

In The  
Supreme Court of the United States

—◆—  
ALEC L., et al.,

*Petitioners,*

v.

GINA McCARTHY, et al.,

*Respondents.*

—◆—  
**On Petition For A Writ Of Certiorari  
To The United States Court Of Appeals  
For The District Of Columbia Circuit**

—◆—  
**BRIEF OF CLIMATE SCIENTISTS AS AMICI  
CURIAE SUPPORTING PETITIONERS**

—◆—  
DANIEL M. GALPERN  
2760 Onyx Street  
Eugene, OR 97403  
(541) 968-7164  
dan.galpern@gmail.com

CHARLES M. TEBBUTT  
*Counsel of Record*  
941 Lawrence Street  
Eugene, OR 97401  
(541) 344-3505  
charlie.tebbuttlaw@gmail.com

*Counsel for Amici Curiae*

## TABLE OF CONTENTS

	Page
INTEREST OF THE <i>AMICI CURIAE</i> .....	1
REASONS FOR GRANTING THE PETITION ....	4
I. The underlying decisions are based on an overbroad reading of <i>PPL Montana</i> , and the basis for federal application of the public trust doctrine should be reaffirmed.....	4
II. Preservation of a habitable climate system requires immediate effective action.....	10
A. Humanity’s use of fossil fuels has pressed the climate system to the brink .....	10
B. Warming to date serves as a harbinger of far worse to come, absent effective action .....	15
C. To preserve a habitable climate system, action must be undertaken without delay.....	22
III. The federal government’s failure to preserve a viable climate system violates the public trust.....	24
CONCLUSION.....	27

## TABLE OF CONTENTS – Continued

Page

## APPENDIX

Chart 1: Surface temperature estimate for the past 65.6 million years.....	1a
Chart 2: Decay of atmospheric CO <sub>2</sub> perturba- tions .....	2a
Chart 3: Atmospheric CO <sub>2</sub> if fossil fuel emis- sions reduced.....	3a

## TABLE OF AUTHORITIES

Page

## CASES:

<i>Idaho v. Coeur d'Alene Tribe</i> , 521 U.S. 261 (1997).....	9
<i>Illinois Central R.R. v. Illinois</i> , 146 U.S. 387 (1892).....	8, 9, 26
<i>In re Water Permit Applications</i> , 9 P.3d 409 (Haw. 2000) .....	26
<i>PPL Montana, LLC v. Montana</i> , 132 S. Ct. 1215 (2012).....	4, 5, 6, 7, 9
<i>Robinson Twp. v. Commonwealth</i> , 83 A.3d 901 (Pa. 2013).....	25
<i>Shively v. Bowlby</i> , 152 U.S. 1 (1894) .....	7
<i>United States v. 1.58 Acres of Land</i> , 523 F. Supp. 120 (D. Mass. 1981).....	10
<i>United States v. Beebe</i> , 127 U.S. 338 (1888).....	10
<i>United States v. CB &amp; I Constructors, Inc.</i> , 685 F.3d 827 (9th Cir. 2011).....	10

## RULES AND REGULATIONS:

Rule 37.2(a).....	1
Rule 37.6 .....	1

## TABLE OF AUTHORITIES – Continued

Page

## OTHER AUTHORITIES:

Adam Volland, <i>Earth's Energy Budget Remained Out of Balance Despite Unusually Low Solar Activity</i> , NASA's Earth Science News (Jan. 30, 2012).....	12, 13
Andrew A. Lacis, James E. Hansen, et al., <i>The Role of Long-Lived Greenhouse Gases as Principal LW Control Knob That Governs the Global Surface Temperature for Past and Future Climate Change</i> , 65 <i>Tellus B</i> 1 (2013).....	22
Craig D. Rye, et al., <i>Rapid Sea-level Rise Along the Antarctic Margins in Response to Increased Glacial Discharge</i> , 7 <i>Nature Geoscience</i> 732 (2014).....	21
David C. Slade, <i>Putting the Public Trust Doctrine to Work</i> (1990).....	7, 8, 10
David C. Slade, <i>Putting the Public Trust Doctrine to Work</i> (2d ed. 1997).....	8
Douglas L. Grant, <i>Underpinnings of the Public Trust Doctrine: Lessons from Illinois Central Railroad</i> , 33 <i>Ariz. St. L.J.</i> 849 (2001).....	9, 10, 26
I. Joughin, et al., <i>Brief Communication: Further Summer Speedup of Jakobshavn Isbrae</i> , 8 <i>The Cryosphere</i> 209 (2014).....	20
International Monetary Fund, <i>Energy Subsidy Reform: Lessons and Implications</i> 13 (Jan. 28, 2013).....	24

