*, 731 F.2d 1433, 1435 (9th Cir. 1984)).

"Absent a mandate which explicitly directs to the contrary, a district court upon remand can permit the plaintiff to file additional pleadings ...." *San Francisco Herring Ass'n v. Dep't of the Interior*, 946 F.3d 564, 574 (9th Cir. 2019) (quoting *Nguyen,* 792 F.2d at 1502; *see also Sierra Club v. Penfold*, 857 F.2d 1307, 1312 (9th Cir. 1988). When mandate in the prior appeal did not expressly address the possibility of amendment and did not indicate a clear intent to deny amendment seeking to raise new issues not decided by the prior appeal, that prior opinion did not purport "to shut the courthouse doors." *San Francisco Herring Ass'n*, 946 F.3d at 574 (citing *Nguyen*, 792 F.2d at 1503).

In *San Francisco Herring Ass'n*, the Ninth Circuit discussed its issuance of a mandate in a prior appeal, which vacated the district court's order entering summary judgment in the defendants' favor and directed the district court to dismiss the complaint. *See San Francisco Herring Ass'n v. U.S. Dep't of Interior*, 683 F. App'x 579, 581 (9th Cir. 2017) (vacating judgment and remanding case with instructions to dismiss for lack of subject matter jurisdiction). On remand, the district court allowed the plaintiff to seek leave to file a second amended complaint. The Ninth Circuit determined the district court correctly found that the mandate to dismiss did not prevent the plaintiff from seeking leave to re-plead. *San Francisco Herring Ass'n*, 946 F.3d 574. The court reasoned that in instructing to dismiss, it had been silent on whether the dismissal should be with or without leave to amend and did not preclude the plaintiff from filing new allegations. *Id.* at 572-574.

Here, this Court does not take lightly its responsibility under the rule of mandate. Rather, it considers plaintiffs' new factual allegations under the Declaratory Judgment Act, and amended request for relief in light of intervening recent precedent, to be a new issue that, while discussed, was not decided by the Ninth Circuit in the interlocutory appeal. Nor did the mandate expressly state that plaintiffs could not amend to replead their case—particularly where the opinion found a narrow deficiency with plaintiffs' pleadings on redressability. This Court therefore does not interpret the Ninth Circuit's instructions as mandating it "to shut the courthouse doors" on plaintiffs' case where they present newly amended allegations. *San Francisco Herring Ass'n*, 946 F.3d at 574.

II. Amendment is Not Futile

A. The Interlocutory Opinion

The Ninth Circuit recited the established rule that, to demonstrate Article III redressability, plaintiffs must show that the relief they seek is both (1) substantially likely to redress their injuries; and (2) within the district court's power to award. *Juliana,* 947 F.3d at 1170. Redress need not be guaranteed, but it must be more than "merely speculative." *Id*. (quoting *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 561 (1992).

Here, applying the above rule, the Ninth Circuit stated that a declaration alone is not relief "substantially likely to mitigate [plaintiffs'] asserted concrete injuries." *Juliana*, 947 F.3d at 1170. The court considered whether partial redress suffices to prove the first redressability prong, concluding that it likely does not, because even

if plaintiffs obtained the sought relief and federal defendants ceased promoting fossil fuel, such would only ameliorate, rather than "solve global climate change." *Id. at* 1171.

Even so, the court did not decide that plaintiffs had failed to prove the first prong of redressability: the court stated, "[w]e are therefore skeptical that the first redressability prong is satisfied. But even *assuming that it is*, [plaintiffs] do not surmount the remaining hurdle—establishing that the specific relief they seek is within the power of an Article III court." *Juliana,* 947 F.3d at 1171. (emphasis added).

In addressing whether plaintiffs had proved the second prong, the court identified the "specific relief" plaintiffs sought was an injunction requiring federal defendants not only to cease permitting, authorizing, and subsidizing fossil fuel, but also to prepare a plan, subject to judicial monitoring, to draw down harmful emissions. That specific relief, the court determined, was not within the power of an Article III court to award. *Id*. The court explained that for the district court to "order, design, supervise, or implement" plaintiffs' requested remedial plan, any effective plan would require a "host of complex policy decisions" entrusted under constitutional separation of powers to the executive and legislative branches. *Id.* In essence, the court found plaintiffs' injuries beyond redress because, in its view, plaintiffs' requested relief requires the district court to evaluate "competing policy considerations" and supervise implementation over many years. *Id*. at 1171–73

Summarizing what the court did—and did not—identify as the legal defects in plaintiffs' case, the court did not decide whether plaintiffs' requested declaratory

relief failed or satisfied the redressability requirement for standing, and did not consider that issue under *Uzuegbunam* or the Declaratory Judgment Act. Rather, the court resolved that plaintiffs failed to demonstrate redressability on grounds that plaintiffs' requested remedial and injunctive relief was beyond the power of an Article III court to provide. The court was also silent on whether dismissal was to be with or without leave to amend.

B. Plaintiffs' Proposed Amendments

Plaintiffs assert that their proposed amendments cure the defects the Ninth Circuit identified and that they should be given opportunity to amend. Plaintiffs explain that the amended allegations demonstrate that relief under the Declaratory Judgment Act alone would be substantially likely to provide partial redress of asserted and ongoing concrete injuries, and that partial redress is sufficient, even if further relief is later found unavailable.

Plaintiffs also amended their factual allegations directly linking how a declaratory judgment alone will redress of plaintiffs' individual ongoing injuries. (*See* doc. 514-2 ¶¶ 19-A, 22-A, 30-A, 34-A, 39-A, 43-A, 46-A, 49-A, 52-A, 56-A, 59-A, 62-A, 64-A, 67-A, 70-A, 72-A, 76-A, 80-A, 85-A, 88-A, 90-A.). Plaintiffs assert that declaratory relief is within a court's Article III power to provide. Plaintiffs also omitted the "specific relief" the Ninth Circuit majority found to be outside Article III authority to award. Among other deletions, plaintiffs eliminated their requests for this Court to order federal defendants to prepare and implement a remedial plan and prepare a list of U.S. CO_2 emissions. Plaintiffs also omitted their request for this Court to monitor and enforce the remedial plan.

Plaintiffs' Second Amended Complaint thus requests this Court to: (1) declare that the United States' national energy system violates and continues to violate the Fifth Amendment of the U.S. Constitution and Plaintiffs' constitutional rights to substantive due process and equal protection of the law; (2) enter a judgment declaring the United States' national energy system has violated and continues to violate the public trust doctrine; and (3) enter a judgment declaring that § 201 of the Energy Policy Act has violated and continues to violate the Fifth Amendment of the U.S. Constitution and plaintiffs' constitutional rights to substantive due process and equal protection of the law.

While declaratory relief was part of plaintiffs' prayer in the operative complaint, plaintiffs did not cite *Uzuegbunam*—recent authority affirming that partial declaratory relief satisfies redressability for purposes of Article III standing. Plaintiffs contend that they should be granted leave to amend based on the Supreme Court's holding that a request for nominal damages alone (a form of declaratory relief) satisfies the redressability element necessary for Article III standing, where the plaintiff's claim is based on a completed violation of a legal right, and the plaintiff establishes the first two elements of standing. *Uzuegbunam*, 141 S. Ct. at 801–02.

C. *Plaintiffs' Amended Pleadings Satisfy Redressability*

This Court adamantly agrees with the Ninth Circuit that its ability to provide redress is animated by two inquiries, one of efficacy and one of power. *Juliana*, 947 F.3d at 1169. Plaintiffs' proposed amendments allege that a declaration under the Declaratory Judgment Act is substantially likely to remediate their ongoing injuries, and that such relief is within this Court's power to award.

1. Declaratory Relief Alone is Substantially Likely to Redress Injury

The court can grant declaratory relief in the first instance and later consider further necessary or proper relief, if warranted, under the Declaratory Judgment Act. 28 U.S.C. §§ 2201, *et seq*. "In a case of actual controversy within its jurisdiction, [ ] any court of the United States, upon the filing of an appropriate pleading, may declare the rights and other legal relations of any interested party seeking such declaration, whether or not further relief is or could be sought. Any such declaration shall have the force and effect of a final judgment or decree and shall be reviewable as such." 28 U.S.C. § 2201. "Further necessary or proper relief based on a declaratory judgment or decree may be granted, after reasonable notice and hearing, against any adverse party whose rights have been determined by such judgment." 28 U.S.C. § 2202.

The Supreme Court has long recognized that declaratory judgment actions can provide redressability, even where relief obtained is a declaratory judgment alone. Well-known cases involve the census, *Franklin v. Massachusetts*, 505 U.S. 788, 803 (1992), and *Utah v. Evans,* 536 U.S. 452 (2002).

In each of the census cases, a state objected to the way the Census Bureau counted people and sued government officials. In *Franklin v. Massachusetts*, the Supreme Court stated, "For purposes of establishing standing," it did not need to decide whether injunctive relief against was appropriate where "the injury alleged is likely to be redressed by declaratory relief" and the court could "assume it is substantially likely that the President and other executive and congressional officials would abide by an authoritative interpretation of the census statute and

constitutional provision by the District Court." 505 U.S. at 803.

In *Utah v. Evans*, the Supreme Court referenced *Franklin*, explaining that, in terms of its "standing" precedent, declaratory relief affects a change in legal status, and the practical consequence of that change would "amount to a significant increase in the likelihood that the plaintiff would obtain relief that directly redresses the injury suffered." 536 U.S. 452 (2002).

Similarly, the Supreme Court has determined that a plaintiff had standing to sue the Nuclear Regulatory Commission for a declaration that the Price-Anderson Act, which limited the liability of nuclear power companies, was unconstitutional. *Duke Power Co. v. Carolina Envtl. Study Grp., Inc.*, 438 U.S. 59, 81 (1978).

Other cases recognized the role of declaratory relief in resolving constitutional cases. *See, e.g.*, *Evers v. Dwyer*, 358 U.S. 202, 202-04 (1958) (ongoing governmental enforcement of segregation laws created actual controversy for declaratory judgment); *Powell v. McCormack*, 395 U.S. 486, 499 (1969) ("A court may grant declaratory relief even though it chooses not to issue an injunction or mandamus.").

Finally, the Supreme Court held that, for the purpose of Article III standing, nominal damages—a form of declaratory relief—provide the necessary redress for a completed violation of a legal right, even where the underlying unlawful conduct had ceased. *Uzuegbunam*, 141 S. Ct. 792, 802. *Uzuegbunam* illustrates that when a plaintiff shows a completed violation of a legal right, as plaintiffs have shown here, standing survives, even when relief is nominal or trivial.

Here, this Court notes that, in its determination of standing, the Ninth Circuit was "skeptical" that declaratory relief alone would remediate plaintiffs' injuries,

Juliana, 947 F.3d at 1171. The court noted that even if all plaintiffs' requests for relief were granted against federal defendants, such would not solve the problem of climate change entirely. But for redressability under Article III standing, plaintiffs need not allege that a declaration alone would solve their every ill. To plead a justiciable case, a court need only evaluate "whether the facts alleged, under all the circumstances, show that there is a substantial controversy, between parties having adverse legal interests, of sufficient immediacy and reality to warrant the issuance of a declaratory judgment." *MedImmune, Inc. v. Genentech, Inc.*, 549 U.S. 118, 127 (2007) (quoting *Md. Cas. Co. v. Pac. Coal & Oil Co.*, 312 U.S. 270, 273 (1941). There is nothing in § 2201 preventing a court from granting declaratory relief even if it is the only relief awarded.

In light of that determination, by pleading a claim under § 2201, plaintiffs establish that the text of the statute itself resolves the uncertainty posed by the Ninth Circuit, given that plaintiffs have established an active case and controversy showing injury and causation. Section 2201 also provides that declaratory relief may be granted "whether or not further relief is or could be sought." *Id.* Under the statute, the relief plaintiffs seek fits like a glove, where plaintiffs request consideration of declaratory relief independently of other forms of relief, such as an injunction. *See Steffel v. Thompson*, 415 U.S. 452, 475, (1974) (stating in a different context that "regardless of whether injunctive relief may be appropriate, federal declaratory relief is not precluded."). This Court finds that plaintiffs' proposed amendments are not futile: a declaration that federal defendants' energy policies violate plaintiffs' constitutional rights would itself be significant relief.

2. Redress is Within Power of Article III Courts

It is a foundational doctrine that when government conduct catastrophically harms American citizens, the judiciary is constitutionally required to perform its independent role and determine whether the challenged conduct, not exclusively committed to any branch by the Constitution, is unconstitutional. *Marbury v. Madison*, 5 U.S. (1 Cranch) 137, 176–78 (1803). The judicial role in cases like this is to apply constitutional law, declare rights, and declare the government's responsibilities. No other branch of government can perform this function because the "judicial Power" is exclusively in the hands of Article III courts. U.S. Const. Art. III, § 1. The issue before this Court now is not to determine what relief, specifically, is in its power to provide. This Court need only decide whether plaintiffs' amendments—alleging that declaratory relief is within an Article III court's power to award— "would be subject to dismissal." *Carrico,* 656 F.3d 1002.

The Declaratory Judgment Act authorizes this Court's determination in its embrace of both constitutional and prudential concerns where the text is "deliberately cast in terms of permissive, rather than mandatory, authority." *Pub. Serv. Comm'n of Utah v. Wycoff Co.*, 344 U.S. 237, 250 (1952) (J. Reed, concurring). The Act gives "federal courts competence to make a declaration of rights." *Pub. Affairs Associates v. Rickover*, 369 U.S. 111, 112 (1962). The Supreme Court has found it "consistent with the statute . . . to vest district courts with discretion in the first instance, because facts bearing on the usefulness of the declaratory judgment remedy, and the fitness of the case for resolution, are peculiarly within their grasp." *MedImmune, Inc. v. Genentech, Inc.,* 549 U.S. 118, 136 (2007).

Here, plaintiffs seek declaratory relief that "the United States' national energy system that creates the harmful conditions described herein has violated and continues to violate the Fifth Amendment of the U.S. Constitution and Plaintiffs' constitutional rights to substantive due process and equal protection of the law." (Doc. 514-1 ¶ 1). This relief is squarely within the constitutional and statutory power of Article III courts to grant. Such relief would at least partially, and perhaps wholly, redress plaintiffs' ongoing injuries caused by federal defendants' ongoing policies and practices. Last, but not least, the declaration that plaintiffs seek would by itself guide the independent actions of the other branches of our government and cures the standing deficiencies identified by the Ninth Circuit. This Court finds that the complaint can be saved by amendment. *See Corinthian Colleges*, 655 F.3d at 995.

CONCLUSION

For the reasons stated above, plaintiffs' Motion to File a Second Amended Complaint, doc. 462, is GRANTED.

IT IS SO ORDERED.

Dated this 1st day of June 2023.

/s/Ann Aiken

Ann Aiken
United States District Judge

Exhibit 4

Ninth Circuit decision, No. 18-36082 (Jan. 17, 2020)

FOR PUBLICATION

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

KELSEY CASCADIA ROSE JULIANA; XIUHTEZCATL TONATIUH M., through his Guardian Tamara Roske-Martinez; ALEXANDER LOZNAK; JACOB LEBEL; ZEALAND B., through his Guardian Kimberly Pash-Bell; AVERY M., through her Guardian Holly McRae; SAHARA V., through her Guardian Toa Aguilar; KIRAN ISAAC OOMMEN; TIA MARIE HATTON; ISAAC V., through his Guardian Pamela Vergun; MIKO V., through her Guardian Pamel Vergun; HAZEL V., through her Guardian Margo Van Ummerson; SOPHIE K., through her Guardian Dr. James Hansen; JAIME B., through her Guardian Jamescita Peshlakai; JOURNEY Z., through his Guardian Erika Schneider; VICTORIA B., through her Guardian Daisy Calderon; NATHANIEL B., through his Guardian Sharon Baring; AJI P., through his Guardian Helaina Piper; LEVI D., through his Guardian Leigh-Ann Draheim; JAYDEN F., through her Guardian Cherri Foytlin; NICHOLAS V., through his Guardian Marie Venner; EARTH GUARDIANS, a	No. 18-36082 D.C. No. 6:15-cv-01517-AA OPINION

nonprofit organization; FUTURE GENERATIONS, through their Guardian Dr. James Hansen,

Plaintiffs-Appellees,

v.

UNITED STATES OF AMERICA; MARY B. NEUMAYR, in her capacity as Chairman of Council on Environmental Quality; MICK MULVANEY, in his official capacity as Director of the Office of Management and the Budget; KELVIN K. DROEGEMEIR, in his official capacity as Director of the Office of Science and Technology Policy; DAN BROUILLETTE, in his official capacity as Secretary of Energy; U.S. DEPARTMENT OF THE INTERIOR; DAVID L. BERNHARDT, in his official capacity as Secretary of Interior; U.S. DEPARTMENT OF TRANSPORTATION; ELAINE L. CHAO, in her official capacity as Secretary of Transportation; UNITED STATES DEPARTMENT OF AGRICULTURE; SONNY PERDUE, in his official capacity as Secretary of Agriculture; UNITED STATES DEPARTMENT OF COMMERCE; WILBUR ROSS, in his official capacity as Secretary of Commerce; UNITED STATES DEPARTMENT OF DEFENSE; MARK T.

ESPER, in his official capacity as Secretary of Defense; UNITED STATES DEPARTMENT OF STATE; MICHAEL R. POMPEO, in his official capacity as Secretary of State; ANDREW WHEELER, in his official capacity as Administrator of the EPA; OFFICE OF THE PRESIDENT OF THE UNITED STATES; U.S. ENVIRONMENTAL PROTECTION AGENCY; U.S. DEPARTMENT OF ENERGY; DONALD J. TRUMP, in his official capacity as President of the United States,

Defendants-Appellants.

Appeal from the United States District Court
for the District of Oregon
Ann L. Aiken, District Judge, Presiding

Argued and Submitted June 4, 2019
Portland, Oregon

Filed January 17, 2020

Before: Mary H. Murguia and Andrew D. Hurwitz, Circuit Judges, and Josephine L. Staton,* District Judge.

Opinion by Judge Hurwitz;
Dissent by Judge Staton

* The Honorable Josephine L. Staton, United States District Judge for the Central District of California, sitting by designation.

SUMMARY**

Climate Change / Standing

The panel reversed the district court's interlocutory orders in an action brought by an environmental organization and individual plaintiffs against the federal government, alleging climate-change related injuries to the plaintiffs caused by the federal government continuing to "permit, authorize, and subsidize" fossil fuel; and remanded to the district court with instructions to dismiss for lack of Article III standing.

Some plaintiffs claimed psychological harms, others impairment to recreational interests, others exacerbated medical conditions, and others damage to property. Plaintiffs alleged violations of their constitutional rights, and sought declaratory relief and an injunction ordering the government to implement a plan to "phase out fossil fuel emissions and draw down excess atmospheric [carbon dioxide]."

The panel held that: the record left little basis for denying that climate change was occurring at an increasingly rapid pace; copious expert evidence established that the unprecedented rise in atmospheric carbon dioxide levels stemmed from fossil fuel combustion and will wreak havoc on the Earth's climate if unchecked; the record conclusively established that the federal government has long understood the risks of fossil fuel use and increasing carbon dioxide emissions; and the record established that the government's

** This summary constitutes no part of the opinion of the court. It has been prepared by court staff for the convenience of the reader.

contribution to climate change was not simply a result of inaction.

The panel rejected the government's argument that plaintiffs' claims must proceed, if at all, under the Administrative Procedure Act ("APA"). The panel held that because the APA only allows challenges to discrete agency decisions, the plaintiffs could not effectively pursue their constitutional claims – whatever their merits – under that statute.

The panel considered the three requirements for whether plaintiffs had Article III standing to pursue their constitutional claims. First, the panel held that the district court correctly found that plaintiffs claimed concrete and particularized injuries. Second, the panel held that the district court properly found the Article III causation requirement satisfied for purposes of summary judgment because there was at least a genuine factual dispute as to whether a host of federal policies were a "substantial factor" in causing the plaintiffs' injuries. Third, the panel held that plaintiffs' claimed injuries were not redressable by an Article III court. Specifically, the panel held that it was beyond the power of an Article III court to order, design, supervise, or implement the plaintiffs' requested remedial plan where any effective plan would necessarily require a host of complex policy decisions entrusted to the wisdom and discretion of the executive and legislative branches.

The panel reluctantly concluded that the plaintiffs' case must be made to the political branches or to the electorate at large.

District Judge Staton dissented, and would affirm the district court. Judge Staton wrote that plaintiffs brought suit to enforce the most basic structural principal embedded in

our system of liberty: that the Constitution does not condone the Nation's willful destruction. She would hold that plaintiffs have standing to challenge the government's conduct, have articulated claims under the Constitution, and have presented sufficient evidence to press those claims at trial.

COUNSEL

Jeffrey Bossert Clark (argued), Assistant Attorney General; Andrew C. Mergen, Sommer H. Engels, and Robert J. Lundman, Attorneys; Eric Grant, Deputy Assistant Attorney General; Environment and Natural Resources Division, United States Department of Justice, Washington, D.C.; for Defendants-Appellants.

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Theodore Hadzi-Antich and Ryan D. Walters, Texas Public Policy Foundation, Austin, Texas, for Amici Curiae Nuckels Oil Co., Inc. DBA Merit Oil Company; Libety Packing Company, LLC; Western States Trucking Association; and National Federation of Independent Business Small Business Legal Center.

Richard K. Eichstaedt, University Legal Assistance, Spokane, Washington, for Amici Curiae Eco-Justice Ministries; Interfaith Moral Action on Climate; General Synod of the United Church of Christ; Temple Beth Israel of Eugene, Oregon; National Advocacy Center of the Sisters of the Good Shepherd; Leadership Counsel of the Sisters Servants of the Immaculate Heart of Mary of Monroe, Michigan; Sisters of Mercy of the Americas' Institute Leadership Team; GreenFaith; Leadership Team of the Sisters of Providence of Saint-Mary-of-the-Woods Indiana; Leadership Conference of Women Religious; Climate Change Task Force of the Sisters of Providence of Saint-Mary-of-the-Woods; Quaker Earthcare Witness; Colorado

Interfaith Power and Light; and the Congregation of Our Lady of Charity of the Good Shepherd, U.S. Provinces.

Dr. Curtis FJ Doebbler, Law Office of Dr. Curtis FJ Doebbler, San Antonio, Texas; D. Inder Comar, Comar LLP, San Francisco, California; for Amici Curiae International Lawyers for International Law.

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Oday Salim, Environmental Law & Sustainability Clinic; Julian D. Mortensen and David M. Uhlmann, Professors; Alexander Chafetz, law student; University of Michigan Law School, Ann Arbor, Michigan; for Amicus Curiae Sunrise Movement Education Fund.

Zachary B. Corrigan, Food & Water Watch, Inc., Washington, D.C., for Amici Curiae Food & Water Watch, Inc.; Friends of the Earth – US; and Greenpeace, Inc.

Patti Goldman, Earthjustice, Seattle, Washington; Sarah H. Burt, Earthjustice, San Francisco, California; for Amici Curiae EarthRights International, Center for Biological

Diversity, Defenders of Wildlife, and Union of Concerned Scientists.

David Hunter and William John Snape III, American University, Washington College of Law, Washington, D.C., for Amici Curiae International Environmental Law and Environmental Law Alliance Worldwide—US.

Timothy M. Bechtold, Bechtold Law Firm PLLC, Missoula, Montana, for Amici Curiae Members of the United States Congress.

Rachael Paschal Osborn, Vashon, Washington, for Amici Curiae Environmental History Professors.

Thomas J. Beers, Beers Law Offices, Seeley Lake, Montana; Irma S. Russell, Professor, and Edward A. Smith, Missouri Chair in Law, the Constitution, and Society, University of Missouri-Kansas City School of Law, Kansas City, Missouri; W. Warren H. Binford Professor or Law & Director, Clinical Law Program, Willamette University, Salem, Oregon; for Amicus Curiae Zero Hour on Behalf of Approximately 32,340 Children and Young People.

Helen H. Kang, Environmental Law and Justice Clinic, Golden Gate University School of Law, San Francisco, California; James R. May and Erin Daly, Dignity Rights Project, Delaware Law School, Wilmington, Delaware; for Amici Curiae Law Professors.

Toby J. Marshall, Terrell Marshall Law Group PLLC, Seattle, Washington, for Amici Curiae Guayaki Sustainable Rainforest Products, Inc.; Royal Blue Organics; Organically Grown Company; Bliss Unlimited, LLC, dba Coconut Bliss; Hummingbird Wholesale; Aspen Skiing Company, LLC;

Protect Our Winters; National Ski Areas Association; Snowsports Industries America; and American Sustainable Business Council.

Alejandra Núñez and Andres Restrepo, Sierra Club, Washington, D.C.; Joanne Spalding, Sierra Club, Oakland, California; for Amicus Curiae Sierra Club.

OPINION

HURWITZ, Circuit Judge:

In the mid-1960s, a popular song warned that we were "on the eve of destruction."[1] The plaintiffs in this case have presented compelling evidence that climate change has brought that eve nearer. A substantial evidentiary record documents that the federal government has long promoted fossil fuel use despite knowing that it can cause catastrophic climate change, and that failure to change existing policy may hasten an environmental apocalypse.

The plaintiffs claim that the government has violated their constitutional rights, including a claimed right under the Due Process Clause of the Fifth Amendment to a "climate system capable of sustaining human life." The central issue before us is whether, even assuming such a broad constitutional right exists, an Article III court can provide the plaintiffs the redress they seek—an order requiring the government to develop a plan to "phase out fossil fuel emissions and draw down excess atmospheric CO2." Reluctantly, we conclude that such relief is beyond our constitutional power. Rather, the plaintiffs' impressive case for redress must be presented to the political branches of government.

I.

The plaintiffs are twenty-one young citizens, an environmental organization, and a "representative of future generations." Their original complaint named as defendants

[1] Barry McGuire, *Eve of Destruction*, *on* Eve of Destruction (Dunhill Records, 1965).

the President, the United States, and federal agencies (collectively, "the government"). The operative complaint accuses the government of continuing to "permit, authorize, and subsidize" fossil fuel use despite long being aware of its risks, thereby causing various climate-change related injuries to the plaintiffs. Some plaintiffs claim psychological harm, others impairment to recreational interests, others exacerbated medical conditions, and others damage to property. The complaint asserts violations of: (1) the plaintiffs' substantive rights under the Due Process Clause of the Fifth Amendment; (2) the plaintiffs' rights under the Fifth Amendment to equal protection of the law; (3) the plaintiffs' rights under the Ninth Amendment; and (4) the public trust doctrine. The plaintiffs seek declaratory relief and an injunction ordering the government to implement a plan to "phase out fossil fuel emissions and draw down excess atmospheric [carbon dioxide]."[2]

The district court denied the government's motion to dismiss, concluding that the plaintiffs had standing to sue, raised justiciable questions, and stated a claim for infringement of a Fifth Amendment due process right to a "climate system capable of sustaining human life." The court defined that right as one to be free from catastrophic climate change that "will cause human deaths, shorten human lifespans, result in widespread damage to property, threaten human food sources, and dramatically alter the planet's ecosystem." The court also concluded that the

[2] The plaintiffs also assert that section 201 of the Energy Policy Act of 1992, Pub. L. No. 102-486, § 201, 106 Stat. 2776, 2866 (codified at 15 U.S.C. § 717b(c)), which requires expedited authorization for certain natural gas imports and exports "without modification or delay," is unconstitutional on its face and as applied. The plaintiffs also challenge DOE/FE Order No. 3041, which authorizes exports of liquefied natural gas from the proposed Jordan Cove terminal in Coos Bay, Oregon.

plaintiffs had stated a viable "danger-creation due process claim" arising from the government's failure to regulate third-party emissions. Finally, the court held that the plaintiffs had stated a public trust claim grounded in the Fifth and the Ninth Amendments.

The government unsuccessfully sought a writ of mandamus. *In re United States*, 884 F.3d 830, 837–38 (9th Cir. 2018). Shortly thereafter, the Supreme Court denied the government's motion for a stay of proceedings. *United States v. U.S. Dist. Court for Dist. of Or.*, 139 S. Ct. 1 (2018). Although finding the stay request "premature," the Court noted that the "breadth of respondents' claims is striking . . . and the justiciability of those claims presents substantial grounds for difference of opinion." *Id.*

The government then moved for summary judgment and judgment on the pleadings. The district court granted summary judgment on the Ninth Amendment claim, dismissed the President as a defendant, and dismissed the equal protection claim in part.[3] But the court otherwise denied the government's motions, again holding that the plaintiffs had standing to sue and finding that they had presented sufficient evidence to survive summary judgment. The court also rejected the government's argument that the plaintiffs' exclusive remedy was under the Administrative Procedure Act ("APA"), 5 U.S.C. § 702 *et seq.*

The district court initially declined the government's request to certify those orders for interlocutory appeal. But, while considering a second mandamus petition from the government, we invited the district court to revisit

[3] The court found that age is not a suspect class, but allowed the equal protection claim to proceed on a fundamental rights theory.

certification, noting the Supreme Court's justiciability concerns. *United States v. U.S. Dist. Court for the Dist. of Or.*, No. 18-73014, Dkt. 3; *see In re United States*, 139 S. Ct. 452, 453 (2018) (reiterating justiciability concerns in denying a subsequent stay application from the government). The district court then reluctantly certified the orders denying the motions for interlocutory appeal under 28 U.S.C. § 1292(b) and stayed the proceedings, while "stand[ing] by its prior rulings . . . as well as its belief that this case would be better served by further factual development at trial." *Juliana v. United States*, No. 6:15-cv-01517-AA, 2018 WL 6303774, at *3 (D. Or. Nov. 21, 2018). We granted the government's petition for permission to appeal.

II.

The plaintiffs have compiled an extensive record, which at this stage in the litigation we take in the light most favorable to their claims. *See Plumhoff v. Rickard*, 572 U.S. 765, 768 (2014). The record leaves little basis for denying that climate change is occurring at an increasingly rapid pace. It documents that since the dawn of the Industrial Age, atmospheric carbon dioxide has skyrocketed to levels not seen for almost three million years. For hundreds of thousands of years, average carbon concentration fluctuated between 180 and 280 parts per million. Today, it is over 410 parts per million and climbing. Although carbon levels rose gradually after the last Ice Age, the most recent surge has occurred more than 100 times faster; half of that increase has come in the last forty years.

Copious expert evidence establishes that this unprecedented rise stems from fossil fuel combustion and will wreak havoc on the Earth's climate if unchecked. Temperatures have already risen 0.9 degrees Celsius above

pre-industrial levels and may rise more than 6 degrees Celsius by the end of the century. The hottest years on record all fall within this decade, and each year since 1997 has been hotter than the previous average. This extreme heat is melting polar ice caps and may cause sea levels to rise 15 to 30 feet by 2100. The problem is approaching "the point of no return." Absent some action, the destabilizing climate will bury cities, spawn life-threatening natural disasters, and jeopardize critical food and water supplies.

The record also conclusively establishes that the federal government has long understood the risks of fossil fuel use and increasing carbon dioxide emissions. As early as 1965, the Johnson Administration cautioned that fossil fuel emissions threatened significant changes to climate, global temperatures, sea levels, and other stratospheric properties. In 1983, an Environmental Protection Agency ("EPA") report projected an increase of 2 degrees Celsius by 2040, warning that a "wait and see" carbon emissions policy was extremely risky. And, in the 1990s, the EPA implored the government to act before it was too late. Nonetheless, by 2014, U.S. fossil fuel emissions had climbed to 5.4 billion metric tons, up substantially from 1965. This growth shows no signs of abating. From 2008 to 2017, domestic petroleum and natural gas production increased by nearly 60%, and the country is now expanding oil and gas extraction four times faster than any other nation.

The record also establishes that the government's contribution to climate change is not simply a result of inaction. The government affirmatively promotes fossil fuel use in a host of ways, including beneficial tax provisions, permits for imports and exports, subsidies for domestic and

overseas projects, and leases for fuel extraction on federal land.[4]

A.

The government by and large has not disputed the factual premises of the plaintiffs' claims. But it first argues that those claims must proceed, if at all, under the APA. We reject that argument. The plaintiffs do not claim that any individual agency action exceeds statutory authorization or, taken alone, is arbitrary and capricious. *See* 5 U.S.C. § 706(2)(A), (C). Rather, they contend that the totality of various government actions contributes to the deprivation of constitutionally protected rights. Because the APA only allows challenges to discrete agency decisions, *see Lujan v. Nat'l Wildlife Fed'n*, 497 U.S. 871, 890–91 (1990), the plaintiffs cannot effectively pursue their constitutional claims—whatever their merits—under that statute.

The defendants argue that the APA's "comprehensive remedial scheme" for challenging the constitutionality of agency actions implicitly bars the plaintiffs' freestanding constitutional claims. But, even if some constitutional challenges to agency action must proceed through the APA, forcing all constitutional claims to follow its strictures would

[4] The programs and policies identified by the plaintiffs include: (1) the Bureau of Land Management's authorization of leases for 107 coal tracts and 95,000 oil and gas wells; (2) the Export-Import Bank's provision of $14.8 billion for overseas petroleum projects; (3) the Department of Energy's approval of over 2 million barrels of crude oil imports; (4) the Department of Agriculture's approval of timber cutting on federal land; (5) the undervaluing of royalty rates for federal leasing; (6) tax subsidies for purchasing fuel-inefficient sport-utility vehicles; (7) the "intangible drilling costs" and "percentage depletion allowance" tax code provisions, 26 U.S.C. §§ 263(c), 613; and (8) the government's use of fossil fuels to power its own buildings and vehicles.

bar plaintiffs from challenging violations of constitutional rights in the absence of a discrete agency action that caused the violation. *See Sierra Club v. Trump*, 929 F.3d 670, 694, 696 (9th Cir. 2019) (stating that plaintiffs could "bring their challenge through an equitable action to enjoin unconstitutional official conduct, or under the judicial review provisions of the [APA]"); *Navajo Nation v. Dep't of the Interior*, 876 F.3d 1144, 1172 (9th Cir. 2017) (holding "that the second sentence of § 702 waives sovereign immunity broadly for all causes of action that meet its terms, while § 704's 'final agency action' limitation applies only to APA claims"). Because denying "any judicial forum for a colorable constitutional claim" presents a "serious constitutional question," Congress's intent through a statute to do so must be clear. *See Webster v. Doe*, 486 U.S. 592, 603 (1988) (quoting *Bowen v. Mich. Acad. of Family Physicians*, 476 U.S. 667, 681 n.12 (1986)); *see also Allen v. Milas*, 896 F.3d 1094, 1108 (9th Cir. 2018) ("After *Webster*, we have assumed that the courts will be open to review of constitutional claims, even if they are closed to other claims."). Nothing in the APA evinces such an intent.[5] Whatever the merits of the plaintiffs' claims, they may proceed independently of the review procedures mandated by the APA. *See Sierra Club*, 929 F.3d at 698–99 ("Any constitutional challenge that Plaintiffs may advance under the APA would exist regardless of whether they could also assert an APA claim . . . . [C]laims challenging agency

[5] The government relies upon *Armstrong v. Exceptional Child Center, Inc.*, 575 U.S. 320, 328–29 (2015), and *Seminole Tribe of Florida v. Florida*, 517 U.S. 44, 74–76 (1996), both of which held that statutory remedial schemes implicitly barred freestanding equitable claims. Neither case, however, involved claims by the plaintiffs that the federal government was violating their constitutional rights. *See Armstrong*, 575 U.S. at 323–24 (claiming that state officials had violated a federal statute); *Seminole Tribe*, 517 U.S. at 51–52 (same).

actions—particularly constitutional claims—may exist wholly apart from the APA."); *Navajo Nation*, 876 F.3d at 1170 (explaining that certain constitutional challenges to agency action are "not grounded in the APA").

B.

The government also argues that the plaintiffs lack Article III standing to pursue their constitutional claims. To have standing under Article III, a plaintiff must have (1) a concrete and particularized injury that (2) is caused by the challenged conduct and (3) is likely redressable by a favorable judicial decision. *See Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc.*, 528 U.S. 167, 180–81 (2000); *Jewel v. NSA*, 673 F.3d 902, 908 (9th Cir. 2011). A plaintiff need only establish a genuine dispute as to these requirements to survive summary judgment. *See Cent. Delta Water Agency v. United States*, 306 F.3d 938, 947 (9th Cir. 2002).

1.

The district court correctly found the injury requirement met. At least some plaintiffs claim concrete and particularized injuries. Jaime B., for example, claims that she was forced to leave her home because of water scarcity, separating her from relatives on the Navajo Reservation. *See Trump v. Hawaii*, 138 S. Ct. 2392, 2416 (2018) (finding separation from relatives to be a concrete injury). Levi D. had to evacuate his coastal home multiple times because of flooding. *See Maya v. Centex Corp.*, 658 F.3d 1060, 1070–71 (9th Cir. 2011) (finding diminution in home property value to be a concrete injury). These injuries are not simply "'conjectural' or 'hypothetical;'" at least some of the plaintiffs have presented evidence that climate change is affecting them now in concrete ways and will continue to do

so unless checked. *Lujan v. Defs. of Wildlife*, 504 U.S. 555, 560 (1992) (quoting *Whitmore v. Arkansas*, 495 U.S. 149, 155 (1990)); *cf. Ctr. for Biological Diversity v. U.S. Dep't of Interior*, 563 F.3d 466, 478 (D.C. Cir. 2009) (finding no standing because plaintiffs could "only aver that any significant adverse effects of climate change 'may' occur at some point in the future").

The government argues that the plaintiffs' alleged injuries are not particularized because climate change affects everyone. But, "it does not matter how many persons have been injured" if the plaintiffs' injuries are "concrete and personal." *Massachusetts v. EPA*, 549 U.S. 497, 517 (2007) (quoting *Lujan*, 504 U.S. at 581 (Kennedy, J., concurring)); *see also Novak v. United States*, 795 F.3d 1012, 1018 (9th Cir. 2015) ("[T]he fact that a harm is widely shared does not necessarily render it a generalized grievance.") (alteration in original) (quoting *Jewel*, 673 F.3d at 909). And, the Article III injury requirement is met if only one plaintiff has suffered concrete harm. *See Hawaii*, 138 S. Ct. at 2416; *Town of Chester, N.Y. v. Laroe Estates, Inc.*, 137 S. Ct. 1645, 1651 (2017) ("At least one plaintiff must have standing to seek each form of relief requested in the complaint. . . . For all relief sought, there must be a litigant with standing.").

2.

The district court also correctly found the Article III causation requirement satisfied for purposes of summary judgment. Causation can be established "even if there are multiple links in the chain," *Mendia v. Garcia*, 768 F.3d 1009, 1012 (9th Cir. 2014), as long as the chain is not "hypothetical or tenuous," *Maya*, 658 F.3d at 1070 (quoting *Nat'l Audubon Soc'y, Inc. v. Davis*, 307 F.3d 835, 849 (9th Cir. 2002), *amended on denial of reh'g*, 312 F.3d 416 (9th Cir. 2002)). The causal chain here is sufficiently established.

The plaintiffs' alleged injuries are caused by carbon emissions from fossil fuel production, extraction, and transportation. A significant portion of those emissions occur in this country; the United States accounted for over 25% of worldwide emissions from 1850 to 2012, and currently accounts for about 15%. *See Massachusetts*, 549 U.S. at 524–25 (finding that emissions amounting to about 6% of the worldwide total showed cause of alleged injury "by any standard"). And, the plaintiffs' evidence shows that federal subsidies and leases have increased those emissions. About 25% of fossil fuels extracted in the United States come from federal waters and lands, an activity that requires authorization from the federal government. *See* 30 U.S.C. §§ 181–196 (establishing legal framework governing the disposition of fossil fuels on federal land), § 201 (authorizing the Secretary of the Interior to lease land for coal mining).

Relying on *Washington Environmental Council v. Bellon*, 732 F.3d 1131, 1141–46 (9th Cir. 2013), the government argues that the causal chain is too attenuated because it depends in part on the independent actions of third parties. *Bellon* held that the causal chain between local agencies' failure to regulate five oil refineries and the plaintiffs' climate-change related injuries was "too tenuous to support standing" because the refineries had a "scientifically indiscernible" impact on climate change. *Id.* at 1143–44. But the plaintiffs here do not contend that their injuries were caused by a few isolated agency decisions. Rather, they blame a host of federal policies, from subsidies to drilling permits, spanning "over 50 years," and direct actions by the government. There is at least a genuine factual dispute as to whether those policies were a "substantial factor" in causing the plaintiffs' injuries. *Mendia*, 768 F.3d at 1013 (quoting *Tozzi v. U.S. Dep't of*

Health & Human Servs., 271 F.3d 301, 308 (D.C. Cir. 2001)).

3.

The more difficult question is whether the plaintiffs' claimed injuries are redressable by an Article III court. In analyzing that question, we start by stressing what the plaintiffs do and do not assert. They do not claim that the government has violated a statute or a regulation. They do not assert the denial of a procedural right. Nor do they seek damages under the Federal Tort Claims Act, 28 U.S.C. § 2671 *et seq.* Rather, their sole claim is that the government has deprived them of a substantive constitutional right to a "climate system capable of sustaining human life," and they seek remedial declaratory and injunctive relief.

Reasonable jurists can disagree about whether the asserted constitutional right exists. *Compare Clean Air Council v. United States*, 362 F. Supp. 3d 237, 250–53 (E.D. Pa. 2019) (finding no constitutional right), *with Juliana*, 217 F. Supp. 3d at 1248–50; *see also In re United States*, 139 S. Ct. at 453 (reiterating "that the 'striking' breadth of plaintiffs' below claims 'presents substantial grounds for difference of opinion'"). In analyzing redressability, however, we assume its existence. *See M.S. v. Brown*, 902 F.3d 1076, 1083 (9th Cir. 2018). But that merely begins our analysis, because "not all meritorious legal claims are redressable in federal court." *Id.* To establish Article III redressability, the plaintiffs must show that the relief they seek is both (1) substantially likely to redress their injuries; and (2) within the district court's power to award. *Id.* Redress need not be guaranteed, but it must be more than "merely speculative." *Id.* (quoting *Lujan*, 504 U.S. at 561).

The plaintiffs first seek a declaration that the government is violating the Constitution. But that relief alone is not substantially likely to mitigate the plaintiffs' asserted concrete injuries. A declaration, although undoubtedly likely to benefit the plaintiffs psychologically, is unlikely by itself to remediate their alleged injuries absent further court action. *See Clean Air Council*, 362 F. Supp. 3d at 246, 249; *Steel Co. v. Citizens for a Better Env't*, 523 U.S. 83, 107 (1998) ("By the mere bringing of his suit, *every* plaintiff demonstrates his belief that a favorable judgment will make him happier. But although a suitor may derive great comfort and joy from the fact that the United States Treasury is not cheated, that a wrongdoer gets his just deserts, or that the Nation's laws are faithfully enforced, that psychic satisfaction is not an acceptable Article III remedy because it does not redress a cognizable Article III injury."); *see also Friends of the Earth*, 528 U.S. at 185 ("[A] plaintiff must demonstrate standing separately for each form of relief sought.").

The crux of the plaintiffs' requested remedy is an injunction requiring the government not only to cease permitting, authorizing, and subsidizing fossil fuel use, but also to prepare a plan subject to judicial approval to draw down harmful emissions. The plaintiffs thus seek not only to enjoin the Executive from exercising discretionary authority expressly granted by Congress, *see, e.g.*, 30 U.S.C. § 201 (authorizing the Secretary of the Interior to lease land for coal mining), but also to enjoin Congress from exercising power expressly granted by the Constitution over public lands, *see* U.S. Const. art. IV, § 3, cl. 2 ("The Congress shall have Power to dispose of and make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States.").

As an initial matter, we note that although the plaintiffs contended at oral argument that they challenge only affirmative activities by the government, an order simply enjoining those activities will not, according to their own experts' opinions, suffice to stop catastrophic climate change or even ameliorate their injuries.[6] The plaintiffs' experts opine that the federal government's leases and subsidies have contributed to global carbon emissions. But they do not show that even the total elimination of the challenged programs would halt the growth of carbon dioxide levels in the atmosphere, let alone decrease that growth. Nor does any expert contend that elimination of the challenged pro-carbon fuels programs would by itself prevent further injury to the plaintiffs. Rather, the record shows that many of the emissions causing climate change happened decades ago or come from foreign and non-governmental sources.

Indeed, the plaintiffs' experts make plain that reducing the global consequences of climate change demands much more than cessation of the government's promotion of fossil fuels. Rather, these experts opine that such a result calls for no less than a fundamental transformation of this country's energy system, if not that of the industrialized world. One expert opines that atmospheric carbon reductions must come "largely via reforestation," and include rapid and immediate decreases in emissions from many sources. "[L]eisurely reductions of one of two percent per year," he explains, "will not suffice." Another expert has opined that although the required emissions reductions are "technically feasible," they can be achieved only through a comprehensive plan for "nearly complete decarbonization" that includes both an "unprecedently rapid build out" of renewable energy and a

[6] The operative complaint, however, also seems to challenge the government's inaction.

"sustained commitment to infrastructure transformation over decades." And, that commitment, another expert emphasizes, must include everything from energy efficient lighting to improved public transportation to hydrogen-powered aircraft.

The plaintiffs concede that their requested relief will not alone solve global climate change, but they assert that their "injuries would be to some extent ameliorated." Relying on *Massachusetts v. EPA*, the district court apparently found the redressability requirement satisfied because the requested relief would likely slow or reduce emissions. *See* 549 U.S. at 525–26. That case, however, involved a procedural right that the State of Massachusetts was allowed to assert "without meeting all the normal standards for redressability;" in that context, the Court found redressability because "there [was] some possibility that the requested relief [would] prompt the injury-causing party to reconsider the decision that allegedly harmed the litigant." *Id.* at 517–18, 525–26 (quoting *Lujan*, 504 U.S. at 572 n.7). The plaintiffs here do not assert a procedural right, but rather a substantive due process claim.[7]

[7] The dissent reads *Massachusetts* to hold that "a perceptible reduction in the advance of climate change is sufficient to redress a plaintiff's climate change-induced harms." Diss. at 47. But *Massachusetts* "permitted a State to challenge EPA's refusal to regulate greenhouse gas emissions," *Am. Elec. Power Co., Inc. v. Connecticut*, 564 U.S. 410, 420 (2011), finding that as a sovereign it was "entitled to special solicitude in [the] standing analysis," *Ariz. State Legislature v. Ariz. Indep. Redistricting Comm'n*, 135 S. Ct. 2652, 2664 n.10 (2015) (quoting *Massachusetts*, 549 U.S. at 520). Here, in contrast, the plaintiffs are not sovereigns, and a substantive right, not a procedural one, is at issue. *See Massachusetts*, 549 U.S. at 517–21, 525–26; *see also Lujan*, 504 U.S. at 572 n.7 ("There is this much truth to the assertion that 'procedural rights' are special: The person who has been accorded a

We are therefore skeptical that the first redressability prong is satisfied. But even assuming that it is, the plaintiffs do not surmount the remaining hurdle—establishing that the specific relief they seek is within the power of an Article III court. There is much to recommend the adoption of a comprehensive scheme to decrease fossil fuel emissions and combat climate change, both as a policy matter in general and a matter of national survival in particular. But it is beyond the power of an Article III court to order, design, supervise, or implement the plaintiffs' requested remedial plan. As the opinions of their experts make plain, any effective plan would necessarily require a host of complex policy decisions entrusted, for better or worse, to the wisdom and discretion of the executive and legislative branches. *See Brown*, 902 F.3d at 1086 (finding the plaintiff's requested declaration requiring the government to issue driver cards "incompatible with democratic principles embedded in the structure of the Constitution"). These decisions range, for example, from determining how much to invest in public transit to how quickly to transition to renewable energy, and plainly require consideration of "competing social, political, and economic forces," which must be made by the People's "elected representatives, rather than by federal judges interpreting the basic charter of Government for the entire country." *Collins v. City of Harker Heights*, 503 U.S. 115, 128–29 (1992); *see Lujan*, 504 U.S. at 559–60 ("[S]eparation of powers depends largely upon common understanding of what activities are appropriate to legislatures, to executives, and to courts.").

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procedural right to protect his concrete interests can assert that right without meeting all the normal standards for redressability and immediacy.").

The plaintiffs argue that the district court need not itself make policy decisions, because if their general request for a remedial plan is granted, the political branches can decide what policies will best "phase out fossil fuel emissions and draw down excess atmospheric CO2." To be sure, in some circumstances, courts may order broad injunctive relief while leaving the "details of implementation" to the government's discretion. *Brown v. Plata*, 563 U.S. 493, 537–38 (2011). But, even under such a scenario, the plaintiffs' request for a remedial plan would subsequently require the judiciary to pass judgment on the sufficiency of the government's response to the order, which necessarily would entail a broad range of policymaking. And inevitably, this kind of plan will demand action not only by the Executive, but also by Congress. Absent court intervention, the political branches might conclude—however inappropriately in the plaintiffs' view—that economic or defense considerations called for continuation of the very programs challenged in this suit, or a less robust approach to addressing climate change than the plaintiffs believe is necessary. "But we cannot substitute our own assessment for the Executive's [or Legislature's] predictive judgments on such matters, all of which 'are delicate, complex, and involve large elements of prophecy.'" *Hawaii*, 138 S. Ct. at 2421 (quoting *Chi. & S. Air Lines, Inc. v. Waterman S.S. Corp.*, 333 U.S. 103, 111 (1948)). And, given the complexity and long-lasting nature of global climate change, the court would be required to supervise the government's compliance with any suggested plan for many decades. *See Nat. Res. Def. Council, Inc. v. EPA*, 966 F.2d 1292, 1300 (9th Cir. 1992) ("Injunctive relief could involve

extraordinary supervision by this court. . . . [and] may be inappropriate where it requires constant supervision.").[8]

As the Supreme Court recently explained, "a constitutional directive or legal standards" must guide the courts' exercise of equitable power. *Rucho v. Common Cause*, 139 S. Ct. 2484, 2508 (2019). *Rucho* found partisan gerrymandering claims presented political questions beyond the reach of Article III courts. *Id.* at 2506–07. The Court did not deny extreme partisan gerrymandering can violate the Constitution. *See id.* at 2506; *id.* at 2514–15 (Kagan, J., dissenting). But, it concluded that there was no "limited and precise" standard discernible in the Constitution for redressing the asserted violation. *Id.* at 2500. The Court

[8] However belatedly, the political branches are currently debating such action. Many resolutions and plans have been introduced in Congress, ranging from discrete measures to encourage clean energy innovation to the "Green New Deal" and comprehensive proposals for taxing carbon and transitioning all sectors of the economy away from fossil fuels. *See, e.g.*, H.R. Res. 109, 116th Cong. (2019); S.J. Res. 8, 116th Cong. (2019); Enhancing Fossil Fuel Energy Carbon Technology Act, S. 1201, 116th Cong. (2019); Climate Action Now Act, H.R. 9, 116th Cong. (2019); Methane Waste Prevention Act, H.R. 2711, 116th Cong. (2019); Clean Energy Standard Act, S. 1359, 116th Cong. (2019); National Climate Bank Act, S. 2057, 116th Cong. (2019); Carbon Pollution Transparency Act, S. 1745, 116th Cong. (2019); Leading Infrastructure for Tomorrow's America Act, H.R. 2741, 116th Cong. (2019); Buy Clean Transparency Act, S. 1864, 116th Cong. (2019); Carbon Capture Modernization Act, H.R. 1796, 116th Cong. (2019); Challenges & Prizes for Climate Act, H.R. 3100, 116th Cong. (2019); Energy Innovation and Carbon Dividend Act, H.R. 763, 116th Cong. (2019); Climate Risk Disclosure Act, S. 2075, 116th Cong. (2019); Clean Energy for America Act, S. 1288, 116th Cong. (2019). The proposed legislation, consistent with the opinions of the plaintiffs' experts, envisions that tackling this global problem involves the exercise of discretion, trade-offs, international cooperation, private-sector partnerships, and other value judgments ill-suited for an Article III court.

rejected the plaintiffs' proposed standard because unlike the one-person, one-vote rule in vote dilution cases, it was not "relatively easy to administer as a matter of math." *Id.* at 2501.