## TABLE OF AUTHORITIES – Continued

	Page
James E. Hansen, et al., <i>Assessing “Dangerous Climate Change”: Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature</i> , 8(12) PLoS ONE (2013).....	<i>passim</i>
James E. Hansen, et al., <i>Climate Sensitivity, Sea Level and Atmospheric Carbon Dioxide</i> , 371 Phil Trans. R. Soc. 1, Fig. 4 (2013).....	14, 18
James E. Hansen, <i>Storms of My Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity</i> 189, Fig. 27 (2009).....	24
M. Collins, et al., <i>Long-term Climate Change: Projections, Commitments and Irreversibility</i> , in <i>Climate Change 2013: The Physical Science Basis</i> , Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (2013).....	14
M. Morlighem, et al., <i>Deeply Incised Submarine Glacial Valleys Beneath the Greenland Ice Sheet</i> , 7 Nature Geoscience 418 (2014).....	20
Mary Christina Wood, <i>Nature’s Trust: Environmental Law for a New Ecological Age</i> (2014).....	8, 26
MIT Joint Program on the Science and Policy of Global Change, <i>2014 Energy and Climate Outlook</i> , 11 (2014).....	15

## TABLE OF AUTHORITIES – Continued

	Page
National Drought Mitigation Center, <i>U.S. Drought Monitor</i> (Oct. 30, 2014) .....	16
Shfaqat A. Khan, et al., <i>Sustained Mass Loss of the Northeast Greenland Ice Sheet Triggered by Regional Warming</i> , 4 <i>Nature Climate Change</i> 292 (2014) .....	20
United Nations Framework Convention on Climate Change, pmbl., art. 2, May 9, 1992, 1771 U.N.T.S. 107 .....	25
U.S. Dep't of Commerce, Nat'l Oceanic & Atmospheric Admin., Earth System Research Laboratory, Global Monitoring Division, <i>Trends in Atmospheric Carbon Dioxide</i> .....	11, 14
U.S. Env'tl Prot. Agency, <i>Overview of Greenhouse Gas Emissions</i> .....	11
USGS, Northern Rocky Mountain Science Center, <i>Retreat of Glaciers in Glacier National Park</i> .....	16

**INTEREST OF THE *AMICI CURIAE*<sup>1</sup>**

*Amici* are climate scientists with an interest in promoting effective action to preserve Earth's climate system. *Amici* filed an *amicus* brief in support of Petitioners when this matter was before the D.C. Circuit Court of Appeals.

James E. Hansen is director of the Climate Science, Awareness and Solutions Program at Columbia University's Earth Institute, and the former director of the NASA Goddard Institute for Space Studies.

David Beerling is a palaeobiologist in the Department of Animal and Plant Sciences, University of Sheffield, UK.

Paul J. Hearty is Research Associate Professor at the University of North Carolina at Wilmington.

---

<sup>1</sup> Pursuant to Rule 37.6, no counsel for any party authored this brief, in whole or in part, and no counsel for a party or party made a monetary contribution to fund the preparation or submission of this brief. A monetary contribution covering the cost of preparation and submission of this brief will be provided by Climate Science, Awareness and Solutions, Inc. (CSAS), a non-profit, tax-exempt organization headed by *Amicus* Dr. James E. Hansen. Aside from CSAS, no entity or person made any monetary contribution for the preparation or submission of this brief. Pursuant to Rule 37.2(a), counsel of record for the parties received timely notice of the intent to file this brief, and their letters consenting to the filing of this brief have been filed with the Clerk.



Ove Hoegh-Guldberg is Professor of Marine Studies and Director of the Global Change Institute, at the University of Queensland in Brisbane, Australia.

Pushker Kharecha is Deputy Director of the Climate Science, Awareness and Solutions Program at Columbia University's Earth Institute.