Rucho reaffirmed that redressability questions implicate the separation of powers, noting that federal courts "have no commission to allocate political power and influence" without standards to guide in the exercise of such authority. *See id.* at 2506–07, 2508. Absent those standards, federal judicial power could be "unlimited in scope and duration," and would inject "the unelected and politically unaccountable branch of the Federal Government [into] assuming such an extraordinary and unprecedented role." *Id.* at 2507; *see also Lexmark Int'l, Inc. v. Static Control Components, Inc.*, 572 U.S. 118, 125 (2014) (noting the "separation-of-powers principles underlying" standing doctrine); *Brown*, 902 F.3d at 1087 (stating that "in the context of Article III standing, . . . federal courts must respect their 'proper—and properly limited—role . . . in a democratic society'" (quoting *Gill v. Whitford*, 138 S. Ct. 1916, 1929 (2018)). Because "it is axiomatic that 'the Constitution contemplates that democracy is the appropriate process for change,'" *Brown*, 902 F.3d at 1087 (quoting *Obergefell v. Hodges*, 135 S. Ct. 2584, 2605 (2015)), some questions—even those existential in nature—are the province of the political branches. The Court found in *Rucho* that a proposed standard involving a mathematical comparison to a baseline election map is too difficult for the judiciary to manage. *See* 139 S. Ct. at 2500–02. It is impossible to reach a different conclusion here.

The plaintiffs' experts opine that atmospheric carbon levels of 350 parts per million are necessary to stabilize the global climate. But, even accepting those opinions as valid,

they do not suggest how an order from this Court can achieve that level, other than by ordering the government to develop a plan. Although the plaintiffs' invitation to get the ball rolling by simply ordering the promulgation of a plan is beguiling, it ignores that an Article III court will thereafter be required to determine whether the plan is sufficient to remediate the claimed constitutional violation of the plaintiffs' right to a "climate system capable of sustaining human life." We doubt that any such plan can be supervised or enforced by an Article III court. And, in the end, any plan is only as good as the court's power to enforce it.

C.

Our dissenting colleague quite correctly notes the gravity of the plaintiffs' evidence; we differ only as to whether an Article III court can provide their requested redress. In suggesting that we can, the dissent reframes the plaintiffs' claimed constitutional right variously as an entitlement to "the country's perpetuity," Diss. at 35–37, 39, or as one to freedom from "the amount of fossil-fuel emissions that will irreparably devastate our Nation," *id.* at 57. But if such broad constitutional rights exist, we doubt that the plaintiffs would have Article III standing to enforce them. Their alleged individual injuries do not flow from a violation of these claimed rights. Indeed, any injury from the dissolution of the Republic would be felt by all citizens equally, and thus would not constitute the kind of discrete and particularized injury necessary for Article III standing. *See Friends of the Earth*, 528 U.S. at 180–81. A suit for a violation of these reframed rights, like one for a violation of the Guarantee Clause, would also plainly be nonjusticiable. *See, e.g.*, *Rucho*, 139 S. Ct. at 2506 ("This Court has several times concluded, however, that the Guarantee Clause does not provide the basis for a justiciable claim.") (citing *Pac. States*

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Tel. & Tel. Co. v. Oregon, 223 U.S. 118, 149 (1912)); *Luther v. Borden*, 48 U.S. 1, 36–37, 39 (1849).

More importantly, the dissent offers no metrics for judicial determination of the level of climate change that would cause "the willful dissolution of the Republic," Diss. at 40, nor for measuring a constitutionally acceptable "perceptible reduction in the advance of climate change," *id.* at 47. Contrary to the dissent, we cannot find Article III redressability requirements satisfied simply because a court order might "postpone[] the day when remedial measures become insufficiently effective." *Id.* at 46; *see Brown*, 902 F.3d at 1083 ("If, however, a favorable judicial decision would not require the defendant to redress the plaintiff's claimed injury, the plaintiff cannot demonstrate redressability[.]"). Indeed, as the dissent recognizes, a guarantee against government conduct that might threaten the Union—whether from political gerrymandering, nuclear proliferation, Executive misconduct, or climate change—has traditionally been viewed by Article III courts as "not separately enforceable." *Id.* at 39. Nor has the Supreme Court recognized "the perpetuity principle" as a basis for interjecting the judicial branch into the policy-making purview of the political branches. *See id.* at 42.

Contrary to the dissent, we do not "throw up [our] hands" by concluding that the plaintiffs' claims are nonjusticiable. *Id.* at 33. Rather, we recognize that "Article III protects liberty not only through its role in implementing the separation of powers, but also by specifying the defining characteristics of Article III judges." *Stern v. Marshall*, 564 U.S. 462, 483 (2011). Not every problem posing a threat—even a clear and present danger—to the American Experiment can be solved by federal judges. As Judge Cardozo once aptly warned, a judicial commission does not

confer the power of "a knight-errant, roaming at will in pursuit of his own ideal of beauty or of goodness;" rather, we are bound "to exercise a discretion informed by tradition, methodized by analogy, disciplined by system.'" Benjamin N. Cardozo, *The Nature of the Judicial Process* 141 (1921).[9]

The dissent correctly notes that the political branches of government have to date been largely deaf to the pleas of the plaintiffs and other similarly situated individuals. But, although inaction by the Executive and Congress may affect the form of judicial relief ordered when there is Article III standing, it cannot bring otherwise nonjusticiable claims within the province of federal courts. *See Rucho*, 139 S. Ct. at 2507–08; *Gill*, 138 S. Ct. at 1929 ("'Failure of political will does not justify unconstitutional remedies.' . . . Our power as judges . . . rests not on the default of politically accountable officers, but is instead grounded in and limited by the necessity of resolving, according to legal principles, a plaintiff's particular claim of legal right." (quoting *Clinton v. City of New York*, 524 U.S. 417, 449 (1998) (Kennedy, J., concurring))); *Brown*, 902 F.3d at 1087 ("The *absence* of a law, however, has never been held to constitute a 'substantive result' subject to judicial review[.]").

The plaintiffs have made a compelling case that action is needed; it will be increasingly difficult in light of that record

[9] Contrary to the dissent, we do not find this to be a political question, although that doctrine's factors often overlap with redressability concerns. Diss. at 51–61; *Republic of Marshall Islands v. United States*, 865 F.3d 1187, 1192 (9th Cir. 2017) ("Whether examined under the . . . the redressability prong of standing, or the political question doctrine, the analysis stems from the same separation-of-powers principle—enforcement of this treaty provision is not committed to the judicial branch. Although these are distinct doctrines . . . there is significant overlap.").

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for the political branches to deny that climate change is occurring, that the government has had a role in causing it, and that our elected officials have a moral responsibility to seek solutions. We do not dispute that the broad judicial relief the plaintiffs seek could well goad the political branches into action. Diss. at 45–46, 49–50, 57–61. We reluctantly conclude, however, that the plaintiffs' case must be made to the political branches or to the electorate at large, the latter of which can change the composition of the political branches through the ballot box. That the other branches may have abdicated their responsibility to remediate the problem does not confer on Article III courts, no matter how well-intentioned, the ability to step into their shoes.

III.

For the reasons above, we reverse the certified orders of the district court and remand this case to the district court with instructions to dismiss for lack of Article III standing.[10]

REVERSED.

STATON, District Judge, dissenting:

In these proceedings, the government accepts as fact that the United States has reached a tipping point crying out for a concerted response—yet presses ahead toward calamity. It is as if an asteroid were barreling toward Earth and the government decided to shut down our only defenses.

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[10] The plaintiffs' motion for an injunction pending appeal, Dkt. 21, is **DENIED**. Their motions for judicial notice, Dkts. 134, 149, are **GRANTED**.

Seeking to quash this suit, the government bluntly insists that it has the absolute and unreviewable power to destroy the Nation.

My colleagues throw up their hands, concluding that this case presents nothing fit for the Judiciary. On a fundamental point, we agree: No case can singlehandedly prevent the catastrophic effects of climate change predicted by the government and scientists. But a federal court need not manage all of the delicate foreign relations and regulatory minutiae implicated by climate change to offer real relief, and the mere fact that this suit cannot alone halt climate change does not mean that it presents no claim suitable for judicial resolution.

Plaintiffs bring suit to enforce the most basic structural principle embedded in our system of ordered liberty: that the Constitution does not condone the Nation's willful destruction. So viewed, plaintiffs' claims adhere to a judicially administrable standard. And considering plaintiffs seek no less than to forestall the Nation's demise, even a partial and temporary reprieve would constitute meaningful redress. Such relief, much like the desegregation orders and statewide prison injunctions the Supreme Court has sanctioned, would vindicate plaintiffs' constitutional rights without exceeding the Judiciary's province. For these reasons, I respectfully dissent.[1]

[1] I agree with the majority that plaintiffs need not bring their claims under the APA. *See Franklin v. Massachusetts*, 505 U.S. 788, 801 (1992); *Webster v. Doe*, 486 U.S. 592, 603–04 (1988).

I.

As the majority recognizes, and the government does not contest, carbon dioxide ("CO_2") and other greenhouse gas ("GHG") emissions created by burning fossil fuels are devastating the planet. Maj. Op. at 14–15. According to one of plaintiffs' experts, the inevitable result, absent immediate action, is "an inhospitable future . . . marked by rising seas, coastal city functionality loss, mass migrations, resource wars, food shortages, heat waves, mega-storms, soil depletion and desiccation, freshwater shortage, public health system collapse, and the extinction of increasing numbers of species." Even government scientists[2] project that, given current warming trends, sea levels will rise two feet by 2050, nearly four feet by 2070, over eight feet by 2100, 18 feet by 2150, and over 31 feet by 2200. To put that in perspective, a three-foot sea level rise will make two million American homes uninhabitable; a rise of approximately 20 feet will result in the total loss of Miami, New Orleans, and other coastal cities. So, as described by plaintiffs' experts, the injuries experienced by plaintiffs are the first small wave in an oncoming tsunami—now visible on the horizon of the not-so-distant future—that will destroy the United States as we currently know it.

What sets this harm apart from all others is not just its magnitude, but its irreversibility. The devastation might look and feel somewhat different if future generations could simply pick up the pieces and restore the Nation. But plaintiffs' experts speak of a certain level of global warming as "locking in" this catastrophic damage. Put more starkly by plaintiffs' expert, Dr. Harold R. Wanless, "[a]tmospheric

[2] NOAA, Technical Rep. NOS CO-OPS 083, Global and Regional Sea Level Rise Scenarios for the United States 23 (Jan. 2017).

warming will continue for some 30 years after we stop putting more greenhouse gasses into the atmosphere. But that warmed atmosphere will continue warming the ocean for centuries, and the accumulating heat in the oceans *will persist for millennia*" (emphasis added). Indeed, another of plaintiffs' experts echoes, "[t]he fact that GHGs dissipate very slowly from the atmosphere . . . and that the costs of taking CO_2 out of the atmosphere through non-biological carbon capture and storage are very high means that *the consequences of GHG emissions should be viewed as effectively irreversible*" (emphasis added). In other words, "[g]iven the self-reinforcing nature of climate change," the tipping point may well have arrived, and we may be rapidly approaching the point of no return.

Despite countless studies over the last half century warning of the catastrophic consequences of anthropogenic greenhouse gas emissions, many of which the government conducted, the government not only failed to act but also "affirmatively promote[d] fossil fuel use in a host of ways." Maj. Op. at 15. According to plaintiffs' evidence, our nation is crumbling—at our government's own hand—into a wasteland. In short, the government has directly facilitated an existential crisis to the country's perpetuity.[3]

II.

In tossing this suit for want of standing, the majority concedes that the children and young adults who brought suit have presented enough to proceed to trial on the first two aspects of the inquiry (injury in fact and traceability). But

[3] My asteroid analogy would therefore be more accurate if I posited a scenario in which the government itself accelerated the asteroid towards the earth before shutting down our defenses.

the majority provides two-and-a-half reasons for concluding that plaintiffs' injuries are not redressable. After detailing its "skeptic[ism]" that the relief sought could "suffice to stop catastrophic climate change or even ameliorate [plaintiffs'] injuries[,]" Maj. Op. at 23–25, the majority concludes that, at any rate, a court would lack any power to award it. In the majority's view, the relief sought is too great and unsusceptible to a judicially administrable standard.

To explain why I disagree, I first step back to define the interest at issue. While standing operates as a threshold issue distinct from the merits of the claim, "it often turns on the nature and source of the claim asserted." *Warth v. Seldin*, 422 U.S. 490, 500 (1975). And, unlike the majority, I believe the government has more than just a nebulous "moral responsibility" to preserve the Nation. Maj. Op. at 31–32.

A.

The Constitution protects the right to "life, liberty, and property, to free speech, a free press, [and] freedom of worship and assembly." *W. Virginia State Bd. of Educ. v. Barnette*, 319 U.S. 624, 638 (1943). Through "reasoned judgment," the Supreme Court has recognized that the Due Process Clause, enshrined in the Fifth and Fourteenth Amendments, also safeguards certain "interests of the person so fundamental that the [government] must accord them its respect." *Obergefell v. Hodges*, 135 S. Ct. 2584, 2598 (2015). These include the right to marry, *Loving v. Virginia*, 388 U.S. 1, 12 (1967), to maintain a family and rear children, *M.L.B. v. S.L.J.*, 519 U.S. 102, 116 (1996), and to pursue an occupation of one's choosing, *Schware v. Bd. of Bar Exam.*, 353 U.S. 232, 238–39 (1957). As fundamental rights, these "may not be submitted to vote; they depend on the outcome of no elections." *Lucas v. Forty-Fourth Gen. Assembly*,

377 U.S. 713, 736 (1964) (quoting *Barnette*, 319 U.S. at 638).

Some rights serve as the necessary predicate for others; their fundamentality therefore derives, at least in part, from the necessity to preserve other fundamental constitutional protections. *Cf., e.g.*, *Timbs v. Indiana*, 139 S. Ct. 682, 689 (2019) (deeming a right fundamental because its deprivation would "undermine other constitutional liberties"). For example, the right to vote "is of the essence of a democratic society, and any restrictions on that right strike at the heart of representative government." *Reynolds v. Sims*, 377 U.S. 533, 555 (1964). Because it is "preservative of all rights," the Supreme Court has long regarded suffrage "as a fundamental political right." *Yick Wo v. Hopkins*, 118 U.S. 356, 370 (1886). This holds true even though the right to vote receives imperfect express protection in the Constitution itself: While several amendments proscribe the denial or abridgement of suffrage based on certain characteristics, the Constitution does not guarantee the right to vote *ab initio*. *See* U.S. Const. amends. XV, XIX, XXIV, XXVI; *cf.* U.S. Const. art. I, § 4, cl. 1.

Much like the right to vote, the perpetuity of the Republic occupies a central role in our constitutional structure as a "guardian of all other rights," *Plyler v. Doe*, 457 U.S. 202, 217 n.15 (1982). "Civil liberties, as guaranteed by the Constitution, imply the existence of an organized society . . . ." *Cox v. New Hampshire*, 312 U.S. 569, 574 (1941); *see also The Ku Klux Cases*, 110 U.S. 651, 657–68 (1884). And, of course, in our system, that organized society consists of the Union. Without it, all the liberties protected by the Constitution to live the good life are meaningless.

This observation is hardly novel. After securing independence, George Washington recognized that "the destiny of unborn millions" rested on the fate of the new Nation, cautioning that "whatever measures have a tendency to dissolve the Union, or contribute to violate or lessen the Sovereign Authority, ought to be considered as hostile to the Liberty and Independency of America[.]" President George Washington, Circular Letter of Farewell to the Army (June 8, 1783). Without the Republic's preservation, Washington warned, "there is a natural and necessary progression, from the extreme of anarchy to the extreme of Tyranny; and that arbitrary power is most easily established on the ruins of Liberty abused to licentiousness." *Id.*

When the Articles of the Confederation proved ill-fitting to the task of safeguarding the Union, the framers formed the Constitutional Convention with "the great object" of "preserv[ing] and perpetuat[ing]" the Union, for they believed that "the prosperity of America depended on its Union." The Federalist No. 2, at 19 (John Jay) (E. H. Scott ed., 1898); *see also* Letter from James Madison to Thomas Jefferson (Oct. 24, 1787)[4] ("It appeared to be the sincere and unanimous wish of the Convention to cherish and preserve the Union of the States."). In pressing New York to ratify the Constitution, Alexander Hamilton spoke of the gravity of the occasion: "The subject speaks its own importance; comprehending in its consequences nothing less than the existence of the Union, the safety and welfare of the parts of which it is composed—the fate of an empire, in many respects the most interesting in the world." The Federalist No. 1, at 11 (Alexander Hamilton) (E. H. Scott ed., 1898). In light of this animating principle, it is fitting that the

[4] Available at https://founders.archives.gov/documents/Jefferson/01-12-02-0274.

Preamble declares that the Constitution is intended to secure "the Blessings of Liberty" not just for one generation, but for all future generations—our "Posterity."

The Constitution's structure reflects this perpetuity principle. *See Alden v. Maine*, 527 U.S. 706, 713 (1999) (examining how "[v]arious textual provisions of the Constitution assume" a structural principle). In taking the Presidential Oath, the Executive must vow to "preserve, protect and defend the Constitution of the United States," U.S. Const. art. II, § 1, cl. 8, and the Take Care Clause obliges the President to "take Care that the Laws be faithfully executed," U.S. Const. art. II, § 3. Likewise, though generally not separately enforceable, Article IV, Section 4 provides that the "United States shall guarantee to every State in this Union a Republican Form of Government, and shall protect each of them against Invasion; and . . . against domestic Violence." U.S. Const. art. IV, § 4; *see also New York v. United States*, 505 U.S. 144, 184–85 (1992).

Less than a century after the country's founding, the perpetuity principle undergirding the Constitution met its greatest challenge. Faced with the South's secession, President Lincoln reaffirmed that the Constitution did not countenance its own destruction. "[T]he Union of these States is perpetual[,]" he reasoned in his First Inaugural Address, because "[p]erpetuity is implied, if not expressed, in the fundamental law of all national governments. It is safe to assert that no government proper ever had a provision in its organic law for its own termination." President Abraham Lincoln, First Inaugural Address (Mar. 4, 1861). In justifying this constitutional principle, Lincoln drew from history, observing that "[t]he Union is much older than the Constitution." *Id.* He reminded his fellow citizens, "one of

the declared objects for ordaining and establishing the Constitution was 'to form a *more perfect* Union.'" *Id.* (emphasis added) (quoting U.S. Const. pmbl.). While secession manifested the existential threat most apparently contemplated by the Founders—political dissolution of the Union—the underlying principle applies equally to its physical destruction.

This perpetuity principle does not amount to "a right to live in a contaminant-free, healthy environment." *Guertin v. Michigan*, 912 F.3d 907, 922 (6th Cir. 2019). To be sure, the stakes can be quite high in environmental disputes, as pollution causes tens of thousands of premature deaths each year, not to mention disability and diminished quality of life.[5] Many abhor living in a polluted environment, and some pay with their lives. But mine-run environmental concerns "involve a host of policy choices that must be made by . . . elected representatives, rather than by federal judges interpreting the basic charter of government[.]" *Collins v. City of Harker Heights*, 503 U.S. 115, 129 (1992). The perpetuity principle is not an environmental right at all, and it does not task the courts with determining the optimal level of environmental regulation; rather, it prohibits only the willful dissolution of the Republic.[6]

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[5] *See, e.g.*, Andrew L. Goodkind et al., *Fine-Scale Damage Estimates of Particulate Matter Air Pollution Reveal Opportunities for Location-Specific Mitigation of Emissions*, *in* 116 Proceedings of the National Academy of Sciences 8775, 8779 (2019) (estimating that fine particulate matter caused 107,000 premature deaths in 2011).

[6] Unwilling to acknowledge that the very nature of the climate crisis places this case in a category of one, the government argues that "the Constitution does not provide judicial remedies for every social and economic ill." For support, the government cites *Lindsey v. Normet*,

That the principle is structural and implicit in our constitutional system does not render it any less enforceable. To the contrary, our Supreme Court has recognized that "[t]here are many [] constitutional doctrines that are not spelled out in the Constitution" but are nonetheless enforceable as "historically rooted principle[s] embedded in the text and structure of the Constitution." *Franchise Tax Bd. of California v. Hyatt*, 139 S. Ct. 1485, 1498–99 (2019). For instance, the Constitution does not in express terms provide for judicial review, *Marbury v. Madison*, 5 U.S. 137, 176–77 (1803); sovereign immunity (outside of the Eleventh Amendment's explicit restriction), *Alden*, 527 U.S. at 735–36; the anticommandeering doctrine, *Murphy v. NCAA*, 138 S. Ct. 1461, 1477 (2018); or the regimented tiers of scrutiny applicable to many constitutional rights, *see, e.g.*, *Turner Broad. Sys., Inc. v. FCC*, 512 U.S. 622, 641–42 (1994). Yet these doctrines, as well as many other implicit principles, have become firmly entrenched in our constitutional landscape. And, in an otherwise justiciable case, a private litigant may seek to vindicate such structural principles, for they "protect the individual as well" as the Nation. *See Bond v. United States*, 564 U.S. 211, 222, 225–26 (2011); *INS. v. Chadha*, 462 U.S. 919, 935–36 (1983).

In *Hyatt*, for instance, the Supreme Court held that a state could not be sued in another state's courts without its consent. Although nothing in the text of the Constitution expressly forbids such suits, the Court concluded that they

405 U.S. 56, 74 (1972), which held Oregon's wrongful detainer statute governing landlord/tenant disputes constitutional. The perpetuity principle, however, cabins the right and avoids any slippery slope. While the principle's goal is to preserve the most fundamental individual rights to life, liberty, and property, it is not triggered absent an existential threat to the country arising from a "point of no return" that is, at least in part, of the government's own making.

contravened "the 'implicit ordering of relationships within the federal system necessary to make the Constitution a workable governing charter and to give each provision within that document the full effect intended by the Framers.'" *Hyatt*, 139 S. Ct. at 1492 (quoting *Nevada v. Hall*, 440 U.S. 410, 433 (1979) (Rehnquist, J., dissenting)). So too here.

Nor can the perpetuity principle be rejected simply because the Court has not yet had occasion to enforce it as a limitation on government conduct. Only over time, as the Nation confronts new challenges, are constitutional principles tested. For instance, courts did not recognize the anticommandeering doctrine until the 1970s because "[f]ederal commandeering of state governments [was] such a novel phenomenon." *Printz v. United States*, 521 U.S. 898, 925 (1997). And the Court did not recognize that cell-site data fell within the Fourth Amendment until 2018. In so holding, the Court rejected "a 'mechanical interpretation' of the Fourth Amendment" because "technology has enhanced the Government's capacity to encroach upon areas normally guarded from inquisitive eyes[.]" *Carpenter v. United States*, 138 S. Ct. 2206, 2214 (2018). Thus, it should come as no surprise that the Constitution's commitment to perpetuity only now faces judicial scrutiny, for never before has the United States confronted an existential threat that has not only gone unremedied but is actively backed by the government.

The mere fact that we have alternative means to enforce a principle, such as voting, does not diminish its constitutional stature. Americans can vindicate federalism, separation of powers, equal protection, and voting rights through the ballot box as well, but that does not mean these constitutional guarantees are not independently enforceable.

By its very nature, the Constitution "withdraw[s] certain subjects from the vicissitudes of political controversy, to place them beyond the reach of majorities and officials and to establish them as legal principles to be applied by the courts." *Barnette*, 319 U.S. at 638. When fundamental rights are at stake, individuals "need not await legislative action." *Obergefell*, 135 S. Ct. at 2605.

Indeed, in this *sui generis* circumstance, waiting is not an option. Those alive today are at perhaps the singular point in history where society (1) is scientifically aware of the impending climate crisis, and (2) can avoid the point of no return. And while democracy affords citizens the right "to debate so they can learn and decide and then, through the political process, act in concert to try to shape the course of their own times[,]" *id.* (quoting *Schuette v. Coalition to Defend Affirmative Action*, 572 U.S. 291, 312 (2014)), that process cannot override the laws of nature. Or, more colloquially, we can't shut the stable door after the horse has bolted.

As the last fifty years have made clear, telling plaintiffs that they must vindicate their right to a habitable United States through the political branches will rightfully be perceived as telling them they have no recourse. The political branches must often realize constitutional principles, but in a justiciable case or controversy, courts serve as the ultimate backstop. To this issue, I turn next.

B.

Of course, "it is not the role of courts, but that of the political branches, to shape the institutions of government in such fashion as to comply with the laws and the Constitution." *Lewis v. Casey*, 518 U.S. 343, 349 (1996). So federal courts are not free to address *every* grievance.

"Whether a party has a sufficient stake in an otherwise justiciable controversy to obtain judicial resolution of that controversy is what has traditionally been referred to as the question of standing to sue." *Sierra Club v. Morton*, 405 U.S. 727, 731–32 (1972). Standing is "a doctrine rooted in the traditional understanding of a case or controversy," developed to "ensure that federal courts do not exceed their authority as it has been traditionally understood." *Spokeo, Inc. v. Robins*, 136 S. Ct. 1540, 1547 (2016).

A case is fit for judicial determination only if the plaintiff has: "(1) suffered an injury in fact, (2) that is fairly traceable to the challenged conduct of the defendant, and (3) that is likely to be redressed by a favorable judicial decision." *Id.* (citing *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560–61 (1992); then citing *Friends of the Earth, Inc. v. Laidlaw Envtl. Serv. (TOC), Inc.*, 528 U.S. 167, 180–81 (2000)). As to the first two elements, my colleagues and I agree: Plaintiffs present adequate evidence at this pre-trial stage to show particularized, concrete injuries to legally-protected interests, and they present further evidence to raise genuine disputes as to whether those injuries—at least in substantial part—are fairly traceable to the government's conduct at issue. *See* Maj. Op. at 18–21. Because I find that plaintiffs have also established the third prong for standing, redressability, I conclude that plaintiffs' legal stake in this action suffices to invoke the adjudicative powers of the federal bench.

1.

"Redressability" concerns whether a federal court is capable of vindicating a plaintiff's legal rights. I agree with the majority that our ability to provide redress is animated by two inquiries, one of efficacy and one of power. Maj. Op. at 21 (citing *M.S. v. Brown*, 902 F.3d 1076, 1083 (9th Cir.

2018)). First, as a causal matter, is a court order likely to actually remediate the plaintiffs' injury? If so, does the judiciary have the constitutional authority to levy such an order? *Id.*

Addressing the first question, my colleagues are skeptical that curtailing the government's facilitation of fossil-fuel extraction and combustion will ameliorate the plaintiffs' harms. *See* Maj. Op. at 22–25. I am not, as the nature of the injury at stake informs the effectiveness of the remedy. *See Warth*, 422 U.S. at 500.

As described above, the right at issue is not to be entirely free from any climate change. Rather, plaintiffs have a constitutional right to be free from *irreversible and catastrophic climate change*. Plaintiffs have begun to feel certain concrete manifestations of this violation, ripening their case for litigation, but such prefatory harms are just the first barbs of an *ongoing* injury flowing from an *ongoing* violation of plaintiffs' rights. The bulk of the injury is yet to come. Therefore, practical redressability is not measured by our ability to stop climate change in its tracks and immediately undo the injuries that plaintiffs suffer today—an admittedly tall order; it is instead measured by our ability to curb by some meaningful degree what the record shows to be an otherwise inevitable march to the point of no return. Hence, the injury at issue is not climate change writ large; it is climate change beyond the threshold point of no return. As we approach that threshold, the significance of every emissions reduction is magnified.

The majority portrays any relief we can offer as just a drop in the bucket. *See* Maj. Op. at 22–25. In a previous generation, perhaps that characterization would carry the day and we would hold ourselves impotent to address plaintiffs' injuries. But we are perilously close to an overflowing

bucket. These final drops matter. *A lot.* Properly framed, a court order—even one that merely postpones the day when remedial measures become insufficiently effective—would likely have a real impact on preventing the impending cataclysm. Accordingly, I conclude that the court could do something to help the plaintiffs before us.

And "something" is all that standing requires. In *Massachusetts v. EPA*, 549 U.S. 497 (2007), the Supreme Court explicitly held that a non-negligible reduction in emissions—there, by regulating vehicles emissions—satisfied the redressability requirement of Article III standing:

> While it may be true that regulating motor-vehicle emissions will not by itself *reverse* global warming, it by no means follows that we lack jurisdiction to decide whether EPA has a duty to take steps to *slow* or *reduce* it. Because of the enormity of the potential consequences associated with manmade climate change, the fact that the effectiveness of a remedy might be delayed during the (relatively short) time it takes for a new motor-vehicle fleet to replace an older one is essentially irrelevant. Nor is it dispositive that developing countries such as China and India are poised to increase greenhouse gas emissions substantially over the next century: A reduction in domestic emissions would slow the pace of global emissions increases, no matter what happens elsewhere.
>
> . . . .

> . . . The risk of catastrophic harm, though remote, is nevertheless real.

Id. at 525–26 (internal citation omitted).

In other words, under Article III, a perceptible reduction in the advance of climate change is sufficient to redress a plaintiff's climate change-induced harms. Full stop. The majority dismisses this precedent because *Massachusetts v. EPA* involved a procedural harm, whereas plaintiffs here assert a purely substantive right. Maj. Op. at 24. But this difference in posture does not affect the outcome.

While the redressability requirement is relaxed in the procedural context, that does not mean (1) we must engage in a similarly relaxed analysis whenever we invoke *Massachusetts v. EPA* or (2) we cannot rely on *Massachusetts v. EPA's* substantive examination of the relationship between government action and the course of climate change. Accordingly, here, we do not consider the likelihood that plaintiffs will prevail in any newly-awarded agency procedure, nor whether granting access to that procedure will redress plaintiffs' injury. *Cf. Massachusetts v. EPA*, 549 U.S. at 517–18; *Lujan*, 504 U.S. at 572 n.7. Rather, we assume plaintiffs *will* prevail—removing the procedural link from the causal chain—and we resume our traditional analysis to determine whether the desired outcome would in fact redress plaintiffs' harms.[7] In

[7] The presence of a procedural right is more critical when determining whether the first and second elements of standing are present. This is especially true where Congress has "define[d] injuries and articulate[d] chains of causation that will give rise to a case or controversy where none existed before" by conferring procedural rights that give certain persons a "stake" in an injury that is otherwise not their own. *Spokeo*, 136 S. Ct. at 1549 (quoting *Lujan*, 504 U.S. at 580

Massachusetts v. EPA, the remaining substantive inquiry was whether reducing emissions from fossil-fuel combustion would likely ameliorate climate change-induced injuries despite the global nature of climate change (regardless of whether renewed procedures were themselves likely to mandate such lessening). The Supreme Court unambiguously answered that question in the affirmative. That holding squarely applies to the instant facts,[8] rendering the absence of a procedural right here irrelevant.[9]

(Kennedy, J., concurring)). But who seeks to vindicate an injury is irrelevant to the question of whether a court has the tools to relieve that injury.

[8] Indeed, the majority has already acknowledged as much in finding plaintiffs' injuries traceable to the government's misconduct because the traceability and redressability inquiries are largely coextensive. *See* Maj. Op. at 19–21; *see also Wash. Envtl. Council v. Bellon*, 732 F.3d 1131, 1146 (2013) ("The Supreme Court has clarified that the 'fairly traceable' and 'redressability' components for standing overlap and are 'two facets of a single causation requirement.' The two are distinct insofar as causality examines the connection between the alleged misconduct and injury, whereas redressability analyzes the connection between the alleged injury and requested judicial relief.") (internal citation omitted). Here, where the requested relief is simply to stop the ongoing misconduct, the inquiries are nearly identical. *Cf. Allen v. Wright*, 468 U.S. 737, 753 n.19 (1984) ("[I]t is important to keep the inquiries separate" where "the relief requested goes well beyond the violation of law alleged."), *abrogated on other grounds by Lexmark Int'l, Inc. v. Static Control Components, Inc.*, 572 U.S. 118 (2014); *see also infra* Part II.B.3.

[9] Nor am I persuaded that *Massachusetts v. EPA* is distinguishable because of the relaxed standing requirements and "special solicitude" in cases brought by a state against the United States. *Massachusetts v. EPA*, 549 U.S. at 517–20. When *Massachusetts v. EPA* was decided, more than a decade ago, there was uncertainty and skepticism as to whether an individual could state a sufficiently definite climate change-induced

2.

The majority laments that it cannot step into the shoes of the political branches, *see* Maj. Op. at 32, but appears ready to yield even if those branches walk the Nation over a cliff. This deference-to-a-fault promotes separation of powers to the detriment of our countervailing constitutional mandate to intervene where the political branches run afoul of our foundational principles. Our tripartite system of government is often and aptly described as one of "checks and balances." The doctrine of standing preserves *balance* among the branches by keeping separate questions of general governance and those of specific legal entitlement. But the doctrine of judicial review compels federal courts to fashion and effectuate relief to right legal wrongs, even when—as frequently happens—it requires that we instruct the other branches as to the constitutional limitations on their power. Indeed, sometimes "the [judicial and governance] roles briefly and partially coincide when a court, in granting relief against actual harm that has been suffered, . . . orders the alteration of an institutional organization or procedure that causes the harm." *Lewis*, 518 U.S. at 350; *cf. Valley Forge Christian Coll. v. Ams. United for Separation of Church & State, Inc.*, 454 U.S. 464, 474 (1982) ("Proper regard for the

harm based on gradually warming air temperatures and rising seas. But the Supreme Court sidestepped such questions of the *concreteness* of the plaintiffs' injuries by finding that "[Massachusetts's] stake in the outcome of this case is sufficiently concrete to warrant the exercise of federal judicial power." *Id.* at 519. Here and now, the plaintiffs submit *undisputed scientific evidence* that their distinct and discrete injuries are caused by climate change brought about by emissions from fossil-fuel combustion. They need not rely on the "special solicitude," *id.* at 520, of a state to be heard. Regardless, any distinction would go to the concreteness or particularity of plaintiffs' injuries and not to the issue of redressability.

complex nature of our constitutional structure requires neither that the Judicial Branch shrink from a confrontation with the other two coequal branches of the Federal Government, nor that it hospitably accept for adjudication claims of constitutional violation by other branches of government where the claimant has not suffered cognizable injury."). In my view, this Court must confront and reconcile this tension before deciding that thorny questions of standing preclude review in this case. And faithful application of our history and precedents reveals that a failure to do so leads to the wrong result.

Taking the long (but essential) way around, I begin first by acknowledging explicitly what the majority does not mention: our history plainly establishes an ambient presumption of judicial review to which separation-of-powers concerns provide a rebuttal under limited circumstances. Few would contest that "[i]t is emphatically the province and duty of the judicial department" to curb acts of the political branches that contravene those fundamental tenets of American life so dear as to be constitutionalized and thus removed from political whims. *See Marbury*, 5 U.S. at 177–78. This presumptive authority entails commensurate power to grant appropriate redress, as recognized in *Marbury*, "which effectively place[s] upon those who would deny the existence of an effective legal remedy the burden of showing why their case was special." *Ziglar v. Abbasi*, 137 S. Ct. 1843, 1874 (2017) (Breyer, J., dissenting). That is, "there must be something 'peculiar' (*i.e.*, special) about a case that warrants 'excluding the injured party from legal redress and placing it within that class of cases which come under the description of *damnum absque injuria*—a loss without an injury.'" *Id.* (cleaned up) (quoting *Marbury*, 5 U.S. at 163–64). In sum, although it is the plaintiffs' burden to establish injury in fact, causation,

and redressability, it is the government's burden to establish why this otherwise-justiciable controversy implicates grander separation-of-powers concerns not already captured by those requirements. We do not otherwise abdicate our duty to enforce constitutional rights.

Without explicitly laying this groundwork, the majority nonetheless suggests that this case is "special"—and beyond our redress—because plaintiffs' requested relief requires (1) the messy business of evaluating competing policy considerations to steer the government away from fossil fuels and (2) the intimidating task of supervising implementation over many years, if not decades. *See* Maj. Op. at 25–27. I admit these are daunting tasks, but we are constitutionally empowered to undertake them. There is no justiciability exception for cases of great complexity and magnitude.

3.

I readily concede that courts must on occasion refrain from answering those questions that are truly reserved for the political branches, even where core constitutional precepts are implicated. This deference is known as the "political question doctrine," and its applicability is governed by a well-worn multifactor test that counsels judicial deference where there is:

> [1] a textually demonstrable constitutional commitment of the issue to a coordinate political department; or [2] a lack of judicially discoverable and manageable standards for resolving it; or [3] the impossibility of deciding without an initial policy determination of a kind clearly for nonjudicial discretion; or [4] the

> impossibility of a court's undertaking independent resolution without expressing lack of the respect due coordinate branches of government; or [5] an unusual need for unquestioning adherence to a political decision already made; or [6] the potentiality of embarrassment from multifarious pronouncements by various departments on one question.

Baker v. Carr, 369 U.S. 186, 217 (1962); *see also Zivotofsky ex rel. Zivotofsky v. Clinton*, 566 U.S. 189, 195–201 (2012) (discussing and applying *Baker* factors); *Vieth v. Jubelirer*, 541 U.S. 267, 277–90 (2004) (same); *Nixon v. United States*, 506 U.S. 224, 228–38 (1993) (same); *Chadha*, 462 U.S. at 940–43 (same).[10] In some sense, these factors are frontloaded in significance. "We have characterized the first three factors as 'constitutional limitations of a court's jurisdiction' and the other three factors as 'prudential considerations.'" *Republic of Marshall Islands v. United States*, 865 F.3d 1187, 1200 (9th Cir. 2017) (quoting *Corrie*

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[10] The political question doctrine was first conceived in *Marbury*. *See Marbury*, 5 U.S. at 165–66 ("By the constitution of the United States, the President is invested with certain important political powers, in the exercise of which he is to use his own discretion, and is accountable only to his country in his political character, and to his own conscience."). The modern incarnation of the doctrine has existed relatively unaltered since its exposition in *Baker* in 1962. Although the majority disclaims the applicability of the political question doctrine, *see* Maj. Op. at 31, n.9, the opinion's references to the lack of discernable standards and its reliance on *Rucho v. Common Cause*, 139 S. Ct. 2484 (2019), as a basis for finding this case nonjusticiable blur any meaningful distinction between the doctrines of standing and political question.

v. Caterpillar, Inc., 503 F.3d 974, 981 (9th Cir. 2007)).[11] Moreover, "we have recognized that the first two are likely the most important." *Marshall Islands*, 865 F.3d at 1200 (citing *Alperin v. Vatican Bank*, 410 F.3d 532, 545 (9th Cir. 2005)). Yet, we have also recognized that the inquiry is highly case-specific, the factors "often collaps[e] into one another[,]" and any one factor of sufficient weight is enough to render a case unfit for judicial determination. *See Marshall Islands*, 865 F.3d at 1200 (first alteration in original) (quoting *Alperin*, 410 F.3d at 544). Regardless of any intra-factor flexibility and flow, however, there is a clear mandate to apply the political question doctrine both shrewdly and sparingly.

> Unless one of these formulations is inextricable from the case at bar, there should be no dismissal for non-justiciability on the ground of a political question's presence. The doctrine of which we treat is one of 'political questions,' not one of 'political cases.' The courts cannot reject as 'no law suit' a bona fide controversy as to whether

[11] The six *Baker* factors have been characterized as "reflect[ing] three distinct justifications for withholding judgment on the merits of a dispute." *Zivotofsky v. Clinton*, 566 U.S. at 203 (Sotomayor, J., concurring). Under the first *Baker* factor, "abstention is warranted because the court lacks authority to resolve" "issue[s] whose resolution is textually committed to a coordinate political department[.]" *Id.* Under the second and third factors, abstention is warranted in "circumstances in which a dispute calls for decisionmaking beyond courts' competence[.]" *Id.* Under the final three factors, abstention is warranted where "prudence . . . counsel[s] against a court's resolution of an issue presented." *Id.* at 204.

> some action denominated 'political' exceeds constitutional authority.

Baker, 369 U.S. at 217; *see also Corrie*, 503 F.3d at 982 ("We will not find a political question 'merely because [a] decision may have significant political overtones.'") (quoting *Japan Whaling Ass'n v. Am. Cetacean Soc'y*, 478U.S. 221, 230 (1986)). Rather, when detecting the presence of a "political question," courts must make a "discriminating inquiry into the precise facts and posture of the particular case" and refrain from "resolution by any semantic cataloguing." *Baker*, 369 U.S. at 217.

Here, confronted by difficult questions on the constitutionality of *policy*, the majority creates a minefield of *politics* en route to concluding that we cannot adjudicate this suit. And the majority's map for navigating that minefield is *Rucho v. Common Cause*, 139 S. Ct. 2484 (2019), an inapposite case about gerrymandering. My colleagues conclude that climate change is too political for the judiciary to touch by likening it to the process of political representatives drawing political maps to elect other political representatives. I vehemently disagree.

The government does not address on appeal the district judge's reasoning that the first, third, fourth, fifth and sixth *Baker* factors do not apply here. Neither does the majority rely on any of these factors in its analysis. In relevant part, I find the opinion below both thorough and well-reasoned, and I adopt its conclusions. I note, however, that the absence of the first *Baker* factor—whether the Constitution textually delegates the relevant subject matter to another branch—is especially conspicuous. As the district judge described, courts invoke this factor only where the Constitution makes an unambiguous commitment of responsibility to one branch

of government. Very few cases turn on this factor, and almost all that do pertain to two areas of constitutional authority: foreign policy and legislative proceedings. *See, e.g.*, *Marshall Islands*, 865 F.3d at 1200–01 (treaty enforcement); *Corrie*, 503 F.3d at 983 (military aid); *Nixon*, 506 U.S. at 234 (impeachment proceedings); *see also Davis v. Passman*, 442 U.S. 228, 235 n.11 (1979) ("[J]udicial review of congressional employment decisions is constitutionally limited only by the reach of the Speech or Debate Clause[,] . . . [which is] a paradigm example of a textually demonstrable constitutional commitment of [an] issue to a coordinate political department.") (internal quotation marks omitted); *Zivotofsky ex rel. Zivotofsky v. Kerry*, 135 S. Ct. 2076, 2086 (2015) ("The text and structure of the Constitution grant the President the power to recognize foreign nations and governments.").

Since this matter has been under submission, the Supreme Court cordoned off an additional area from judicial review based in part on a textual commitment to another branch: partisan gerrymandering. *See Rucho*, 139 S. Ct. at 2494–96.[12] Obviously, the Constitution does not explicitly address climate change. But neither does climate change *implicitly* fall within a recognized political-question area. As the district judge described, the questions of energy

[12] *Rucho* does not turn exclusively on the first *Baker* factor and acknowledges that there are some areas of districting that courts may police, notwithstanding the Elections Clause's "assign[ment] to state legislatures the power to prescribe the 'Times, Places and Manner of holding Elections' for Members of Congress, while giving Congress the power to 'make or alter' any such regulations." *Rucho*, 139 S. Ct. at 2495. Instead, *Rucho* holds that a combination of the text (as illuminated by historical practice) and absence of clear judicial standards precludes judicial review of excessively partisan gerrymanders. *See infra* Part II.B.4.

policy at stake here may have rippling effects on foreign policy considerations, but that is not enough to wholly exempt the subject matter from our review. *See Juliana v. United States*, 217 F. Supp. 3d 1224, 1238 (D. Or. 2016) ("[U]nlike the decisions to go to war, take action to keep a particular foreign leader in power, or give aid to another country, climate change policy is not *inherently*, or even primarily, a foreign policy decision."); *see also Baker*, 369 U.S. at 211 ("[I]t is error to suppose that every case or controversy which touches foreign relations lies beyond judicial cognizance.").

Without endorsement from the constitutional text, the majority's theory is grounded exclusively in the second *Baker* factor: a (supposed) lack of clear judicial standards for shaping relief. Relying heavily on *Rucho*, the majority contends that we cannot formulate standards (1) to determine what relief "is sufficient to remediate the claimed constitutional violation" or (2) to "supervise[] or enforce[]" such relief. Maj. Op. at 29.

The first point is a red herring. Plaintiffs submit ample evidence that there is a discernable "tipping point" at which the government's conduct turns from facilitating mere pollution to inducing an unstoppable cataclysm in violation of plaintiffs' rights. Indeed, the majority itself cites plaintiffs' evidence that "atmospheric carbon levels of 350 parts per million are necessary to stabilize the climate." *Id.* at 24. This clear line stands in stark contrast to *Rucho*, which held that—even assuming an excessively partisan gerrymander was unconstitutional—no standards exist by which to determine *when a rights violation has even occurred*. There, "[t]he central problem [wa]s not determining whether a jurisdiction has engaged in partisan gerrymandering. It [wa]s determining when political

gerrymandering has gone too far." *Rucho*, 139 S. Ct. at 2497 (internal quotation marks omitted); *see also id.* at 2498 ("[T]he question is one of degree: How to provide a standard for deciding how much partisan dominance is too much.") (internal quotation marks omitted); *id.* at 2499 ("If federal courts are to . . . adjudicat[e] partisan gerrymandering claims, they must be armed with a standard that can reliably differentiate unconstitutional from constitutional political gerrymandering.") (internal quotation marks and citation omitted).

Here, the right at issue is fundamentally one of a discernable standard: the amount of fossil-fuel emissions that will irreparably devastate our Nation. That amount can be established by scientific evidence like that proffered by the plaintiffs. Moreover, we need not *definitively* determine that standard today. Rather, we need conclude only that plaintiffs have submitted sufficient evidence to create a genuine dispute as to whether such an amount can possibly be determined as a matter of scientific fact. Plaintiffs easily clear this bar. Of course, plaintiffs will have to carry their burden of proof to establish this fact in order to prevail at trial, but that issue is not before us. We must not get ahead of ourselves.

The procedural posture of this case also informs the question of oversight and enforcement. It appears the majority's real concerns lie not in the judiciary's ability to draw a line between lawful and unlawful conduct, but in our ability to equitably walk the government back from that line without wholly subverting the authority of our coequal branches. My colleagues take great issue with plaintiffs' request for a "plan" to reduce fossil-fuel emissions. I am not so concerned. At this stage, we need not promise plaintiffs the moon (or, more apropos, the earth in a habitable state).

For purposes of standing, we need hold only that the trial court could fashion some sort of meaningful relief should plaintiffs prevail on the merits.[13]

Nor would any such remedial "plan" necessarily require the courts to muck around in policymaking to an impermissible degree; the *scope* and *number* of policies a court would have to reform to provide relief is irrelevant to the second *Baker* factor, which asks only if there are judicially discernable standards to guide that reformation. Indeed, our history is no stranger to widespread, programmatic changes in government functions ushered in by the judiciary's commitment to requiring adherence to the Constitution. Upholding the Constitution's prohibition on cruel and unusual punishment, for example, the Court ordered the overhaul of prisons in the Nation's most populous state. *See Brown v. Plata*, 563 U.S. 493, 511 (2011) ("Courts may not allow constitutional violations to continue simply because a remedy would involve intrusion into the realm of prison administration.") And in its finest hour, the Court mandated the racial integration of every public school—state and federal—in the Nation, vindicating the Constitution's guarantee of equal protection under the law.[14] *See Brown v. Bd. of Educ.* (*Brown I*), 347 U.S. 483

[13] It is possible, of course, that the district court ultimately concludes that it is unable to provide meaningful redress based on the facts proved at trial, but trial has not yet occurred. Our present occasion is to decide only whether plaintiffs have raised a genuine dispute as to the judiciary's ability to provide meaningful redress under *any* subset of the facts at issue today. *See* Maj. Op. at 18 (citing *Cent. Delta Water Agency v. United States*, 306 F.3d 938, 947 (9th Cir. 2002)).

[14] In contrast, we are haunted by the days we declined to curtail the government's approval of invidious discrimination in public life, *see Plessy v. Ferguson*, 163 U.S. 537, 559 (1896) (Harlan, J., dissenting)

(1954); *Bolling v. Sharpe*, 347 U.S. 497 (1954). In the school desegregation cases, the Supreme Court was explicitly unconcerned with the fact that crafting relief would require individualized review of thousands of state and local policies that facilitated segregation. Rather, a unanimous Court held that the judiciary could work to dissemble segregation over time while remaining cognizant of the many public interests at stake:

> To effectuate [the plaintiffs'] interest[s] may call for elimination of a variety of obstacles in making the transition to school systems operated in accordance with the constitutional principles set forth in [*Brown I*]. Courts of equity may properly take into account the public interest in the elimination of such obstacles in a systematic and effective manner. But it should go without saying that the vitality of these constitutional principles cannot be allowed to yield simply because of disagreement with them.
>
> . . . [T]he courts may find that additional time is necessary to carry out the ruling in an effective manner. The burden rests upon the defendants to establish that such time is necessary in the public interest and is consistent with good faith compliance at the

("[T]he judgment this day rendered will, in time, prove to be quite as pernicious as the decision made by this tribunal in the Dred Scott Case."), and neglected to free thousands of innocents prejudicially interned by their own government without cause, *see Trump v. Hawaii*, 138 S. Ct. 2392, 2423 (2018) ("*Korematsu* was gravely wrong the day it was decided[.]").