Valérie Masson-Delmotte is Senior Climate Scientist and head of the "climate dynamics and archives" research group of Laboratoire des Sciences du Climat, Gif-sur-Yvette, France, at the French National Research Center, Atomic Energy Agency, University of Versailles-St Quentin and Institut Pierre Simon Laplace.

Camille Parmesan is a Professor and National Aquarium Chair in the Public Understanding of Oceans and Human Health in the Marine Institute, Plymouth University (UK), and Senior Research Fellow, Environmental Science Institute, University of Texas at Austin.

Eelco J. Rohling is Professor (Ocean and Climate Change) at the Research School of Earth Sciences, at The Australian National University.

Makiko Sato is Senior Research Scientist with the Climate Science, Awareness and Solutions Program at Columbia University's Earth Institute.

Pete Smith is Professor of Soils and Global Change at the Institute of Biological and Environmental Sciences at the University of Aberdeen

(Scotland, UK), Science Director of the Scottish Climate Change Centre of Expertise (ClimateXChange), and Director of Food Systems for the Scottish Food Security Alliance-Crops.

Lise Van Susteren is a board certified general and forensic psychiatrist practicing in Washington D.C., and Advisory Board Member, Center for Health and the Global Environment, Harvard School of Public Health.

The D.C. Circuit's decision implicates important considerations of law and the public interest, in particular whether persons with standing will be able to effectively challenge federal action, or inaction, on the basis of its conflict with government's fundamental duty to preserve essential natural resources. *Amici* retain an especially strong interest in ensuring that the U.S. government recognizes and fulfills its fundamental trust duty to undertake timely and effective action with respect to emissions that are altering the composition of the atmosphere and causing a dangerous disruption of Earth's climate system. *Amici* believe that the decision below may undermine the federal government's full assumption of its obligation to safeguard the climate system for our children, future generations, and the natural world.



## REASONS FOR GRANTING THE PETITION

In the underlying decision, the D.C. Circuit determined that the doctrine of public trust does not sound in federal law. Unless reversed, that decision removes a potentially effective check on the federal government's perpetuation of business as usual at the moment of truth. Propelled by the burning of fossil fuels, the present concentration of atmospheric carbon dioxide ("CO<sub>2</sub>") is now well into the dangerous zone. Time is not on our side, as further delay of effective action presses Earth's climate system towards tipping points beyond which there is no reasonable prospect of return. The D.C. Circuit's opinion derived from its misreading of this Court's decision in *PPL Montana, LLC v. Montana*, 132 S. Ct. 1215 (2012), and on that basis, the court elected not to consider the federal government's fundamental violation of the public trust that Petitioners sought to challenge. Judicial inaction in the face of the gravest threat to our children and their progeny must not be so cavalierly based. *Amici* Climate Scientists accordingly urge this Court to grant certiorari.

**I. The underlying decisions are based on an overbroad reading of *PPL Montana*, and the basis for federal application of the public trust doctrine should be reaffirmed.**

In their decisions, the D.C. Circuit and the United States District Court for the District of Columbia relied on dicta by this Court in *PPL Montana*

and, on that basis, held that the public trust doctrine provides no basis for subject matter jurisdiction. Pet. App. 2-3, 27-29. The D.C. Circuit opined that this Court had “categorically rejected any federal constitutional foundation” for the public trust doctrine “without qualification or reservation.” Pet. App. 3. The district court also undertook no contextual analysis of the *PPL Montana* public trust language and determined that, even if this Court’s statements in *PPL Montana* were dicta, they nonetheless were binding. Pet. App. 28.

Regrettably, the lower courts over-read this Court’s discussion in *PPL Montana* and ignored its specific context. As Petitioners rightly observed, this Court was not, in *PPL Montana*, considering whether the public trust doctrine applies to the federal government. Pet. at 25. Here, *Amici* consider more precisely what this Court was attempting to do.