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> earliest practicable date. To that end, the courts may consider problems related to administration, arising from the physical condition of the school plant, the school transportation system, personnel, revision of school districts and attendance areas into compact units to achieve a system of determining admission to the public schools on a nonracial basis, and revision of local laws and regulations which may be necessary in solving the foregoing problems.

Brown v. Bd. of Educ. (*Brown II*), 349 U.S. 294, 300–01 (1955).

As we are all too aware, it took decades to even partially realize *Brown*'s promise, but the slow churn of constitutional vindication did not dissuade the *Brown* Court, and it should not dissuade us here. Plaintiffs' request for a "plan" is neither novel nor judicially incognizable. Rather, consistent with our historical practices, their request is a recognition that remedying decades of institutionalized violations may take some time. Here, too, decelerating from our path toward cataclysm will undoubtedly require "elimination of a variety of obstacles." Those obstacles may be great in number, novelty, and magnitude, but there is no indication that they are devoid of discernable standards. Busing mandates, facilities allocation, and district-drawing were all "complex policy decisions" faced by post-*Brown* trial courts, *see* Maj. Op. at 25, and I have no doubt that disentangling the government from promotion of fossil fuels will take an equally deft judicial hand. Mere complexity, however, does not put the issue out of the courts' reach. Neither the government nor the majority has articulated why

the courts could not weigh scientific and prudential considerations—as we often do—to put the government on a path to constitutional compliance.

The majority also expresses concern that any remedial plan would require us to compel "the adoption of a comprehensive scheme to decrease fossil fuel emissions and combat climate change[.]" *Id.* at 25. Even if the operative complaint is fairly read as requesting an affirmative scheme to address *all* drivers of climate change, however caused, *see id.* at 23 n.6., such an overbroad request does not doom our ability to redress those drivers implicated by the conduct at issue here. Courts routinely grant plaintiffs less than the full gamut of requested relief, and our inability to compel legislation that addresses emissions beyond the scope of this case—such as those purely in the private sphere or within the control of foreign governments—speaks nothing to our ability to enjoin the government from exercising its discretion in violation of plaintiffs' constitutional rights.

4.

In sum, resolution of this action requires answers only to scientific questions, not political ones. And plaintiffs have put forth sufficient evidence demonstrating their entitlement to have those questions addressed at trial in a court of law.

As discussed above, the majority reaches the opposite conclusion not by marching purposefully through the *Baker* factors, which carve out a narrow set of nonjusticiable *political* cases, but instead by broadly invoking *Rucho* in a manner that would cull from our dockets any case that presents administrative issues "too difficult for the judiciary to manage." Maj. Op. at 28. That simply is not the test. Difficult questions are not necessarily political questions and, beyond reaching the wrong conclusion in this case, the

majority's application of *Rucho* threatens to eviscerate judicial review in a swath of complicated but plainly apolitical contexts.

Rucho's limitations should be apparent on the face of that opinion. *Rucho* addresses the political process itself, namely whether the metastasis of partisan politics has unconstitutionally invaded the drawing of political districts within states. Indeed, the *Rucho* opinion characterizes the issue before it as a request for the Court to reallocate political power between the major parties. *Rucho*, 139 S. Ct. at 2502, 2507, 2508. *Baker* factors aside, *Rucho* surely confronts fundamentally "political" questions in the common sense of the term. Nothing about climate change, however, is inherently political. The majority is correct that redressing climate change will require consideration of scientific, economic, energy, and other policy factors. But that endeavor does not implicate the way we elect representatives, assign governmental powers, or otherwise structure our polity.

Regardless, we do not limit our jurisdiction based on common parlance. Instead, legal and constitutional principles define the ambit of our authority. In the present case, the *Baker* factors provide the relevant guide and further distinguish *Rucho*. As noted above, *Rucho*'s holding that policing partisan gerrymandering is beyond the courts' competence rests heavily on the first *Baker* factor, *i.e.*, the textual and historical delegation of electoral-district drawing to state legislatures. The *Rucho* Court decided it could not discern mathematical standards to navigate a way out of that particular political thicket. It did not, however, hold that mathematical (or scientific) difficulties in creating appropriate standards divest jurisdiction in *any* context.

Such an expansive reading of *Rucho* would permit the "political question" exception to swallow the rule.

Global warming is certainly an imposing conundrum, but so are diversity in higher education, the intersection between prenatal life and maternal health, the role of religion in civic society, and many other social concerns. *Cf. Regents of the Univ. of Cal. v. Bakke*, 438 U.S. 265, 360 (1978) ("[T]he line between honest and thoughtful appraisal of the effects of past discrimination and paternalistic stereotyping is not so clear[.]"); *Planned Parenthood of Se. Pa. v. Casey*, 505 U.S. 833, 871 (1992) (stating that *Roe v. Wade*, 410 U.S. 113 (1973), involved the "difficult question" of determining the "weight to be given [the] state interest" in light of the "strength of the woman's [privacy] interest"); *Am. Legion v. Am. Humanist Ass'n*, 139 S. Ct. 2067, 2094 (2019) (Kavanaugh, J., concurring) (noting that determining the constitutionality of a large cross's presence on public land was "difficult because it represents a clash of genuine and important interests"). These issues may not have been considered within the purview of the judicial branch had the Court imported wholesale *Rucho*'s "manageable standards" analysis even in the absence of *Rucho*'s inherently political underpinnings. Beyond the outcome of the instant case, I fear that the majority's holding strikes a powerful blow to our ability to hear important cases of widespread concern.

III.

To be sure, unless there is a constitutional violation, courts should allow the democratic and political processes to perform their functions. And while all would now readily agree that the 91 years between the Emancipation Proclamation and the decision in *Brown v. Board* was too long, determining when a court must step in to protect

fundamental rights is not an exact science. In this case, my colleagues say that time is "never"; I say it is now.

Were we addressing a matter of social injustice, one might sincerely lament any delay, but take solace that "the arc of the moral universe is long, but it bends towards justice."[15] The denial of an individual, constitutional right—though grievous and harmful—can be corrected in the future, even if it takes 91 years. And that possibility provides hope for future generations.

Where is the hope in today's decision? Plaintiffs' claims are based on science, specifically, an impending point of no return. If plaintiffs' fears, backed by the government's *own studies*, prove true, history will not judge us kindly. When the seas envelop our coastal cities, fires and droughts haunt our interiors, and storms ravage everything between, those remaining will ask: Why did so many do so little?

I would hold that plaintiffs have standing to challenge the government's conduct, have articulated claims under the Constitution, and have presented sufficient evidence to press those claims at trial. I would therefore affirm the district court.

With respect, I dissent.

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[15] Dr. Martin Luther King, Jr., Remaining Awake Through a Great Revolution, Address at the National Cathedral, Washington, D.C. (Mar. 31, 1968). In coining this language, Dr. King was inspired by an 1853 sermon by abolitionist Theodore Parker. *See* Theodore Parker, *Of Justice and the Conscience*, *in* Ten Sermons of Religion 84–85 (Boston, Crosby, Nichols & Co. 1853).

To Thomas Jefferson from James Madison, 24 October 1787

From James Madison

Dear Sir New York Octr. 24. 1787.

My two last, though written for the two last Packets, have unluckily been delayed till this conveyance. The first of them was sent from Philada. to Commodore Jones in consequence of information that he was certainly to go by the packet then about to sail. Being detained here by his business with Congress, and being unwilling to put the letter into the mail without my approbation, which could not be obtained in time, he detained the letter also. The second was sent from Philada. to Col. Carrington, with a view that it might go by the last packet at all events in case Commodore Jones should meet with further detention here. By ill luck he was out of Town, and did not return till it was too late to make use of the opportunity. Neither of the letters were indeed of much consequence at the time and are still less so now. I let them go forward nevertheless as they may mention some circumstances not at present in my recollection, and as they will prevent a chasm on my part of our correspondence which I have so many motives to cherish by an exact punctuality.

Your favor of June 20. has been already acknowledged. The last packet from France brought me that of August 2d. I have received also by the Mary Capt. Howland the three Boxes for W. H. B. F. and myself. The two first have been duly forwarded. The contents of the last are a valuable addition to former literary remittances and lay me under additional obligations, which I shall always feel more strongly than I express. The articles included for Congress have been delivered and those for the two Universities and for General Washington have been forwarded, as have been the various letters for your friends in Virginia and elsewhere. The parcel of rice referred to in your letter to the Delegates of S. Carolina has met with some accident. No account whatever can be obtained concerning it. It probably was not shipped from France. Ubbo's book I find was not omitted as you seem to have apprehended. The charge for it however is, which I must beg you to supply. The duplicate volume of the Encyclopedie, I left in Virginia, and it is uncertain when I shall have an opportunity of returning it. Your Spanish duplicates will I fear be hardly vendible. I shall make a trial wherever a chance presents itself. A few days ago I received your favor of the 15 of Augst. via L'Orient and Boston. The letters inclosed along with it were immediately sent on to Virga.

You will herewith receive the result of the Convention, which continued its session till the 17th of September. I take the liberty of making some observations on the subject which will help to make up a letter, if they should answer no other purpose.

It appeared to be the sincere and unanimous wish of the Convention to cherish and preserve the Union of the States. No proposition was made, no suggestion was thrown out in favor of a partition of the Empire into two or more Confederacies.

It was generally agreed that the objects of the Union could not be secured by any system founded on the principle of a confederation of sovereign States. A voluntary observance of the federal law by all the members could never be hoped for. A compulsive one could evidently never be reduced to practice, and if it could, involved equal calamities to the innocent and the guilty, the necessity of a military force both obnoxious and dangerous, and in general, a scene resembling much more a civil war, than the administration of a regular Government.

Hence was embraced the alternative of a government which instead of operating, on the States, should operate without their intervention on the individuals composing them: and hence the change in the principle and proportion of representation.

This ground-work being laid, the great objects which presented themselves were 1. to unite a proper energy in the Executive and a proper stability in the Legislative departments, with the essential characters of Republican Government. 2. To draw a line of demarkation which would give to the General Government every power requisite for general purposes, and leave to the States every power which might be most beneficially administered by them. 3. To provide for the different interests of different parts of the Union. 4. To adjust the clashing pretensions of the large and small States. Each of these objects was pregnant with difficulties. The whole of them together formed a task more difficult than can be well conceived by those who were not concerned in the execution of it. Adding to these considerations the natural diversity of human opinions on all new[1] and complicated subjects, it is impossible to consider the degree of concord which ultimately prevailed as less than a miracle.

The first of these objects as it respects the Executive, was peculiarly embarrassing. On the question whether it should consist of a single person, or a plurality of co-ordinate members, on the mode of appointment, on the duration in

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plurality of co-ordinate members, on the mode of appointment, on the duration in office, on the degree of power, on the re-eligibility, tedious and reiterated discussions took place. The plurality of co-ordinate members had finally but few advocates. Governour Randolph was at the head of them. The modes of appointment proposed were various, as by the people at large—by electors chosen by the people—by the Executives of the States—by the Congress, some preferring a joint ballot of the two Houses—some a separate concurrent ballot allowing to each a negative on the other house—some a nomination of several canditates by one House, out of whom a choice should be made by the other. Several other modifications were started. The expedient at length adopted seemed to give pretty general satisfaction to the members. As to the duration in office, a few would have preferred a tenure during good behaviour—a considerable number would have done so in case an easy and effectual removal by impeachment could be settled. It was much agitated whether a long term, seven years for example, with a subsequent and perpetual ineligibility, or a short term with a capacity to be re-elected, should be fixed. In favor of the first opinion were urged the danger of a gradual degeneracy of re-elections from time to time, into first a life and then a hereditary tenure, and the favorable effect of an incapacity to be reappointed, on the independent exercise of the Executive authority. On the other side it was contended that the prospect of necessary degradation would discourage the most dignified characters from aspiring to the office, would take away the principal motive to the faithful discharge of its duties the hope of being rewarded with a reappointment would stimulate ambition to violent efforts for holding over the constitutional term, and instead of producing an independent administration, and a firmer defence of the constitutional rights of the department, would render the officer more indifferent to the importance of a place which he would soon be obliged to quit for ever, and more ready to yield to the incroachments of the Legislature of which he might again be a member.—The questions concerning the degree of power turned chiefly on the appointment to offices, and the controul on the Legislature. An *absolute* appointment to all offices—to some offices—to no offices, formed the scale of opinions on the first point. On the second, some contended for an absolute negative, as the only possible mean of reducing to practice, the theory of a free government which forbids[2] a mixture of the Legislative and Executive powers. Others would be content with a revisionary power to be overruled by three fourths of both Houses.[3] It was warmly urged that the judiciary department should be associated in the revision. The idea of some was that a separate revision should be given to the two departments—that if either objected two thirds; if both three fourths,[4] should be necessary to overrule.

In forming the Senate, the great anchor of the Government, the questions as they came within the first object turned mostly on the mode of appointment, and the duration of it. The different modes proposed were, 1. by the House of Representatives, 2. by the Executive, 3 by electors chosen by the people for the purpose, 4. by the State Legislatures. On the point of duration, the propositions descended from good behavior to four years, through the intermediate terms of nine, seven, six and five years. The election of the other branch was first determined to be triennial, and afterwards reduced to biennial.

The second object, the due partition of power, between the General and local Governments, was perhaps of all, the most nice and difficult. A few contended for an entire abolition of the States; Some for indefinite power of Legislation in the Congress, with a negative on the laws of the States, some for such a power without a negative,[5] some for a limited power of legislation, with such a negative: the majority finally for a limited power without the negative. The question with regard to the Negative underwent repeated discussions, and was finally rejected by a bare majority. As I formerly intimated to you my opinion in favor of this ingredient, I will take this occasion of explaining myself on the subject. [Such a check on the States appears to me necessary 1. to prevent encroachments on the General authority, 2. to prevent instability and injustice in the legislation[6] of the States.

1. Without such a check in the whole over the parts, our system involves the evil of imperia in imperio. If a compleat supremacy some where is not necessary in every Society, a controuling power at least is so, by which the general authority may be defended against encroachments of the subordinate authorities, and by which the latter may be restrained from encroachments on each other.[7] If the supremacy of the British Parliament is not necessary as has been contended,[8] for the harmony of that Empire, it is evident I think that without the royal negative[9] or some equivalent controul, the unity of the system would be[10] destroyed. The want of some such provision seems to have been mortal to the antient Confederacies, and to be the disease of the modern. Of the Lycian Confederacy little is known.[11] That of the Amphyctions is well known to have been rendered of little use whilst it lasted, and in the end to have been destroyed by the predominance of the local over the federal authority.[12] The same observation may be made, on the authority of Polybius, with regard to the Achæan League. The Helvetic System scarcely amounts to a confederacy and is distinguished by too many peculiarities to be a ground of comparison. The case of the United Netherlands is in point. The authority of a Statholder, the influence of a standing army, the common interest in the conquered possessions, the pressure of surrounding danger, the guarantee of foreign powers, are not sufficient to secure the authority and interests of the generality, against the antifederal tendency of the provincial sovereignties.[13] The German Empire is another example. A Hereditary chief with vast independent resources of wealth and power, a federal Diet, with ample parchment authority, a regular Judiciary establishment, the influence of the neighbourhood of great and formidable Nations, have been found unable either to maintain the subordination of the members, or to prevent their mutual contests and encroachments. Still more to the purpose is our own experience both during the war and since the peace. Encroachments of the States on the general authority, sacrifices of national to local interests, interferences of the measures of different States, form a great part of the history of our political system. It may be said that the new Constitution is founded on different principles, and will have a different operation. I admit the difference to be material. It presents

the aspect rather of a feudal system of republics, if such a phrase may be used,[14] than of a Confederacy of independent States. And what has been the progress and event of the feudal Constitutions? In all of them a continual struggle between the head and the inferior[15] members, until a final victory has been gained in some instances by one, in others, by the other of them. In one respect indeed there is a remarkable variance between the two cases. In the feudal system the sovereign, though limited, was independent; and having no particular sympathy of interests with the great Barons, his ambition had as full play as theirs in the mutual projects of usurpation. In the American Constitution The general authority will be derived entirely from the subordinate authorities.[16] The Senate will represent the States in their political capacity, the other House will represent the people of the States in their individual capacity. The former will be accountable to their constituents at moderate, the latter at short periods. The President also derives his appointment from the States, and is periodically accountable to them. This dependence of the General, on the local authorities seems effectually to guard the latter against any dangerous encroachments of the former: Whilst the latter within their respective limits, will be continually sensible of the abridgment of their power, and be stimulated by ambition to resume the surrendered portion of it. We find the representatives of counties and corporations in the Legislatures of the States, much more disposed to sacrifice the aggregate interest, and even authority, to the local views of their Constituents, than the latter to the former. I mean not by these remarks to insinuate that an esprit de corps will not exist in the national Government, that opportunities may[17] not occur of extending its jurisdiction in some points. I mean only that the danger of encroachments is much greater from the other side, and that the impossibility[18] of dividing powers of legislation, in such a manner, as to be free from different constructions by different interests, or even from ambiguity in the judgment of the impartial, requires some such expedient as I contend for. Many illustrations might be given of this impossibility. How long has it taken to fix, and how imperfectly is yet fixed the legislative power of corporations, though that power is subordinate in the most compleat manner? The line of distinction between the power of regulating trade and that of drawing revenue from it, which was once considered as the barrier of our liberties, was found on fair discussion, to be absolutely undefinable. No distinction seems to be more obvious than that between spiritual and temporal matters. Yet wherever they have been made objects of Legislation, they have clashed and contended with each other, till one or the other has gained the supremacy. Even the boundaries between the Executive, Legislative and Judiciary powers, though in general so strongly marked in themselves, consist in many instances of mere shades of difference. It may be said that the Judicial authority under our new system will[19] keep the States within their proper limits, and supply the place of a negative on their laws. The answer is that it is more convenient to prevent the passage of a law, than to declare it void after it is passed; that this will be particularly the case where the law aggrieves individuals, who may be unable to support an appeal against a State to the supreme Judiciary, that a State which would violate the Legislative rights of the Union, would not be very ready to obey a Judicial decree in support of them, and that a recurrence to force, which in the event of disobedience would be necessary, is[20] an evil which the new Constitution meant to exclude as far as possible.

2. A Constitutional negative on the laws of the States seems equally necessary to secure individuals against encroachments on their rights. The mutability of the laws of the States is found to be a serious evil. The injustice of them has been so frequent and so flagrant as to alarm the most stedfast friends of Republicanism. I am persuaded I do not err in saying that the evils issuing from these sources[21] contributed more to that uneasiness which produced the Convention, and prepared the public mind for a general reform, than those which accrued to our national character and interest from the inadequacy of the Confederation to its immediate objects. A reform therefore which does not make provision for private rights, must be materially defective. The restraints against paper emissions, and violations of contracts are not sufficient. Supposing them to be effectual as far as they go, they are short of the mark. Injustice may be effected by such an infinitude of legislative expedients, that where the disposition exists it can only be controuled by some provision which reaches all cases whatsoever. The partial provision made, supposes the disposition which will evade it. It may be asked how private rights[22] will be more secure under the Guardianship of the General Government than under the State Governments, since they are both founded on the republican principle which refers the ultimate decision to the will of the majority, and are distinguished rather[23] by the extent within which they will operate, than by any material difference in their structure. A full discussion of this question would, if I mistake not, unfold the true principles of Republican Government, and prove in contradiction to the concurrent opinions of theoretical writers, that this form of Government, in order to effect its purposes must operate not within a small but an extensive sphere. I will state some of the ideas which have occurred to me on this subject. Those who contend for a simple Democracy, or a pure republic, actuated by the sense of the majority, and operating within narrow limits, assume or suppose a case which is altogether fictitious. They found their reasoning on the idea, that the people composing the Society enjoy not only an equality of political rights; but that they have all precisely the same interests and the same feelings in every respect.[24] Were this in reality the case, their reasoning would be conclusive. The interest of the majority would be that of the minority also; the decisions could only turn on mere opinion concerning the good of the whole of which the major voice would be the safest criterion; and within a small sphere, this voice could be most easily collected and the public affairs most accurately managed. We know however that no Society[25] ever did or can consist of so homogeneous a mass of Citizens. In the savage State indeed, an approach is made towards it; but in that state little or no Government is necessary. In all civilized Societies, distinctions are various and unavoidable. A distinction of property results from that very protection which a free Government gives to unequal faculties of acquiring it.[26] There will be rich and poor; creditors and debtors; a landed interest, a monied interest, a mercantile interest, a manufacturing interest. These classes may

again be subdivided according[27] to the different productions of different situations and soils, and according to different branches of commerce and of manufactures. In addition to these natural distinctions, artificial ones[28] will be founded on accidental differences in political, religious and other opinions, or an attachment to the persons of leading individuals. However erroneous or ridiculous these grounds of dissention and faction may appear to the enlightened Statesman, or the benevolent philosopher, the bulk of mankind who are neither Statesmen nor Philosophers, will continue to view[29] them in a different light. It remains then to be enquired whether a majority having any common interest, or feeling any common passion, will find sufficient motives to restrain them from oppressing the minority. An individual is never allowed to be a judge or even a witness in his own cause. If two individuals are under the biass of interest[30] or enmity against a third, the rights of the latter could never be safely referred to the majority of the three. Will two thousand individuals be less apt to oppress one thousand, or two hundred thousand, one hundred thousand? Three motives only can restrain in such cases. 1. A prudent regard to private or partial good, as essentially involved in the general and permanent good of the whole.[31] This ought no doubt to be sufficient of itself. Experience however shews that it has little effect on individuals, and perhaps still less on a collection of individuals, and least of all on a majority with the public authority in their hands. If the former are ready to forget that honesty is the best policy; the last do more. They often proceed on the converse of the maxim: that whatever is politic is honest. 2. Respect for character. This motive is not found sufficient to restrain individuals from injustice, and loses its efficacy in proportion to the number which is to divide the praise or the blame. Besides as it has reference to public opinion, which is that of the majority, the standard is fixed by those whose conduct is to be measured by it. 3. Religion. The inefficacy of this restraint on individuals is well known. The conduct of every popular assembly, acting on oath, the strongest of religious ties, shews that individuals join without remorse in acts against which their consciences would revolt, if proposed to them separately in their closets. When Indeed Religion is kindled into enthusiasm, its force like that of other passions is increased by the sympathy of a multitude. But enthusiasm is only a temporary state of Religion, and whilst it lasts will hardly be seen with pleasure at the helm. Even in its coolest state, it has been much oftener a motive to oppression than a restraint from it. If then there must be different interests and parties in Society; and a majority[32] when united by a common interest or passion can not be restrained from oppressing[33] the minority, what remedy can be found in a republican Government, where the majority must ultimately decide, but that of giving such an extent to its sphere, that no common interest or passion will be likely to unite a majority of the whole number in an unjust pursuit.[34] In a large Society, the people are broken into so many interests and parties, that a common sentiment is less likely to be felt, and the requisite concert[35] less likely to be formed, by a majority of the whole. The same security seems requisite for the civil as for the religious rights of individuals. If the same sect form a majority and have the power, other sects will be sure to be depressed. Divide et impera, the reprobated axiom of tyranny, is under certain qualifications, the only policy, by which a republic can be administered on just principles. It must be observed however that this doctrine can only hold within a sphere of a mean extent. As in too small a sphere oppressive combinations may be too easily formed against the weaker party; so in too extensive a one a defensive concert may be rendered too difficult against the oppression of those entrusted with the administration. The great desideratum in Government is, so to modify the sovereignty as that it may be sufficiently neutral between different parts of the Society to controul one part from invading the rights of another, and at the same time sufficiently controuled itself, from setting up an interest adverse *to* that of the entire Society. In absolute monarchies, the Prince may be tolerably neutral towards different classes of his subjects, but may sacrifice the[36] happiness of all to his personal ambition or avarice. In small republics, the sovereign will is controuled from such a sacrifice of the entire Society, but it is not sufficiently neutral towards the parts composing it. In the extended Republic of the United States, the General Government[37] would hold a pretty even balance between the parties of particular States, and be at the same time sufficiently restrained by its dependence on the community, from betraying its general interests.][38]

Begging pardon for this immoderate digression, I return to the third object abovementioned, the adjustment of the different interests of different parts of the Continent. Some contended for an unlimited power over trade including exports as well as imports, and over slaves as well as other imports; some for such a power, provided the concurrence of two thirds of both Houses were required; some for such a qualification of the power, with an exemption of exports and slaves, others for an exemption of exports only. The result is seen in the Constitution. S. Carolina and Georgia were inflexible on the point of the slaves.

The remaining object, created more embarrassment, and a greater alarm for the issue of the Convention than all the rest put together. The little States insisted on retaining their equality in both branches, unless a compleat abolition of the State Governments should take place; and made an equality in the Senate a sine qua non. The large States on the other hand urged that as the new Government was to be drawn principally from the people immediately and was to operate directly on them, not on the States; and consequently as the States would lose that importance which is now proportioned to the importance of their voluntary compliances with the requisitions of Congress, it was necessary that the representation in both Houses should be in proportion to their size. It ended in the compromise which you will see, but very much to the dissatisfaction of several members from the large States.