Specifically, this Court sought to show why Montana’s invocation of the public’s right to recreational uses of river waters within the state provided no support for its claim to title of certain disputed riverbeds. *PPL Mont., LLC*, 132 S. Ct. at 1235. The public trust doctrine at issue in *PPL Montana*, accordingly, was not one governing the federal administration of natural resources, but rather that applicable to waters and submersible lands conveyed to a newly admitted state. Accordingly, this Court observed that “federal law determines riverbed title under the equal-footing doctrine,” while state law – subject to the federal Commerce Clause and admiralty

power – determines the right of access to such “waters within [a state’s] borders.” *Id.* This Court in *PPL Montana* was describing a two-step decision tree: (1) federal constitutional law is considered to determine the scope of a state’s title to riverbeds received upon statehood, and thus, the borders of a state’s waters; (2) state law, per that public trust doctrine whose scope the state retains “residual power to determine,” governs the public’s access to such waters. *Id.* As the *PPL Montana* Court then noted, “the contours of *that* public trust,” namely the set of public trust duties that burden a state’s receipt of title to navigable waters and their beds, “do not depend on the [U.S.] Constitution.” *Id.* (emphasis added). Instead, as the Court correctly noted in passing, those contours depend on development of the state’s own law. *Id.*

Under *PPL Montana*, the “contours” of the trust – that is, factors governing public access to state waters – are provided by each individual state’s laws, while the “borders” of those state waters are decided by federal law. The title issue in *PPL Montana* was fully resolved by consideration of those borders alone, as determined by the equal-footing doctrine and corollary concepts of navigability for title. The Court’s statement that the public trust doctrine was a matter of state law simply elaborated on the federalist scheme for determining ownership and use of state submersible lands and waters. In that context, according to well-settled precedent, the state public trust plays an important role.

The D.C. Circuit, however, rejected Petitioners' contention that *PPL Montana* "contemplated only the state public trust doctrine." Pet. App. 2-3. Instead, it stated that the *PPL Montana* Court had "repeatedly referred to 'the' public trust doctrine and directly and categorically rejected any federal constitutional foundation" for it. Pet. App. 3. However, every use by this Court in *PPL Montana* of the phrase "*the* public trust doctrine" refers to the set of state-defined obligations to the public that applied to the state's administration of waters whose borders are determined pursuant to federal constitutional law.

Moreover, as Petitioners also pointed out, this Court in *PPL Montana* "affirmed the doctrine's underpinnings for imposing trust obligations on all sovereigns [and] in the course of this affirmation" cited to the work of David C. Slade, which discussed not only the state public trust doctrine but also the federal doctrine. Pet. at 26; *PPL Mont., LLC*, 132 S. Ct. at 1235 (citing David C. Slade, *Putting the Public Trust Doctrine to Work* 3-8, 15-24 (1990)).

In that work, Slade observed – similar to this Court's subsequent writing in *PPL Montana*, 132 S. Ct. at 1235 – that "[i]n the United States, each State has the authority and responsibility for applying the Public Trust Doctrine to trust lands and waters 'within its borders according to its own views of justice and policy.'" Slade, *supra*, at 4 (citing *Shively v. Bowlby*, 152 U.S. 1, 26 (1894)). Accordingly, Slade observed, there is "no single 'Public Trust Doctrine.'" Rather, there are over fifty different

applications of the doctrine, one for each State, Territory or Commonwealth, *as well as the federal government.*” *Id.* (emphasis added). “Nevertheless,” Slade concluded, “a common core of principles remains, forming the foundation for how the Doctrine is applied. . . .” *Id.* Slade also discussed the “dual-sovereign nature of the public trust.” *Id.* at 309; *see also* David C. Slade, *Putting the Public Trust Doctrine to Work* 307-317 (2d ed. 1997) (concurrent federal and state authority of public trust resources); Mary Christina Wood, *Nature’s Trust: Environmental Law for a New Ecological Age* 129-136 (2014) (defining the public trust as “a fundamental attribute of sovereignty” and describing state and federal governments as “co-trustees”).