It will not escape you that three names only from Virginia are subscribed to the Act. Mr. Wythe did not return after the death of his lady. Docr. MClurg left the Convention some time before the adjournment. The Governour and Col. Mason refused to be parties to it. Mr. Gerry was the only other member who refused. The objections of the Govr. turn principally on the latitude of the general powers, and on the connection established between the President and the Senate. He wished that the

plan should be proposed to the States with liberty to them to suggest alterations which should all be referred to another general Convention to be[39] incorporated into the plan as far as might be judged expedient. He was not inveterate in his opposition, and grounded his refusal to subscribe pretty much on his unwillingness to commit himself so as not to be at liberty to be governed by further lights on the subject. Col. Mason left Philada. in an exceeding ill humour indeed. A number of little circumstances arising in part from the impatience which prevailed towards the close of the business, conspired to whet his acrimony. He returned to Virginia with a fixed disposition to prevent the adoption of the plan if possible. He considers the want of a Bill of Rights as a fatal objection. His other objections are to the substitution of the Senate in place of an Executive Council and to the powers vested in that body—to the powers of the Judiciary—to the vice President being made President of the Senate—to the smallness of the number of Representatives—to the restriction on the States with regard to ex post facto laws—and most of all probably to the power of regulating trade, by a majority only of each House. He has some other lesser objections. Being now under the necessity of justifying his refusal to sign, he will of course, muster every possible one.[40] His conduct has given great umbrage to the County of Fairfax, and particularly to the Town of Alexandria. He is already instructed to promote in the Assembly the calling a Convention, and will probably be either not deputed to the Convention, or be tied up by express instructions. He did not object in general to the powers vested in the National Government, so much as to the modification. In some respects he admitted that some further powers could have improved the system. He acknowledged in particular that a negative on the State laws, and the appointment of the State Executives ought to be ingredients; but supposed that the public mind would not now bear them and that experience would hereafter produce these amendments.

The final reception which will be given by the people at large to this proposed System can not yet be decided. The Legislature of N. Hampshire was sitting when it reached that State and was well pleased with it. As far as the sense of the people there has been expressed, it is equally favorable. Boston is warm and almost unanimous in embracing[41] it. The impression on the country is not yet known. No symptoms of disapprobation have appeared. The Legislature of that State is now sitting, through which the sense of the people at large will soon be promulged with tolerable certainty. The paper money faction in Rh. Island is hostile. The other party zealously attached to it. Its passage through Connecticut is likely to be very smooth and easy. There seems to be less agitation in this[42] state than any where. The discussion of the subject seems confined to the newspapers. The principal characters are known to be friendly. The Governour's party which has hitherto been the popular and most numerous one, is supposed to be on the opposite side; but considerable reserve is practiced, of which he sets the example. N. Jersey takes the affirmative side of course. Meetings of the people are declaring their approbation, and instructing their representatives. Penna. will be divided. The City of Philada., the Republican party, the Quakers, and most of the Germans espouse the Constitution. Some of the Constitutional leaders, backed by the western Country will oppose. An unlucky ferment on the subject in their assembly just before its late adjournment has irritated both sides, particularly the opposition, and by redoubling the exertions of that party may render the event doubtful. The voice of Maryland I understand from pretty good authority, is, as far as it has been declared, strongly in favor of the Constitution. Mr. Chase is an enemy, but the Town of Baltimore which he now represents, is warmly attached to it, and will shackle him as far as they can. Mr. Paca will probably be, as usually, in the politics of Chase. My information from Virginia is as yet extremely imperfect. I have a letter from Genl. Washington which speaks favorably of the impression within a circle of some extent, and another from Chancellor Pendleton which expresses his full acceptance of the plan, and the popularity of it in his district. I am told also that Innis and Marshall are patrons of it. In the opposite scale are Mr. James Mercer, Mr. R. H. Lee, Docr. Lee and their connections of course, Mr. M. Page according to Report, and most of the Judges and Bar of the general Court. The part which Mr. Henry will take is unknown here. Much will depend on it. I had taken it for granted from a variety of circumstances that he would be in the opposition, and still think that will be the case. There are reports however which favor a contrary supposition. From the States South of Virginia nothing has been heard. As the deputation from S. Carolina consisted of some of its weightiest characters, who have returned unanimously zealous in favor of the Constitution, it is probable that State will readily embrace it. It is not less probable, that N. Carolina will follow the example unless that of Virginia should counterbalance it. Upon the whole, although, the public mind will not be fully[43] known, nor finally settled for a considerable time, appearances at present augur a more prompt, and general adoption of the plan than could have been well expected.[44]

When the plan came before Congress for their sanction, a very serious effort was made by R. H. Lee and Mr. Dane from Masts. to embarrass it. It was first contended that Congress could not properly give any positive countenance to a measure which had for its object the subversion of the Constitution under which they acted. This ground of attack failing, the former gentleman urged the expediency of sending out the plan with amendments, and proposed a number of them corresponding with the objections of Col. Mason. This experiment had still less effect. In order however to obtain unanimity it was necessary to couch the resolution in very moderate terms.

Mr. Adams has received permission to return with thanks for his services. No provision is made for supplying his place, or keeping up any representation there. Your reappointment for three years will be notified from the office of F. Affairs. It was *made*[45] *without a negative, eight states* being *present. Connecticut however*[46] *put in a blank ticket*, the *sense of* that *state having been declared against embassies. Massachusetts betrayed some scruple* on *like ground*. Every *personal consideration* was *avowed* and I *believe with sincerity* to have *militated against these scruples*. It seems to be understood that letters to and from the foreign Ministers of the U.S. are not free of postage: but that the charge is to be allowed in their accounts.

The exchange of our French for Dutch Creditors has not been countenanced either

by Congress or the Treasury Board. The paragraph in your last letter to Mr. Jay, on the subject of applying a loan in Holland to the discharge of the pay due to the foreign officers has been referred to the Board since my arrival here. No report has yet been made. But I have little idea that the proposition will be adopted. Such is the state and prospect of our fiscal department that any new loan however small that should now be made, would probably subject us to the reproach of premeditated deception. The balance of Mr. Adams' last loan will be wanted for the interest due in Holland, and with all the income here, will, it is feared, not save our credit in Europe from further wounds. It may well be doubted whether the present Government can be kept alive thro' the ensuing year, or untill the new one may take its place.

Upwards of 100,000 Acres of the surveyed lands of the U.S. have been disposed of in open market. Five million of unsurveyed have been sold by private contract to a N. England Company, at ⅔ of a dollar per acre, payment to be made in the principal of the public securities. A negociation is nearly closed with a N. Jersey Company for two million more on like terms, and another commenced with a Company of this City for four million. Col. Carrington writes more fully on this subject.

You will receive herewith the desired information from Alderman Broome in the case of Mr. Burke. Also the Virga. Bill on crimes and punishments. Sundry alterations having been made in conformity to the sense of the House in its latter stages, it is less accurate and methodical than it ought to have been. To these papers I add a speech of Mr. C. P. on the Mississippi business. It is printed under precautions of secrecy, but surely could not have been properly exposed to so much risk of publication. You will find also among the pamplets and papers I send by Commodore Jones, another printed speech of the same Gentleman. The Musæum Magazine, and Philada. Gazettes, will give you a tolerable idea of the objects of present attention.

The summer crops in the Eastern and Middle States have been extremely plentiful. Southward of Virga. They differ in different places. On the whole I do not know that they are bad in that region. In Virginia the drought has been unprecedented, particularly between the falls of the Rivers and the Mountains. The Crops of Corn are in general alarmingly short. In Orange I find there will be scarcely subsistence for the inhabitants. I have not heard from Albemarle. The crops of Tobacco are every where said to be pretty good in point of quantity, and the quality unusually fine. The crops of wheat were also in general excellent in quality and tolerable in quantity.

Novr. 1. Commodore[47] Jones having preferred another vessel to the packet, has remained here till this time. The interval has produced little necessary to be added to the above. The Legislature of Massts. has it seems taken up the Act of the Convention and have appointed or probably will appoint an early day for its State Convention. There are letters also from Georgia which denote a favorable disposition. I am informed from Richmond that the new Election-law from the Revised Code produced a pretty full House of Delegates, as well as a Senate, on the first day. It had previously had equal effect in producing full meetings of the freeholders for the County elections. A very decided majority of the Assembly is said to be zealous in favor of the New Constitution. The same is said of the Country at large. It appears however that individuals of great weight both within and without the Legislature are opposed to it. A letter I just have from Mr. A. Stuart names Mr. Henry, Genl. Nelson, W. Nelson, the family of Cabels, St. George Tucker, John Taylor and the Judges of the General Court except P. Carrington. The other opponents he described as of too little note to be mentioned, which gives a negative information of the Characters on the other side. All are agreed that the plan must be submitted *to* a Convention.

We hear from Georgia that that State is threatened with a dangerous war with the Creek Indians. The alarm is of so serious a nature, that law-martial has been proclaimed, and they are proceeding to fortify even the Town of Savannah. The idea there is that the Indians derive their motives as well as their means from their Spanish neighbours. Individuals complain also that their fugitive slaves are encouraged by East Florida. The policy of this is explained by supposing that it is considered as a discouragement to the Georgians to form settlements near the Spanish boundaries.

There are but few States on the spot here which will survive the expiration of the federal year; and it is extremely uncertain when a Congress will again be formed. We have not yet heard who are to be in the appointment of Virginia for the next year.

With the most affectionate attachment I remain Dear Sr. Your obed friend & servant,

Js. Madison Jr.

RC (DLC: TJ Papers); partly in code; with a number of deletions and corrections, most of which were not interlinear and which were evidently made contemporaneously, but two of which, as indicated in notes 42 and 47 below, were clearly made by Madison late in life; endorsed. Tr of an Extract (DLC: Madison Papers); in Madison's hand, in highly abbreviated form (see note 38, below). Tr of an Extract (ViU); at foot of text, in the hand of Nicholas P. Trist: "Copied from the original at Montpellier (V. J. T. & C. J. R. & M. J. R. assisting) by N. P. T. Oct. 1. '34"; endorsed by Trist on verso of last leaf: "Madison James—Oct. 24. 1787 To Thomas Jefferson. Copied from the original at Montpellier, Oct. 1. 1834. N. P. Trist." (See note 44 below). Recorded in SJL as received 19 Dec. 1787. Enclosures: (1) The "information from Alderman Broome" has not been found (see TJ to Madison, 20 Dec. 1787). (2) The "Virga. Bill on crimes and punishments" must have been a printed text showing the alterations that the bill underwent in the legislative session of Oct. 1786, but no such printed text is known to have been made and none is known to be in existence; it is also puzzling that Madison waited until this late date to send any text when the Bill was defeated early in the year (see Madison to TJ, 15 Feb. 1787; see also, Vol. 2: 506, note). (3) The "speech of Mr. C. P. [Charles Pinckney] on the Mississippi business" was that delivered on 16 Aug. 1786 in answer to Jay's speech on 3 Aug. 1786 on the negotiations with Spain; it was printed in broadside form by Congress and it was one of these printed texts that Madison sent to TJ (text of Pinckney's speech is printed in JCC, xxxi, 935 – 48). (4) The other "printed speech by the same gentleman," not

actually enclosed but sent by Jones, was Pinckney's *Observations on the Plan of Government submitted to the Federal Convention, in Philadelphia, on the 28th of May, 1787*, New York, 1787 (Sowerby, No. 3016).

It is not known when or for what purpose Madison made the extract from this letter that is described above and referred to below as the Madison Extract, but it was probably made during TJ's lifetime. Certainly the handwriting is much firmer and less crabbed by age than the alterations made by Madison in the text of the letter that are known to have been added late in life (see notes 42 and 47, below). It is possible, even, that he obtained leave from TJ to make the extract not long after the latter returned from France. The fact that he had made such an extract and retained it may also explain why this letter of his was not kept by him among his own papers along with others that he received after TJ's death.

1. Preceding seven words interlined in substitution for "disagreement of opinion on serious," an alteration probably made contemporaneously.

2. This word written lineally in preference to "requires," deleted, evidently contemporaneously.

3. At this point Madison deleted lineally: "Others would have preferred," an alteration evidently made contemporaneously.

4. Preceding six words interlined and "to the other two" deleted, an alteration evidently made contemporaneously.

5. Preceding eight words interlined, probably contemporaneously.

6. This word written lineally in preference to "laws of," deleted.

7. Preceding three words interlined, perhaps contemporaneously.

8. At this point Madison deleted, evidently contemporaneously, the word "certainly."

9. The Madison Extract reads "prerogative."

10. At this point Madison deleted the word "necessarily," evidently contemporaneously.

11. At this point Madison deleted, evidently contemporaneously: "From that to every new instance it may be [premised?] that."

12. This word written over an erasure, perhaps "jurisdiction," and presumably done contemporaneously.

13. This word interlined in substitution for "legislatures," an alteration perhaps made contemporaneously.

14. The Madison Extract reads "allowed."

15. This word, divided, lies in the right and left margins and may have been added later.

16. This word altered by overwriting, evidently contemporaneously, from "authority."

17. This word altered by overwriting, probably later, from "will."

18. This word interlined, evidently contemporaneously, in substitution for "impossibility and difficulty," deleted.

19. At this point Madison deleted lineally, evidently contemporaneously, the word "preserve."

20. This word altered by overwriting, perhaps contemporaneously, from what appears to read "was."

21. At this point Madison deleted lineally, evidently contemporaneously, "had a greater share in."

22. These two words interlined, perhaps contemporaneously, in substitution for "the public and private faith," deleted.

23. This word interlined, probably contemporaneously, in substitution for "principally," deleted.

24. The Madison Extract reads: "… but that they have precisely and in all respects the same interests and the same feelings."

25. This word interlined, probably contemporaneously, in substitution for "Government," deleted.

26. Preceding five words interlined, perhaps later, in substitution for "private rights," deleted.

27. This passage originally read: "These classes will again be subdivided by," and then was altered by overwriting, evidently contemporaneously, to read as above.

28. These two words interlined, evidently contemporaneously, in substitution for "others," deleted.

29. This word written lineally in preference to "act," deleted, evidently contemporaneously.

30. Preceding seven words interlined, evidently contemporaneously, in substitution for "men have a same interest," deleted.

31. This word written over another that may be "sovereignty" or "majority," an alteration made contemporaneously.

32. These two words interlined, evidently contemporaneously, in substitution for "the predominant party," deleted.

33. This word altered by overwriting, perhaps contemporaneously, from "suppressing."

34. Preceding four words interlined, perhaps contemporaneously.

35. The Madison Extract reads: "combination."

36. At this point Madison deleted "general," evidently contemporaneously.

37. These two words interlined, evidently contemporaneously, in substitution for "authority of the whole."

38. The text within brackets (supplied) constitutes the whole of the Extract in Madison's hand, which, however, varies in the following caption and opening sentence: "Extract of a letter to Mr. J—son dated Ocr. 24. 1787.—A negative in the General Government on laws of the States necessary 1. to prevent encroachments on General Government. 2. instability and injustice in state legislation."

39. At this point the word "adopted" is deleted, evidently contemporaneously.

40. This word interlined, perhaps later, in substitution for "objection," deleted.

41. This word written over "adopting," an alteration possibly contemporaneous.

42. Late in life Madison placed an asterisk at this point and interlined "N.York."

43. This word written over "officially," an alteration that was probably contemporaneous.

44. The text of the Trist Extract, which begins with the third paragraph of the letter ("You will herewith receive the result of the Convention…" &c), ends at this point.

45. This and subsequent words in italics are written in code and were decoded interlineally by TJ. The Editors have verified his decoding, employing Code No. 9.

46. Madison wrote "74," the code symbol for "however," but TJ decoded this as "notwithstanding," the code symbol for which was "73."

47. Late in life Madison put an asterisk at this point and wrote "Paul" in the margin opposite.

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To Thomas Jefferson from James Madison, 24 October 1787

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From James Madison

New York Octr. 24. 1787.

My two last, though written for the two last Packets, have unluckily been delayed till this conveyance. The first of them was sent from Philada. to Commodore Jones in consequence of information that he was certainly to go by the packet then about to sail. Being detained here by his business with Congress, and being unwilling to put the letter into the mail without my approbation, which could not be obtained in time, he detained the letter also. The second was sent from Philada. to Col. Carrington, with a view that it might go by the last packet at all events in case Commodore Jones should meet with further detention here. By ill luck he was out of Town, and did not return till it was too late to make use of the opportunity. Neither of the letters were indeed of much consequence at the time and are still less so now. I let them go forward nevertheless as they may mention some circumstances not at present in my recollection, and as they will prevent a chasm on my part of our correspondence which I have so many motives to cherish by an exact punctuality.

Your favor of June 20. has been already acknowledged. The last packet from France brought me that of August 2d. I have received also by the Mary Capt. Howland the three Boxes for W. H. B. F. and myself. The two first have been duly forwarded. The contents of the last are a valuable addition to former literary remittances and lay me under additional obligations, which I shall always feel more strongly than I express. The articles included for Congress have been delivered and those for the two Universities and for General Washington have been forwarded, as have been the various letters for your friends in Virginia and elsewhere. The parcel of rice referred to in your letter to the Delegates of S. Carolina has met with some accident. No account whatever can be gathered concerning it. It probably was not shipped from France. Ubbo's book I find was not omitted as you seem to have apprehended. The charge for it however is, which I must beg you to supply. The duplicate volume of the Encyclopedie, I left in Virginia, and it is uncertain when I shall have an opportunity of returning it. Your Spanish duplicates will I fear be hardly vendible. I shall make a trial wherever a chance presents itself. A few days ago I received your favor of the 15 of Augst. via L'Orient and Boston. The letters inclosed along with it were immediately sent on to Virga.

You will herewith receive the result of the Convention, which continued its session till the 17th of September. I take the liberty of making some observations on the subject which will help to make up a letter, if they should answer no other purpose.

It appeared to be the sincere and unanimous wish of the Convention to cherish and preserve the Union of the States. No proposition was made, no suggestion was thrown out in favor of a partition of the Empire into two or more Confederacies.

It was generally agreed that the objects of the Union could not be secured by any system founded on the principle of a confederation of sovereign States. A voluntary observance of the federal law by all the members could never be hoped for. A compulsive one could evidently never be reduced to practice, and if it could, involved equal calamities to the innocent and the guilty, the necessity of a military force both obnoxious and dangerous, and in general, a scene resembling much more a civil war, than the administration of a regular Government.

Hence was embraced the alternative of a government which instead of operating, on the States, should operate without their intervention on the individuals composing them: and hence the change in the principle and proportion of representation.

This ground-work being laid, the great objects which presented themselves were 1. to unite a proper energy in the Executive and a proper stability in the Legislative departments, with the essential characters of Republican Government. 2. To draw a line of demarkation which would give to the General Government every power requisite for general purposes, and leave to the States every power which might be most beneficially administered by them. 3. To provide for the different interests of different parts of the Union. 4. To adjust the clashing pretensions of the large and small States. Each of these objects was pregnant with difficulties. The whole of them together formed a task more difficult than can be well conceived by those who were not concerned in the execution of it. Adding to these considerations the natural diversity of human opinions on all new[1] and complicated subjects, it is impossible to consider the degree of concord which ultimately prevailed as less than a miracle.

The first of these objects as it respects the Executive, was peculiarly embarrassing. On the question whether it should consist of a single person, or a plurality of co-ordinate members, on the mode of appointment, on the duration in office, on the degree of power, on the re-eligibility, tedious and reiterated discussions took place. The plurality of co-ordinate members had finally but few advocates. Governour Randolph was at the head of them. The modes of appointment proposed were various, as by the people at large—by electors chosen by the people—by the Executives of the States—by the Congress, some preferring a joint ballot of the two Houses—some a separate concurrent ballot allowing to each a negative on the other house—some a nomination of several canditates by one House, out of whom a choice should be made by the other. Several other modifications were started. The expedient at length adopted seemed to give pretty general satisfaction to the members. As to the duration in office, a few would have preferred a tenure during good behaviour—a considerable number would have done so in case an easy and effectual removal by

impeachment could be settled. It was much agitated whether a long term, seven years for example, with a subsequent and perpetual ineligibility, or a short term with a capacity to be re-elected, should be fixed. In favor of the first opinion were urged the danger of a gradual degeneracy of re-elections from time to time, into first a life and then a hereditary tenure, and the favorable effect of an incapacity to be reappointed, on the independent exercise of the Executive authority. On the other side it was contended that the prospect of necessary degradation would discourage the most dignified characters from aspiring to the office, would take away the principal motive to the faithful discharge of its duties the hope of being rewarded with a reappointment would stimulate ambition to violent efforts for holding over the constitutional term, and instead of producing an independent administration, and a firmer defence of the constitutional rights of the department, would render the officer more indifferent to the importance of a place which he would soon be obliged to quit for ever, and more ready to yield to the incroachments of the Legislature of which he might again be a member.—The questions concerning the degree of power turned chiefly on the appointment to offices, and the controul on the Legislature. An absolute appointment to all offices—to some offices—to no offices, formed the scale of opinions on the first point. On the second, some contended for an absolute negative, as the only possible mean of reducing to practice, the theory of a free government which forbids[2] a mixture of the Legislative and Executive powers. Others would be content with a revisionary power to be overruled by three fourths of both Houses.[3] It was warmly urged that the judiciary department should be associated in the revision. The idea of some was that a separate revision should be given to the two departments—that if either objected two thirds; if both three fourths,[4] should be necessary to overrule.

In forming the Senate, the great anchor of the Government, the questions as they came within the first object turned mostly on the mode of appointment, and the duration of it. The different modes proposed were, 1. by the House of Representatives, 2. by the Executive, 3 by electors chosen by the people for the purpose, 4. by the State Legislatures. On the point of duration, the propositions descended from good behavior to four years, through the intermediate terms of nine, seven, six and five years. The election of the other branch was first determined to be triennial, and afterwards reduced to biennial.

The second object, the due partition of power, between the General and local Governments, was perhaps of all, the most nice and difficult. A few contended for an entire abolition of the States; Some for indefinite power of Legislation in the Congress, with a negative on the laws of the States, some for such a power without a negative,[5] some for a limited power of legislation, with such a negative: the majority finally for a limited power without the negative. The question with regard to the Negative underwent repeated discussions, and was finally rejected by a bare majority. As I formerly intimated to you my opinion in favor of this ingredient, I will take this occasion of explaining myself on the subject. [Such a check on the States appears to me necessary 1. to prevent encroachments on the General authority, 2. to prevent instability and injustice in the legislation[6] of the States.

1. Without such a check in the whole over the parts, our system involves the evil of imperia in imperio. If a compleat supremacy some where is not necessary in every Society, a controuling power at least is so, by which the general authority may be defended against encroachments of the subordinate authorities, and by which the latter may be restrained from encroachments on each other.7 If the supremacy of the British Parliament is not necessary as has been contended,8 for the harmony of that Empire, it is evident I think that without the royal negative9 or some equivalent controul, the unity of the system would be10 destroyed. The want of some such provision seems to have been mortal to the antient Confederacies, and to be the disease of the modern. Of the Lycian Confederacy little is known.11 That of the Amphyctions is well known to have been rendered of little use whilst it lasted, and in the end to have been destroyed by the predominance of the local over the federal authority.12 The same observation may be made, on the authority of Polybius, with regard to the Achæan League. The Helvetic System scarcely amounts to a confederacy and is distinguished by too many peculiarities to be a ground of comparison. The case of the United Netherlands is in point. The authority of a Statholder, the influence of a standing army, the common interest in the conquered possessions, the pressure of surrounding danger, the guarantee of foreign powers, are not sufficient to secure the authority and interests of the generality, against the antifederal tendency of the provincial sovereignties.13 The German Empire is another example. A Hereditary chief with vast independent resources of wealth and power, a federal Diet, with ample parchment authority, a regular Judiciary establishment, the influence of the neighbourhood of great and formidable Nations, have been found unable either to maintain the subordination of the members, or to prevent their mutual contests and encroachments. Still more to the purpose is our own experience both during the war and since the peace. Encroachments of the States on the general authority, sacrifices of national to local interests, interferences of the measures of different States, form a great part of the history of our political system. It may be said that the new Constitution is founded on different principles, and will have a different operation. I admit the difference to be material. It presents the aspect rather of a feudal system of republics, if such a phrase may be used,14 than of a Confederacy of independent States. And what has been the progress and event of the feudal Constitutions? In all of them a continual struggle between the head and the inferior15 members, until a final victory has been gained in some instances by one, in others, by the other of them. In one respect indeed there is a remarkable variance between the two cases. In the feudal system the sovereign, though limited, was independent; and having no particular sympathy of interests with the great Barons, his ambition had as full play as theirs in the mutual projects of usurpation. In the American Constitution The general authority will be derived entirely from the subordinate authorities.16 The Senate will represent the States in their political capacity, the other House will represent the people of the States in their individual capacity. The former will be accountable to their constituents at moderate, the latter at short periods. The President also derives his appointment from the States, and is periodically accountable to them. This dependence of the General, on the local authorities

seems effectually to guard the latter against any dangerous encroachments of the former: Whilst the latter within their respective limits, will be continually sensible of the abridgment of their power, and be stimulated by ambition to resume the surrendered portion of it. We find the representatives of counties and corporations in the Legislatures of the States, much more disposed to sacrifice the aggregate interest, and even authority, to the local views of their Constituents, than the latter to the former. I mean not by these remarks to insinuate that an esprit de corps will not exist in the national Government, that opportunities may17 not occur of extending its jurisdiction in some points. I mean only that the danger of encroachments is much greater from the other side, and that the impossibility18 of dividing powers of legislation, in such a manner, as to be free from different constructions by different interests, or even from ambiguity in the judgment of the impartial, requires some such expedient as I contend for. Many illustrations might be given of this impossibility. How long has it taken to fix, and how imperfectly is yet fixed the legislative power of corporations, though that power is subordinate in the most compleat manner? The line of distinction between the power of regulating trade and that of drawing revenue from it, which was once considered as the barrier of our liberties, was found on fair discussion, to be absolutely undefinable. No distinction seems to be more obvious than that between spiritual and temporal matters. Yet wherever they have been made objects of Legislation, they have clashed and contended with each other, till one or the other has gained the supremacy. Even the boundaries between the Executive, Legislative and Judiciary powers, though in general so strongly marked in themselves, consist in many instances of mere shades of difference. It may be said that the Judicial authority under our new system will19 keep the States within their proper limits, and supply the place of a negative on their laws. The answer is that it is more convenient to prevent the passage of a law, than to declare it void after it is passed; that this will be particularly the case where the law aggrieves individuals, who may be unable to support an appeal against a State to the supreme Judiciary, that a State which would violate the Legislative rights of the Union, would not be very ready to obey a Judicial decree in support of them, and that a recurrence to force, which in the event of disobedience would be necessary, is20 an evil which the new Constitution meant to exclude as far as possible.