Other *amici* have developed a compelling argument that, in light of its reserved powers underpinnings, the public trust doctrine articulated in this Court’s foundational decision, *Illinois Central R.R. v. Illinois*, 146 U.S. 387 (1892), was a function of federal, and not state, constitutional law. *See* Br. of *Amici Curiae* Law Professors, No. 14-405 (forthcoming Nov. 2014). The *Illinois Central* Court determined the state’s title to land underlying Chicago Harbor could not be fully alienated because its title was bound up with the duty of “management and control” of those public trust lands. *Ill. Cent. R.R.*, 146 U.S. at 453. Describing the trust obligation as one “*devolving* upon the state for the public,” the Court determined the state could “no more abdicate its trust over property in which the whole people are interested . . . than

it can abdicate its police powers. . . .” *Id.* (emphasis added). To do so would be an attempt to diminish the authority of a “succeeding legislature [that] possesses the same jurisdiction and power as its predecessor[s].” *Id.* at 459.

The *Illinois Central* Court’s strong statement of the reserved powers doctrine appears to be based in federal law, but the question whether there is a federal public trust doctrine does not turn on that point. The Court may determine that a claim under the public trust doctrine sounds in federal law even if *Illinois Central* was “necessarily a statement of Illinois law,” *PPL Mont., LLC*, 132 S. Ct. at 1235 (citing *Idaho v. Coeur d’Alene Tribe*, 521 U.S. 261, 285 (1997)). Admittedly, *Amici* find it difficult to comprehend how public trust obligations could have “devolve[ed]” to Illinois upon that state’s assumption of title to navigable waterbeds if those obligations were not first held by the federal government (the “devolver”). Nonetheless, the critical point is that the reserved powers underpinning of *Illinois Central* applies equally well to consideration of the federal government’s obligations with respect to natural resources over which it necessarily retains primary “management and control.” *See, e.g.*, Douglas L. Grant, *Underpinnings of the Public Trust Doctrine: Lessons from Illinois Central Railroad*, 33 *Ariz. St. L.J.* 849, 877-881 (2001). This is particularly true where the environmental harm is to an essential resource held by the nation as a whole – harm that is “likely to be objectionable to a future legislature but



not reparable by it within a reasonable time.” *Id.* at 880. In that context, the public trust is held by the federal government or, at least, concurrently by it and the states. See *United States v. Beebe*, 127 U.S. 338, 342 (1888) (“The public domain is held by the government as part of its trust.”); *United States v. CB & I Constructors, Inc.*, 685 F.3d 827, 836 (9th Cir. 2011) (The federal government is “more akin to a trustee that holds natural resources for the benefit of present and future generations. . . .”); *United States v. 1.58 Acres of Land*, 523 F. Supp. 120, 122 (D. Mass. 1981) (The public trust “is administered by both the federal and state sovereigns.”); David C. Slade, *Putting the Public Trust Doctrine to Work* 307-315 (1990).

*Amici* turn, now, to consider whether recognition of the federal government’s public trust obligation to manage, control, and reverse harm to the atmosphere is necessary to preserve the ability of succeeding legislatures to provide for the protection and welfare of the public.

## **II. Preservation of a habitable climate system requires immediate effective action.**

### **A. Humanity’s use of fossil fuels has pressed the climate system to the brink.**

More than twenty years have passed since the United States agreed to limit fossil fuel emissions in

order to avoid dangerous human-made climate change, but U.S. emissions have climbed<sup>2</sup> and the rate of global emissions growth increased from 1.5% per year during 1980-2000 to 3% per year in 2000-2013, mainly because of the increased use of coal. James E. Hansen, et al., *Assessing “Dangerous Climate Change”: Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*, 8(12) PLoS ONE 1, 1-2 (2013) [hereinafter *Young People*].<sup>3</sup> The increased emissions are reflected, in part, in the rising concentration of atmospheric CO<sub>2</sub>, now approaching 400 parts per million (“ppm”), over forty percent more than the pre-industrial level. Moreover, the average annual increase in CO<sub>2</sub> concentration has doubled in the last half-century to two ppm per year.<sup>4</sup>

Increasing levels of atmospheric CO<sub>2</sub> and other greenhouse gases (“GHGs”) operate to reduce Earth’s heat radiation to space, thus causing an energy imbalance with less energy going out than coming in. The imbalance causes Earth to heat up until it again radiates as much energy to space as it absorbs from

---

<sup>2</sup> See U.S. Env’t Prot. Agency, *Overview of Greenhouse Gas Emissions* (July 2, 2014), available at <http://www.epa.gov/climatechange/ghgemissions/gases/co2.html#Trends>.

<sup>3</sup> Available at <http://www.ncbi.nlm.nih.gov/pubmed/24312568>.