2. A Constitutional negative on the laws of the States seems equally necessary to secure individuals against encroachments on their rights. The mutability of the laws of the States is found to be a serious evil. The injustice of them has been so frequent and so flagrant as to alarm the most stedfast friends of Republicanism. I am persuaded I do not err in saying that the evils issuing from these sources21 contributed more to that uneasiness which produced the Convention, and prepared the public mind for a general reform, than those which accrued to our national character and interest from the inadequacy of the Confederation to its immediate objects. A reform therefore which does not make provision for private rights, must be materially defective. The restraints against paper emissions, and violations of contracts are not sufficient. Supposing them to be effectual as far as they go, they are short of the mark. Injustice may be effected by such an infinitude of legislative expedients, that

where the disposition exists it can only be controuled by some provision which reaches all cases whatsoever. The partial provision made, supposes the disposition which will evade it. It may be asked how private rights22 will be more secure under the Guardianship of the General Government than under the State Governments, since they are both founded on the republican principle which refers the ultimate decision to the will of the majority, and are distinguished rather23 by the extent within which they will operate, than by any material difference in their structure. A full discussion of this question would, if I mistake not, unfold the true principles of Republican Government, and prove in contradiction to the concurrent opinions of theoretical writers, that this form of Government, in order to effect its purposes must operate not within a small but an extensive sphere. I will state some of the ideas which have occurred to me on this subject. Those who contend for a simple Democracy, or a pure republic, actuated by the sense of the majority, and operating within narrow limits, assume or suppose a case which is altogether fictitious. They found their reasoning on the idea, that the people composing the Society enjoy not only an equality of political rights; but that they have all precisely the same interests and the same feelings in every respect.24 Were this in reality the case, their reasoning would be conclusive. The interest of the majority would be that of the minority also; the decisions could only turn on mere opinion concerning the good of the whole of which the major voice would be the safest criterion; and within a small sphere, this voice could be most easily collected and the public affairs most accurately managed. We know however that no Society25 ever did or can consist of so homogeneous a mass of Citizens. In the savage State indeed, an approach is made towards it; but in that state little or no Government is necessary. In all civilized Societies, distinctions are various and unavoidable. A distinction of property results from that very protection which a free Government gives to unequal faculties of acquiring it.26 There will be rich and poor; creditors and debtors; a landed interest, a monied interest, a mercantile interest, a manufacturing interest. These classes may again be subdivided according27 to the different productions of different situations and soils, and according to different branches of commerce and of manufactures. In addition to these natural distinctions, artificial ones28 will be founded on accidental differences in political, religious and other opinions, or an attachment to the persons of leading individuals. However erroneous or ridiculous these grounds of dissention and faction may appear to the enlightened Statesman, or the benevolent philosopher, the bulk of mankind who are neither Statesmen nor Philosophers, will continue to view29 them in a different light. It remains then to be enquired whether a majority having any common interest, or feeling any common passion, will find sufficient motives to restrain them from oppressing the minority. An individual is never allowed to be a judge or even a witness in his own cause. If two individuals are under the biass of interest30 or enmity against a third, the rights of the latter could never be safely referred to the majority of the three. Will two thousand individuals be less apt to oppress one thousand, or two hundred thousand, one hundred thousand? Three motives only can restrain in such cases. 1. A prudent regard to private or partial good, as essentially involved in the general and permanent good of the whole.31 This ought no doubt to be sufficient of

itself. Experience however shews that it has little effect on individuals, and perhaps still less on a collection of individuals, and least of all on a majority with the public authority in their hands. If the former are ready to forget that honesty is the best policy; the last do more. They often proceed on the converse of the maxim: that whatever is politic is honest. 2. Respect for character. This motive is not found sufficient to restrain individuals from injustice, and loses its efficacy in proportion to the number which is to divide the praise or the blame. Besides as it has reference to public opinion, which is that of the majority, the standard is fixed by those whose conduct is to be measured by it. 3. Religion. The inefficacy of this restraint on individuals is well known. The conduct of every popular assembly, acting on oath, the strongest of religious ties, shews that individuals join without remorse in acts against which their consciences would revolt, if proposed to them separately in their closets. When Indeed Religion is kindled into enthusiasm, its force like that of other passions is increased by the sympathy of a multitude. But enthusiasm is only a temporary state of Religion, and whilst it lasts will hardly be seen with pleasure at the helm. Even in its coolest state, it has been much oftener a motive to oppression than a restraint from it. If then there must be different interests and parties in Society; and a majority32 when united by a common interest or passion can not be restrained from oppressing33 the minority, what remedy can be found in a republican Government, where the majority must ultimately decide, but that of giving such an extent to its sphere, that no common interest or passion will be likely to unite a majority of the whole number in an unjust pursuit.34 In a large Society, the people are broken into so many interests and parties, that a common sentiment is less likely to be felt, and the requisite concert35 less likely to be formed, by a majority of the whole. The same security seems requisite for the civil as for the religious rights of individuals. If the same sect form a majority and have the power, other sects will be sure to be depressed. Divide et impera, the reprobated axiom of tyranny, is under certain qualifications, the only policy, by which a republic can be administered on just principles. It must be observed however that this doctrine can only hold within a sphere of a mean extent. As in too small a sphere oppressive combinations may be too easily formed against the weaker party; so in too extensive a one a defensive concert may be rendered too difficult against the oppression of those entrusted with the administration. The great desideratum in Government is, so to modify the sovereignty as that it may be sufficiently neutral between different parts of the Society to controul one part from invading the rights of another, and at the same time sufficiently controuled itself, from setting up an interest adverse to that of the entire Society. In absolute monarchies, the Prince may be tolerably neutral towards different classes of his subjects, but may sacrifice the36 happiness of all to his personal ambition or avarice. In small republics, the sovereign will is controuled from such a sacrifice of the entire Society, but it is not sufficiently neutral towards the parts composing it. In the extended Republic of the United States, the General Government37 would hold a pretty even balance between the parties of particular States, and be at the same time sufficiently restrained by its dependence on the community, from betraying its general interests.]38

Begging pardon for this immoderate digression, I return to the third object abovementioned, the adjustment of the different interests of different parts of the Continent. Some contended for an unlimited power over trade including exports as well as imports, and over slaves as well as other imports; some for such a power, provided the concurrence of two thirds of both Houses were required; some for such a qualification of the power, with an exemption of exports and slaves, others for an exemption of exports only. The result is seen in the Constitution. S. Carolina and Georgia were inflexible on the point of the slaves.

The remaining object, created more embarrassment, and a greater alarm for the issue of the Convention than all the rest put together. The little States insisted on retaining their equality in both branches, unless a compleat abolition of the State Governments should take place; and made an equality in the Senate a sine qua non. The large States on the other hand urged that as the new Government was to be drawn principally from the people immediately and was to operate directly on them, not on the States; and consequently as the States would lose that importance which is now proportioned to the importance of their voluntary compliances with the requisitions of Congress, it was necessary that the representation in both Houses should be in proportion to their size. It ended in the compromise which you will see, but very much to the dissatisfaction of several members from the large States.

It will not escape you that three names only from Virginia are subscribed to the Act. Mr. Wythe did not return after the death of his lady. Docr. MClurg left the Convention some time before the adjournment. The Governour and Col. Mason refused to be parties to it. Mr. Gerry was the only other member who refused. The objections of the Govr. turn principally on the latitude of the general powers, and on the connection established between the President and the Senate. He wished that the plan should be proposed to the States with liberty to them to suggest alterations which should all be referred to another general Convention to be39 incorporated into the plan as far as might be judged expedient. He was not inveterate in his opposition, and grounded his refusal to subscribe pretty much on his unwillingness to commit himself so as not to be at liberty to be governed by further lights on the subject. Col. Mason left Philada. in an exceeding ill humour indeed. A number of little circumstances arising in part from the impatience which prevailed towards the close of the business, conspired to whet his acrimony. He returned to Virginia with a fixed disposition to prevent the adoption of the plan if possible. He considers the want of a Bill of Rights as a fatal objection. His other objections are to the substitution of the Senate in place of an Executive Council and to the powers vested in that body—to the powers of the Judiciary—to the vice President being made President of the Senate—to the smallness of the number of Representatives—to the restriction on the States with regard to ex post facto laws—and most of all probably to the power of regulating trade, by a majority only of each House. He has some other lesser objections. Being now under the necessity of justifying his refusal to sign, he will of course, muster every possible one.40 His conduct has given great umbrage

to the County of Fairfax, and particularly to the Town of Alexandria. He is already instructed to promote in the Assembly the calling a Convention, and will probably be either not deputed to the Convention, or be tied up by express instructions. He did not object in general to the powers vested in the National Government, so much as to the modification. In some respects he admitted that some further powers could have improved the system. He acknowledged in particular that a negative on the State laws, and the appointment of the State Executives ought to be ingredients; but supposed that the public mind would not now bear them and that experience would hereafter produce these amendments.

The final reception which will be given by the people at large to this proposed System can not yet be decided. The Legislature of N. Hampshire was sitting when it reached that State and was well pleased with it. As far as the sense of the people there has been expressed, it is equally favorable. Boston is warm and almost unanimous in embracing[41] it. The impression on the country is not yet known. No symptoms of disapprobation have appeared. The Legislature of that State is now sitting, through which the sense of the people at large will soon be promulged with tolerable certainty. The paper money faction in Rh. Island is hostile. The other party zealously attached to it. Its passage through Connecticut is likely to be very smooth and easy. There seems to be less agitation in this[42] state than any where. The discussion of the subject seems confined to the newspapers. The principal characters are known to be friendly. The Governour's party which has hitherto been the popular and most numerous one, is supposed to be on the opposite side; but considerable reserve is practiced, of which he sets the example. N. Jersey takes the affirmative side of course. Meetings of the people are declaring their approbation, and instructing their representatives. Penna. will be divided. The City of Philada., the Republican party, the Quakers, and most of the Germans espouse the Constitution. Some of the Constitutional leaders, backed by the western Country will oppose. An unlucky ferment on the subject in their assembly just before its late adjournment has irritated both sides, particularly the opposition, and by redoubling the exertions of that party may render the event doubtful. The voice of Maryland I understand from pretty good authority, is, as far as it has been declared, strongly in favor of the Constitution. Mr. Chase is an enemy, but the Town of Baltimore which he now represents, is warmly attached to it, and will shackle him as far as they can. Mr. Paca will probably be, as usually, in the politics of Chase. My information from Virginia is as yet extremely imperfect. I have a letter from Genl. Washington which speaks favorably of the impression within a circle of some extent, and another from Chancellor Pendleton which expresses his full acceptance of the plan, and the popularity of it in his district. I am told also that Innis and Marshall are patrons of it. In the opposite scale are Mr. James Mercer, Mr. R. H. Lee, Docr. Lee and their connections of course, Mr. M. Page according to Report, and most of the Judges and Bar of the general Court. The part which Mr. Henry will take is unknown here. Much will depend on it. I had taken it for granted from a variety of circumstances that he would be in the opposition, and still think that will be the case. There are reports however which favor a contrary supposition. From the States South of Virginia nothing has been heard. As the deputation from S. Carolina consisted of some of

its weightiest characters, who have returned unanimously zealous in favor of the Constitution, it is probable that State will readily embrace it. It is not less probable, that N. Carolina will follow the example unless that of Virginia should counterbalance it. Upon the whole, although, the public mind will not be fully43 known, nor finally settled for a considerable time, appearances at present augur a more prompt, and general adoption of the plan than could have been well expected.44

When the plan came before Congress for their sanction, a very serious effort was made by R. H. Lee and Mr. Dane from Masts. to embarrass it. It was first contended that Congress could not properly give any positive countenance to a measure which had for its object the subversion of the Constitution under which they acted. This ground of attack failing, the former gentleman urged the expediency of sending out the plan with amendments, and proposed a number of them corresponding with the objections of Col. Mason. This experiment had still less effect. In order however to obtain unanimity it was necessary to couch the resolution in very moderate terms.

Mr. Adams has received permission to return with thanks for his services. No provision is made for supplying his place, or keeping up any representation there. Your reappointment for three years will be notified from the office of F. Affairs. It was made without a negative, eight states being present. Connecticut however put in a blank ticket, the sense of that state having been declared against embassies. Massachusetts betrayed some scruple on like ground. Every personal consideration was avowed and I believe with sincerity to have militated against these scruples. It seems to be understood that letters to and from the foreign Ministers of the U.S. are not free of postage: but that the charge is to be allowed in their accounts.

The exchange of our French for Dutch Creditors has not been countenanced either by Congress or the Treasury Board. The paragraph in your last letter to Mr. Jay, on the subject of applying a loan in Holland to the discharge of the pay due to the foreign officers has been referred to the Board since my arrival here. No report has yet been made. But I have little idea that the proposition will be adopted. Such is the state and prospect of our fiscal department that any new loan however small that should now be made, would probably subject us to the reproach of premeditated deception. The balance of Mr. Adams' last loan will be wanted for the interest due in Holland, and with all the income here, will, it is feared, not save our credit in Europe from further wounds. It may well be doubted whether the present Government can be kept alive thro' the ensuing year, or untill the new one may take its place.

Upwards of 100,000 Acres of the surveyed lands of the U.S. have been disposed of in open market. Five million of unsurveyed have been sold by private contract to a N. England Company, at ⅔ of a dollar per acre, payment to be made in the principal of the public securities. A negociation is nearly closed with a N. Jersey Company for two million more on like terms, and another commenced with a Company of this City for four million. Col.

Carrington writes more fully on this subject.

You will receive herewith the desired information from Alderman Broome in the case of Mr. Burke. Also the Virga. Bill on crimes and punishments. Sundry alterations having been made in conformity to the sense of the House in its latter stages, it is less accurate and methodical than it ought to have been. To these papers I add a speech of Mr. C. P. on the Mississippi business. It is printed under precautions of secrecy, but surely could not have been properly exposed to so much risk of publication. You will find also among the pamplets and papers I send by Commodore Jones, another printed speech of the same Gentleman. The Musæum Magazine, and Philada. Gazettes, will give you a tolerable idea of the objects of present attention.

The summer crops in the Eastern and Middle States have been extremely plentiful. Southward of Virga. They differ in different places. On the whole I do not know that they are bad in that region. In Virginia the drought has been unprecedented, particularly between the falls of the Rivers and the Mountains. The Crops of Corn are in general alarmingly short. In Orange I find there will be scarcely subsistence for the inhabitants. I have not heard from Albemarle. The crops of Tobacco are every where said to be pretty good in point of quantity, and the quality unusually fine. The crops of wheat were also in general excellent in quality and tolerable in quantity.

Novr. 1. Commodore47 Jones having prefered another vessel to the packet, has remained here till this time. The interval has produced little necessary to be added to the above. The Legislature of Massts. has it seems taken up the Act of the Convention and have appointed or probably will appoint an early day for its State Convention. There are letters also from Georgia which denote a favorable disposition. I am informed from Richmond that the new Election-law from the Revised Code produced a pretty full House of Delegates, as well as a Senate, on the first day. It had previously had equal effect in producing full meetings of the freeholders for the County elections. A very decided majority of the Assembly is said to be zealous in favor of the New Constitution. The same is said of the Country at large. It appears however that individuals of great weight both within and without the Legislature are opposed to it. A letter I just have from Mr. A. Stuart names Mr. Henry, Genl. Nelson, W. Nelson, the family of Cabels, St. George Tucker, John Taylor and the Judges of the General Court except P. Carrington. The other opponents he described as of too little note to be mentioned, which gives a negative information of the Characters on the other side. All are agreed that the plan must be submitted to a Convention.

We hear from Georgia that that State is threatened with a dangerous war with the Creek Indians. The alarm is of so serious a nature, that law-martial has been proclaimed, and they are proceeding to fortify even the Town of Savannah. The idea there is that the Indians derive their motives as well as their means from their Spanish neighbours. Individuals

complain also that their fugitive slaves are encouraged by East Florida. The policy of this is explained by supposing that it is considered as a discouragement to the Georgians to form settlements near the Spanish boundaries.

There are but few States on the spot here which will survive the expiration of the federal year; and it is extremely uncertain when a Congress will again be formed. We have not yet heard who are to be in the appointment of Virginia for the next year.

With the most affectionate attachment I remain Dear Sr. Your obed friend & servant,

Js. Madison Jr.

RC (DLC: TJ Papers); partly in code; with a number of deletions and corrections, most of which were not interlinear and which were evidently made contemporaneously, but two of which, as indicated in notes 42 and 47 below, were clearly made by Madison late in life; endorsed. Tr of an Extract (DLC: Madison Papers); in Madison's hand, in highly abbreviated form (see note 38, below). Tr of an Extract (ViU); at foot of text, in the hand of Nicholas P. Trist: "Copied from the original at Montpellier (V. J. T. & C. J. R. & M. J. R. assisting) by N. P. T. Oct. 1. '34"; endorsed by Trist on verso of last leaf: "Madison James—Oct. 24. 1787 To Thomas Jefferson. Copied from the original at Montpellier, Oct. 1. 1834. N. P. Trist." (See note 44 below). Recorded in SJL as received 19 Dec. 1787. Enclosures: (1) The "information from Alderman Broome" has not been found (see TJ to Madison, 20 Dec. 1787). (2) The "Virga. Bill on crimes and punishments" must have been a printed text showing the alterations that the bill underwent in the legislative session of Oct. 1786, but no such printed text is known to have been made and none is known to be in existence; it is also puzzling that Madison waited until this late date to send any text when the Bill was defeated early in the year (see Madison to TJ, 15 Feb. 1787; see also, Vol. 2: 506, note). (3) The "speech of Mr. C. P. [Charles Pinckney] on the Mississippi business" was that delivered on 16 Aug. 1786 in answer to Jay's speech on 3 Aug. 1786 on the negotiations with Spain; it was printed in broadside form by Congress and it was one of these printed texts that Madison sent to TJ (text of Pinckney's speech is printed in , xxxi, 935 – 48). (4) The other "printed speech by the same gentleman," not actually enclosed but sent by Jones, was Pinckney's Observations on the Plan of Government submitted to the Federal Convention, in Philadelphia, on the 28th of May, 1787, New York, 1787 (No. 3016).

It is not known when or for what purpose Madison made the extract from this letter that is described above and referred to below as the Madison Extract, but it was probably made during TJ's lifetime. Certainly the handwriting is much firmer and less crabbed by age than the alterations made by Madison in the text of the letter that are known to have been added late in life (see notes 42 and 47, below). It is possible, even, that he obtained leave from TJ to make the extract not long after the latter returned from France. The fact that he had made such an extract and retained it may also explain why this letter of his was not kept by him among his own papers along with others that he received after TJ's death.

1. Preceding seven words interlined in substitution for "disagreement of opinion on serious," an alteration probably made contemporaneously.

2. This word written lineally in preference to "requires," deleted, evidently contemporaneously.

3. At this point Madison deleted lineally: "Others would have preferred," an alteration evidently made contemporaneously.

4. Preceding six words interlined and "to the other two" deleted, an alteration evidently made contemporaneously.

5. Preceding eight words interlined, probably contemporaneously.

6. This word written lineally in preference to "laws of," deleted.

7. Preceding three words interlined, perhaps contemporaneously.

8. At this point Madison deleted, evidently contemporaneously, the word "certainly."

9. The Madison Extract reads "prerogative."

10. At this point Madison deleted the word "necessarily," evidently contemporaneously.

11. At this point Madison deleted, evidently contemporaneously: "From that to every new instance it may be [premised?] that."

12. This word written over an erasure, perhaps "jurisdiction," and presumably done contemporaneously.

13. This word interlined in substitution for "legislatures," an alteration perhaps made contemporaneously.

14. The Madison Extract reads "allowed."

15. This word, divided, lies in the right and left margins and may have been added later.

16. This word altered by overwriting, evidently contemporaneously, from "authority."

17. This word altered by overwriting, probably later, from "will."

18. This word interlined, evidently contemporaneously, in substitution for "impossibility and difficulty," deleted.

19. At this point Madison deleted lineally, evidently contemporaneously, the word "preserve."

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20. This word altered by overwriting, perhaps contemporaneously, from what appears to read "was."

21. At this point Madison deleted lineally, evidently contemporaneously, "had a greater share in."

22. These two words interlined, perhaps contemporaneously, in substitution for "the public and private faith," deleted.

23. This word interlined, probably contemporaneously, in substitution for "principally," deleted.

24. The Madison Extract reads: "… but that they have precisely and in all respects the same interests and the same feelings."

25. This word interlined, probably contemporaneously, in substitution for "Government," deleted.

26. Preceding five words interlined, perhaps later, in substitution for "private rights," deleted.

27. This passage originally read: "These classes will again be subdivided by," and then was altered by overwriting, evidently contemporaneously, to read as above.

28. These two words interlined, evidently contemporaneously, in substitution for "others," deleted.

29. This word written lineally in preference to "act," deleted, evidently contemporaneously.

30. Preceding seven words interlined, evidently contemporaneously, in substitution for "men have a same interest," deleted.

31. This word written over another that may be "sovereignty" or "majority," an alteration made contemporaneously.

32. These two words interlined, evidently contemporaneously, in substitution for "the predominant party," deleted.

33. This word altered by overwriting, perhaps contemporaneously, from "suppressing."

34. Preceding four words interlined, perhaps contemporaneously.

35. The Madison Extract reads: "combination."

36. At this point Madison deleted "general," evidently contemporaneously.

37. These two words interlined, evidently contemporaneously, in substitution for “authority of the whole.”

38. The text within brackets (supplied) constitutes the whole of the Extract in Madison’s hand, which, however, varies in the following caption and opening sentence: “Extract of a letter to Mr. J—son dated Ocr. 24. 1787.—A negative in the General Government on laws of the States necessary 1. to prevent encroachments on General Government. 2. instability and injustice in state legislation.”

39. At this point the word “adopted” is deleted, evidently contemporaneously.

40. This word interlined, perhaps later, in substitution for “objection,” deleted.

41. This word written over “adopting,” an alteration possibly contemporaneous.

42. Late in life Madison placed an asterisk at this point and interlined “N.York.”

43. This word written over “officially,” an alteration that was probably contemporaneous.

44. The text of the Trist Extract, which begins with the third paragraph of the letter (“You will herewith receive the result of the Convention…” &c), ends at this point.

45. This and subsequent words in italics are written in code and were decoded interlineally by TJ. The Editors have verified his decoding, employing Code No. 9.

46. Madison wrote “74,” the code symbol for “however,” but TJ decoded this as “notwithstanding,” the code symbol for which was “73.”

47. Late in life Madison put an asterisk at this point and wrote “Paul” in the margin opposite.

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United States Court of Appeals for the Ninth Circuit

Office of the Clerk
95 Seventh Street
San Francisco, CA 94103

Information Regarding Judgment and Post-Judgment Proceedings

Judgment

- This Court has filed and entered the attached judgment in your case. Fed. R. App. P. 36. Please note the filed date on the attached decision because all of the dates described below run from that date, not from the date you receive this notice.

Mandate (Fed. R. App. P. 41; 9th Cir. R. 41-1 & -2)

- The mandate will issue 7 days after the expiration of the time for filing a petition for rehearing or 7 days from the denial of a petition for rehearing, unless the Court directs otherwise. To file a motion to stay the mandate, file it electronically via the appellate ECF system or, if you are a pro se litigant or an attorney with an exemption from using appellate ECF, file one original motion on paper.

Petition for Panel Rehearing (Fed. R. App. P. 40; 9th Cir. R. 40-1)
Petition for Rehearing En Banc (Fed. R. App. P. 35; 9th Cir. R. 35-1 to -3)

(1) A. Purpose (Panel Rehearing):

- A party should seek panel rehearing only if one or more of the following grounds exist:
  - ► A material point of fact or law was overlooked in the decision;
  - ► A change in the law occurred after the case was submitted which appears to have been overlooked by the panel; or
  - ► An apparent conflict with another decision of the Court was not addressed in the opinion.
- Do not file a petition for panel rehearing merely to reargue the case.

B. Purpose (Rehearing En Banc)

- A party should seek en banc rehearing only if one or more of the following grounds exist:

- ▶ Consideration by the full Court is necessary to secure or maintain uniformity of the Court's decisions; or
- ▶ The proceeding involves a question of exceptional importance; or
- ▶ The opinion directly conflicts with an existing opinion by another court of appeals or the Supreme Court and substantially affects a rule of national application in which there is an overriding need for national uniformity.

(2) Deadlines for Filing:

- A petition for rehearing may be filed within 14 days after entry of judgment. Fed. R. App. P. 40(a)(1).
- If the United States or an agency or officer thereof is a party in a civil case, the time for filing a petition for rehearing is 45 days after entry of judgment. Fed. R. App. P. 40(a)(1).
- If the mandate has issued, the petition for rehearing should be accompanied by a motion to recall the mandate.
- *See* Advisory Note to 9th Cir. R. 40-1 (petitions must be received on the due date).
- An order to publish a previously unpublished memorandum disposition extends the time to file a petition for rehearing to 14 days after the date of the order of publication or, in all civil cases in which the United States or an agency or officer thereof is a party, 45 days after the date of the order of publication. 9th Cir. R. 40-2.

(3) Statement of Counsel

- A petition should contain an introduction stating that, in counsel's judgment, one or more of the situations described in the "purpose" section above exist. The points to be raised must be stated clearly.

(4) Form & Number of Copies (9th Cir. R. 40-1; Fed. R. App. P. 32(c)(2))

- The petition shall not exceed 15 pages unless it complies with the alternative length limitations of 4,200 words or 390 lines of text.
- The petition must be accompanied by a copy of the panel's decision being challenged.
- An answer, when ordered by the Court, shall comply with the same length limitations as the petition.
- If a pro se litigant elects to file a form brief pursuant to Circuit Rule 28-1, a petition for panel rehearing or for rehearing en banc need not comply with Fed. R. App. P. 32.

- The petition or answer must be accompanied by a Certificate of Compliance found at Form 11, available on our website at www.ca9.uscourts.gov under *Forms*.
- You may file a petition electronically via the appellate ECF system. No paper copies are required unless the Court orders otherwise. If you are a pro se litigant or an attorney exempted from using the appellate ECF system, file one original petition on paper. No additional paper copies are required unless the Court orders otherwise.

Bill of Costs (Fed. R. App. P. 39, 9th Cir. R. 39-1)

- The Bill of Costs must be filed within 14 days after entry of judgment.
- See Form 10 for additional information, available on our website at www.ca9.uscourts.gov under *Forms*.

Attorneys Fees

- Ninth Circuit Rule 39-1 describes the content and due dates for attorneys fees applications.
- All relevant forms are available on our website at www.ca9.uscourts.gov under *Forms* or by telephoning (415) 355-7806.

Petition for a Writ of Certiorari

- Please refer to the Rules of the United States Supreme Court at www.supremecourt.gov

Counsel Listing in Published Opinions

- Please check counsel listing on the attached decision.
- If there are any errors in a published opinion, please send a letter **in writing within 10 days** to:
  - ► Thomson Reuters; 610 Opperman Drive; PO Box 64526; Eagan, MN 55123 (Attn: Jean Green, Senior Publications Coordinator);
  - ► and electronically file a copy of the letter via the appellate ECF system by using "File Correspondence to Court," or if you are an attorney exempted from using the appellate ECF system, mail the Court one copy of the letter.

UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

Form 10. Bill of Costs

Instructions for this form: http://www.ca9.uscourts.gov/forms/form10instructions.pdf

9th Cir. Case Number(s)

Case Name

The Clerk is requested to award costs to (*party name(s)*):

I swear under penalty of perjury that the copies for which costs are requested were actually and necessarily produced, and that the requested costs were actually expended.

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Exhibit 5

Reporter's transcript of January 19, 2024, status conference,
to be docketed at ECF No. 572 (Jan. 22, 2024)

IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

EUGENE DIVISION

KELSEY CASCADIA ROSE JULIANA; XIUTHEZCATL TONATIUH M., through his Guardian Tamara Roske-Martinez; et al.,	)	No. 6:15-cv-01517-AA
	)	January 19, 2024
Plaintiffs,	)	Eugene, Oregon
v.	)	
THE UNITED STATES OF AMERICA; et al.,	)	
Defendants.	)	

TRANSCRIPT OF PROCEEDINGS

(Status Conference by teleconference)

BEFORE THE HONORABLE ANN AIKEN

UNITED STATES DISTRICT COURT SENIOR JUDGE

COURT REPORTER:
Kellie M. Humiston, RMR, CRR
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A P P E A R A N C E S

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OUR CHILDREN'S TRUST
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FOR THE PLAINTIFFS:
OUR CHILDREN'S TRUST
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FOR THE DEFENDANTS:
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FOR THE DEFENDANTS:
U.S. DEPARTMENT OF JUSTICE
By: Frank J. Singer
P.O. Box 7611
Washington, DC 20044-7611

(January 19, 2024, 1:48 p.m.)

P R O C E E D I N G S

THE COURTROOM DEPUTY: Now is the time set for Civil Case Number 15-1517, Juliana, et al. vs. United States of America, et al., for status conference.

If you could please introduce yourselves for the record, beginning with plaintiffs.

MS. OLSON: This is Julia Olson on behalf of the plaintiffs.

MS. RODGERS: This is Andrea Rodgers on behalf of the plaintiffs.

MR. GREGORY: This is Philip Gregory on behalf of the plaintiffs.

MR. DUFFY: This is Sean Duffy on behalf of defendants.

MR. SINGER: This is Frank Singer for the defendants.

THE COURTROOM DEPUTY: I believe that's everyone, Judge. Thank you.

THE COURT: Thank you. Let me just catch up where I think we are. We issued our opinion on the end of December, and I received a request to grant extension to the defendants to allow them extra time to file their answer. I granted that by minute order, and this matter was set for today to address issues going forward, including setting a trial date. Last night, I received a -- filed was a motion for a stay pending a petition

for writ of mandamus.

Let me just recite the following: I live in Eugene, Oregon, and I live in a part of the city that has had no electricity, heat, or power since Sunday, and it was only until yesterday that I was able to come out of my home and go to a place where I have power, charging ability, electricity, and heat.

So I -- since it was filed last night, I have just barely reviewed it. I suspect I'm going to hear from the plaintiffs that they want an opportunity to respond. So that's -- that catches everybody up where we are, but I need to tell you that that's -- I'm not prepared to talk much about this, because I've only received it this morning when I was able to get on the system.

So I guess I'll start with the fact that this has been filed by the defendants. And, Ms. Olson, do you want to tell me how you wish to proceed?

MS. OLSON: Thank you, Your Honor. I'm glad you're in a safe, warm place now. I am compassionate to the experience. It's been similar. So we --

THE COURT: Just -- not to be -- not to be presumptuous, but I have had -- my law clerks have been in as bad or difficult situation given the ice storm out of Portland and have been on and off the system repeatedly. So people just need to know that that's -- they've had -- that's affecting any number

of things, and that's taken into account in terms of how we're going to address issues today.

So please tell me -- I'm sorry to have interrupted, but I just thought in fairness, I wanted you to know the staff -- the many staff who have not been able to do work because they are not able to get out of their homes or have power. So go ahead.

MS. OLSON: Understood, Your Honor.

So three things we hope to achieve today. One is we would like to have a trial date set in early December, and we would propose December 2nd. We will be filing an opposition to the defendants' motion to stay the case pending their petition for writ of mandamus in the Ninth Circuit, and we can file that according to the rules in two weeks, Your Honor. Meanwhile, we also do want to proceed with discovery. And then the third issue that we wanted to discuss was the timing of the Government's filing of the petition for writ of mandamus. So those were our three key items to discuss today.

THE COURT: I think, Mr. Duffy, you said you were going to lead off and be the responding lawyer. So those are the four issues that have been raised, so tell me what your issues are.

MR. DUFFY: Okay. We'll respond to plaintiffs' -- some of their issues setting forth the dates, because I know they have some -- they've just sent us a somewhat detailed schedule that we just received, and we can -- we'll respond to that.

We're -- the first thing we want to discuss, since I

know you haven't had an opportunity to read it, is we have filed a motion for a stay pending the mandamus. And our position right up front is that this case should be stayed pending resolution of that mandamus petition. I don't have much more to add on that.

THE COURT: No. I've had a cursory -- I've had a cursory read of the -- of the motion, but I understand your position.

MR. DUFFY: Okay. And then the second thing, I'll let plaintiffs go first, but just to preview our position, since the parties did confer yesterday and have discussed next steps somewhat, our view is that the -- if no stay is entered, then the United States will file its answer on February 27th. And our -- we would hope that the parties could then confer and discuss -- after they've reviewed the answer, confer and then discuss next steps in the proceeding. So we're not prepared to discuss trial dates.

And those are basically our two main points, but I can respond to some of the points that plaintiffs made as set forth in more detail.

THE COURT: I think her two other questions were discovery proceeding and the timing of your petition for mandamus. Those are the other two questions that you should address.

MR. DUFFY: Okay. So on the timing for the petition for mandamus, the author -- the Office of Solicitor General has

authorized the petition, so we expect that it will be filed expeditiously, but I -- I don't know exactly when.

And then on the discovery, that relates to our previous point, which is that we believe that the parties need to review the answer -- we think there's going to be a lot of substantive submissions in the answer -- identify the disputed issues of material fact, and at that point, we can confer to discuss when plaintiffs are going to submit their expert reports. And then, you know, we can confer, you know, further on the next steps in the proceeding, but we don't think we can get any further than that right now, because we're still in the pleading stage, and we think it's important that the parties take the answer into consideration before we go into setting discovery deadlines so that we have a good sense of a scope of the proceedings.

MS. OLSON: And this is Julia Olson. May I respond to that point about the need to begin discovery presently?

THE COURT: Please.

MS. OLSON: So my understanding from counsel is that they do intend to update some of the answers that were previously filed in their answer to the first amended complaint in addition to answering the new allegations in the second amended complaint, and there may be areas of agreement on many of those facts about the climate crisis and what's happening to the nation and to the plaintiff.

However, even previously with all of those affirmative

answers and agreeing with the plaintiff, there was still -- there was a lot of agreement between the parties on stipulating to facts that we could then present to the Court as part of the stipulation for trial and there were many areas of dispute. And so the experts that prepared reports and were ready to testify back in 2018 are still going to be important at this trial unless the parties come to agreement and stipulations on facts that this Court can rely on in findings of fact.

And so what needs to be done and what we want to begin doing is having our experts supplement the reports that were prepared in 2018. Some of those experts -- one has deceased, others we may not need at this point, and there may be a couple of new experts that we want to bring in, but basically, you know, the bulk of the content is there. We just need to supplement based on the new information that has developed in the field of science and the conduct of the government over the last five or six years as the case has been delayed.

And so we have proposed that the parties do those supplements of expert reports and exchange them on April 30th -- April 15th or April 30th and then we do rebuttal reports in May, a month later. That was our proposal to defendants.

And the other types of discovery that will be conducted will be pretty limited in terms of requests for admissions, maybe very limited number of interrogatories, but we don't expect a lot of written discovery. And so the bulk of discovery will be

expert work and the depositions of the experts, and if defendants wish to depose the plaintiffs again, and then a handful of depositions of government witnesses that they may have testify.

And we think we can do all of this and have dispositive motion practice and motion in limine practice and be ready for trial on December 2nd.

And to that point, Your Honor, we anticipate that plaintiffs' side could put on our affirmative case and also the government cross-examination of witnesses, we would need approximately 20 days. We've calculated 120 hours as sort of the most we would need.

And, again, if the parties are able to come to some stipulated facts and agree on documents that should be admitted into evidence, then we could also reduce the amount of time needed for trial.

MR. DUFFY: Your Honor, this is Sean Duffy. I think our response to that is our -- we believe that we should file the answer before we delve into discovery. The answer to the first amended complaint contains many admissions. Those admissions should narrow the scope of discovery, and we're expecting that the answers to this amended complaint would also contain many admissions.

So our proposal is let's -- let's get to the point where the answer's filed, the parties confer, and then we can come back to the Court with either a joint proposal for the next

steps in discovery or, if necessary, the parties cannot agree with the parties' proposals, but discussing stipulations at this particular point seems premature, because the answer's going to contain a number of admissions, and I think at that point the parties -- the pleadings have closed, the parties can sit down and decide how the case is going to proceed.

And I don't want to get ahead of myself, but one of the proposals it appears plaintiffs are making is that the parties file simultaneous expert reports. We spoke about this yesterday. We don't think that is a good approach and it's not an efficient approach for a number of reasons. It's not a good approach, because the plaintiffs have the burden here and this is a very sprawling case with many experts. The list they sent us today has over 20.

Plaintiffs should file their expert reports, and then we can review those and try to get our experts under contract and then respond to them, and then they can file -- rebuttals can come later. And that's efficient so that the experts are not just talking past each other, but I don't want to get too far ahead of ourselves.

I think -- if there's not going to be a stay in this case, I think the parties need to look at the pleadings carefully. And I -- I didn't get the sense that the plaintiffs -- honestly, the last time, much of the expert testimony that they offered was quite cumulative of the

admissions, and I would hope that we could have a good discussion this time around and narrow the issues, because 20 days of trial presumes a lot of expert testimony and it also presumes a lot of disputed issues, and I believe that those issues will be significantly narrowed by the pleadings.

MS. OLSON: Your Honor, this is Julia again. And the part -- we are more than happy to work with the defendants to narrow issues and stipulate to facts that the Court can rely on after trial and during trial. We can do that.

Our experience over the last eight and a half years is that it has been virtually impossible to come to stipulation about anything in this case.

So we will continue to participate and work collaboratively with defense counsel to do that, we'll look at the answer; however, expert testimony is going to be needed, and so we want to move expeditiously given the long delay in this case and the urgency of the climate crisis and the irreparable harms that continue to accrue to the plaintiff.

And I'll note that in the defendants' document 571 where they have moved for a stay, on page 5, they say that the issues in this case concern prospective harm and that there isn't current harm. And so, I mean, that's just an indication of one of the areas of disagreement that the parties have to which expert testimony is really important.

So we will work with defense counsel once we have the

answer on -- and can narrow the issues that are actually in dispute and that can be stipulated to.

MR. DUFFY: Your Honor --

THE COURT: (Indiscernible).

MR. DUFFY: Your Honor, if I could add one more thing, something I was thinking about. When we previously structured our expert reports, I believe we were before Judge Coffin at the time in 2017, in that case, he ordered the plaintiffs to file their (indiscernible) expert reports on July 5th and July 31st, and then the United States was ordered to identify its experts by September 14 and serve its expert reports by October 13.

That was a framework that more or less worked, and I think it also sort of took account of these factors we've been discussing, having one set of experts responding to the other.

There's also the issue of our contracting process, which takes us a long time. That's just a delay that's built in, getting our experts under contract. And I think -- I thought Judge Coffin was pretty receptive to understanding that. And so that's in ECF 181, that order.

I think that, if we get to this point where we're discussing experts, could serve as a -- like, as a useful template for how we structure this.

THE COURT: Your Honor, this is Philip Gregory. And Mr. Duffy -- I'm sorry to interject, but Mr. Duffy's citing to the 2017 order of Judge Coffin. That's not the order we followed

in 2018 for experts. We followed a subsequent order leading to the October 2018 trial date.

MR. DUFFY: And this is Sean Duffy. I think what we could do is sit down when we have -- when we're further along after we've gotten past the pleadings and we've discussed the scope of discovery that's needed. I think those are conversations, you know, we can have at that time and we can talk about what worked in the past.

MS. OLSON: Your Honor, we would ask that the Court set dates today, because we -- we have tried working with counsel. We had a phone call yesterday to try to talk about dates. Counsel were not willing to talk about dates. And so we would ask that the Court set a schedule to get us to trial, and the plaintiffs will do everything in our power to meet the deadlines set by the Court.

And I think one other thing I would note is while there are some new allegations in the complaint and there is new science and new facts, the heart of this case is the same and there was a tremendous amount of work done to prepare for trial in 2018 by both sides, and so we aren't starting from -- from ground zero here. Everyone is very familiar with the case, the evidence, and the facts of the case over the last eight and a half years. So a lot of updating needs to be done, but it's not nearly the amount of work that was done in prior years. Thank you.

THE COURT: Well, there are some dates that we can address. Ms. Olson, you told me you needed two weeks to respond to the motion for the stay. So that looks to be --

Ms. Kramer, what day would that be that her response is due?

THE COURTROOM DEPUTY: I believe February 1st.

THE COURT: February 1st. And then will there be a reply?

MR. DUFFY: I'm sorry, Your Honor. You're referring to the stay motion that we filed?

THE COURT: Right. Yes. It's first thing first to (indiscernible) --

MR. DUFFY: Yeah. Well, I mean, it depends on what's in the response, but I -- if this mandamus happens quickly, that may, you know, overtake all of this, of course, but I will say, yes, there will likely be a reply, or at least we reserve the right to file a reply.

THE COURT: So, Counsel, that was my exact point, is Ms. Olson is requesting scheduling, when I think we're playing with -- not talking about what's in the room, and that is I suspect, hearing your comment, that there will be an expedited mandamus, that I may not even get the chance to rule on the stay (indiscernible) proceeding, because I will definitely give counsel -- whoever filed the motion and the other counsel an opportunity to respond. So if you proceed directly to filing a

mandamus before I even get to rule on the stay, I guess that's your decision.

It's surprising, because I really expected when you asked for the delay in filing your answer and the Court granted that extension of time, that we were starting on a different path. And it, again, surprises me that in this case after reading, again, the decision in this case, that the Government isn't saying, "I think we should stay the proceedings and go to the table and have some preliminary settlement discussions," which took place, I don't know now, months and years ago, and could make progress in addressing how this case is now postured. So I'm sort of surprised at receiving what I received and how the Government is proceeding.

So that being said, I'm -- again, I go back to this -- you know, I'm giving the plaintiffs a chance to file their response. And if you file the mandamus before I even get to rule on the motion to stay, I -- I guess I heard you say that, I do believe that your answer is due on February 27th. And this discussion may be academic, because you'll file the stay before you have to file the answer, but I'll expect the answer to be filed at this juncture on the 27th.

I will set a status conference thereafter. And I'm taking under advisement the request for the trial date, which I may issue in a minute order.

And the discovery, I believe that everyone knows that

this case has massive discovery that's been accomplished. My office is aware of it, because we have everything and have reviewed everything over the years and have updated information as to what's needed, and that will take some short period of time, and there's no reason that that needs to really be postponed given information available.

Then I'm going to take a look at that, and as well as get the answer filed, have a status conference to hopefully at that juncture have -- there is conferral about how best to proceed both with additional discovery that's needed to be prepared for trial.

This wasn't what I was expecting to discuss today, so I am going to take it under advisement and wait to read the plaintiffs' response, and we'll have to take a close look at the request for the stay.

And I think -- I think I've covered the issues that the plaintiffs asked to be addressed. Did I miss something --

MS. OLSON: Yes, Your Honor.

THE COURT: -- Mr. Duffy or Ms. Olson?

MS. OLSON: That's all for plaintiffs. Thank you, Your Honor.

MR. DUFFY: Yeah. I believe that's all, Your Honor.

THE COURT: And I -- I hear exactly what the comment is. If the Court doesn't even have the opportunity to rule on the stay in the normal course, proceeding on the mandamus

happens, I understand, and that's the choice you've made.

So is there anything else we need to talk about today?

MS. OLSON: No. Thank you, Your Honor.

MR. DUFFY: Thank you, Your Honor. That's all.

THE COURT: Thank you. We're in recess.

(Proceedings adjourned at 2:12 p.m.)

C E R T I F I C A T E

I certify, by signing below, that the foregoing is a true and correct transcript of the record, taken by stenographic means, of the proceedings in the above-entitled cause.

A transcript without an original signature, conformed signature, or digitally signed signature is not certified.

DATED this 22nd day of January 2024.

/s/ Kellie M. Humiston

Kellie M. Humiston, RMR, CRR
Official Court Reporter
Certificates Expire: 9/2024

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Exhibit 6

Declaration of Guillermo A. Montero,
filed in *In re United States*, No. 18A410 (U.S. Oct. 18, 2018)

IN THE SUPREME COURT OF THE UNITED STATES

No. 18A-_____

IN RE UNITED STATES OF AMERICA, ET AL.

DECLARATION OF GUILLERMO A. MONTERO
IN SUPPORT OF APPLICATION FOR A STAY PENDING
DISPOSITION OF A PETITION FOR A WRIT OF MANDAMUS TO THE
UNITED STATES DISTRICT COURT FOR THE DISTRICT OF OREGON
AND ANY FURTHER PROCEEDINGS IN THIS COURT
AND REQUEST FOR AN ADMINISTRATIVE STAY

I, Guillermo A. Montero, do declare and if called upon would testify as follows:

1. I am an assistant chief in the Environment and Natural Resources Division ("ENRD") of the United States Department of Justice, where I have worked since 2004. In that capacity, I supervise the attorneys of record for Defendants in the district court proceedings of the above-captioned action. I have personal knowledge of the statements made herein, as informed by my review of district court filings, information in the ENRD case management system, and information compiled from the ENRD Office of the Comptroller, Expert Witness Unit, and Office of Litigation Support.

2. As of October 17, 2018, ENRD has devoted over 13,000 attorney and paralegal hours defending this case.

3. As of October 17, 2018, ENRD has expended $2,134,141.09 on expert witness invoice payments; $13,333.57 on invoice payments for depositions and transcripts; and $121,611.61 on employee travel expenses.

4. The liability phase of trial in this case will begin on October 29, 2018, and is expected to last approximately 50 calendar days over the course of several months. The district court has scheduled the first two weeks of this phase of trial for October 29 through November 9, 2018.

5. The parties have indicated that they will call 29 expert witnesses during this phase of trial, and as many as 43 lay witnesses, for a total of 72 potential witnesses. The expert witnesses will testify to a broad range of topics, including the impacts of climate change on ocean chemistry, sea level, glaciers, terrestrial ecosystems, and human physical and emotional health, as well as the technical and economic feasibility of transitioning to renewable sources of energy and sequestering carbon from the atmosphere. That proposed testimony is described in 1,156 pages of expert reports and approximately 130 hours of depositions completed as of October 12.

6. Between now and the end of the liability phase of trial, I estimate that ENRD will expend another $5.2 million in expert witness fees, in addition to the following sundry expenses: $198,986.65 for travel-related expenses from October 2018 through

February 2019; $40,000 in transcript, copying, and shipping costs; and $9,600 for a conference room at trial.

7. Primary responsibilities for handling this phase of trial have been assigned to five attorneys and three paralegals. I estimate that each attorney will expend anywhere from 60 to 80 hours per week on this case for the ten weeks I expect trial to be in session, and anywhere from 30 to 40 hours per week on this case when trial is not in session, *viz.*, the weeks of Nov. 12-16, Nov. 19-23, Dec. 17-21, Dec. 24-28, and Dec. 31-Jan. 4. I also estimate that each attorney will work between 10 and 12 hours per day between now and the start of this phase of trial on October 29. Similarly, I estimate that the three paralegals assigned to this trial will expend a combined total of 220 hours per week on this case for the ten weeks I expect trial to be in session, and a combined total of 100 hours per week on this case while trial is not in session. I also estimate that those three paralegals will work a combined 24 hours per day on this case between now and the start of this phase of trial on October 29. Based on the lowest number in each range, and if trial proceeds as expected, I conservatively estimate that ENRD attorneys and paralegals will expend at least 7,300 hours on the liability phase of trial between now and February, 2019.

8. Attached as Exhibit A is a true and correct copy of Plaintiffs' Witness List, which Plaintiffs filed with the district court on October 15, 2018.

9. Attached as Exhibit B is a true and correct copy of Defendants' Witness List, which Defendants filed with the district court on October 15, 2018.

10. Attached as Exhibit C is a true and correct copy of the Exhibit List Plaintiffs served on Defendants on October 12, 2018, with column-widths modified solely for purposes of facilitating printing.

11. Attached as Exhibit D is a true and correct copy of the Exhibit List Defendants served on Plaintiffs on October 12, 2018, with column-widths modified solely for purposes of facilitating printing.

I declare that the foregoing is true and correct. Executed on this 17th day of October, 2018.

GUILLERMO A. MONTERO

Exhibit 7
Supplemental Declaration of Guillermo A. Montero,
ECF No. 571-1 (Jan. 18, 2024)

TODD KIM
Assistant Attorney General
Environment & Natural Resources Division

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Attorneys for Defendants

UNITED STATES DISTRICT COURT
DISTRICT OF OREGON
EUGENE DIVISION

KELSEY CASCADIA ROSE JULIANA, *et. al.*,

Plaintiffs,

v.

UNITED STATES OF AMERICA, *et al.*,

Defendants.

Case No.: 6:15-cv-01517-TC

DECLARATION OF GUILLERMO A. MONTERO IN SUPPORT OF DEFENDANTS' MOTION FOR A STAY PENDING A PETITION FOR A WRIT OF MANDAMUS

I, Guillermo A. Montero, declare and if called upon would testify as follows:

1. I am an assistant chief in the Environment and Natural Resources Division ("ENRD") of the United States Department of Justice, where I have worked since 2004. In that capacity, I supervise the attorneys of record for Defendants in the district court proceedings for the above-captioned action. I have personal knowledge of the statements made herein, as informed by my review of district court filings and information in the ENRD case management system.
2. As articulated in a prior declaration, ENRD had devoted over 13,000 attorney and paralegal hours to its defense of the United States in this case as of October 17, 2018. See ECF No. 391-1 at 42.
3. Based on my review of the case management system, I have determined that ENRD has devoted over 21,000 attorney and paralegal hours to its defense of the United States in this case as of January 18, 2024.

I declare under penalty of perjury that the foregoing is true and correct.

Executed this 18th day of January, 2024, in Washington, D.C.

Guillermo A. Montero