<sup>4</sup> See U.S. Dep’t of Commerce, Nat’l Oceanic & Atmospheric Admin., Earth System Research Laboratory, Global Monitoring Division, *Trends in Atmospheric Carbon Dioxide* (Oct. 7, 2014), available at <http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html>; App., Chart 2.

the sun. In fact, warming of Earth caused by the increasingly thick CO<sub>2</sub> “blanket” persisted even during the recent five-year solar minimum of 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 GHG forcing had been expended in causing the observed 0.8°C global warming, the residual positive forcing overwhelmed the negative forcing due to unusually low solar irradiance. This illustrates, unequivocally, that it is human activity, and not the sun, that is the dominant driver of recent climate change.<sup>5</sup>

Earth’s warming to approximately 0.8°C above the pre-industrial level is now close to, and probably slightly above, the prior maximum of the Holocene – the period of the most recent 10,000 years during which Earth’s climate was characterized by a reasonably constant global mean temperature conducive to the development of civilization. *Young People, supra*, at 4. That constancy enabled the Greenland and Antarctic ice sheets to remain in near mass balance, sea levels to be relatively stable, species to flourish, and civilization to develop.

---

<sup>5</sup> See Adam Volland, *Earth’s Energy Budget Remained Out of Balance Despite Unusually Low Solar Activity*, NASA’s Earth Science News (Jan. 30, 2012), available at [www.nasa.gov/topics/earth/features/energy-budget.html](http://www.nasa.gov/topics/earth/features/energy-budget.html).

The current 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. Due to that thermal inertia, a similar amount of additional warming is "in the pipeline" before Earth reaches energy balance at the present atmospheric CO<sub>2</sub> concentration. *Id.* Averaged over the entire planet, the energy imbalance is approximately 0.75 W/m<sup>2</sup>. In total, the planet's present energy surplus is approximately 375 trillion joules per second, the equivalent of more than 500,000 Hiroshima-sized atomic explosions per day, every day.<sup>6</sup>

Examination of the paleoclimate record provides insight as to global temperature sensitivity to external forcings such as added CO<sub>2</sub>; sea level sensitivity to global temperature; and quantitative information about so-called "slow" feedback processes, such as melting ice sheets and lessened surface reflectivity attributable to the darker surfaces resulting from the melting ice sheets and reduced area of sea ice. *Young People, supra*, at 4.

The average global surface temperature record of the last 65 million years is summarized in Chart 1,

---

<sup>6</sup> Calculations from *Amicus Curiae* James E. Hansen (Nov. 3, 2014) (on file with the Climate Science, Awareness and Solutions Program at Columbia University's Earth Institute).

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. App. 1. Two conclusions may be drawn. *First*, the mechanisms that accounted for the relatively rapid oscillations between cold and warm climates over the historical period were the same as those operating today. While those oscillations were initiated not by fossil fuel burning, but by slow insolation changes attributable to perturbations of Earth's orbit and spin axis tilt, 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<sub>2</sub>. *Second*, the longer paleoclimate record shows that warming coincident with atmospheric CO<sub>2</sub> concentrations as low as 450-500 ppm may have been enough to melt most of Antarctica.<sup>7</sup> Our emissions have *already* driven up the CO<sub>2</sub> concentration in the atmosphere to about 400 ppm.<sup>8</sup> Recent analyses establish that, absent a major change from current policy and practice, the atmospheric CO<sub>2</sub> concentration is likely to exceed 700 ppm by the end of this century.<sup>9</sup>

---

<sup>7</sup> James E. Hansen, et al., *Climate Sensitivity, Sea Level and Atmospheric Carbon Dioxide*, 371 Phil Trans. R. Soc. 1, 9, Fig. 4 (2013) [hereinafter *Climate Sensitivity*], available at <http://rsta.royalsocietypublishing.org/content/371/2001/20120294>.

<sup>8</sup> NOAA, *supra* note 4.

<sup>9</sup> M. Collins, et al., *Long-term Climate Change: Projections, Commitments and Irreversibility*, in *Climate Change 2013: The Physical Science Basis*, Contribution of Working Group I to the (Continued on following page)

*Amici* Climate Scientists conclude that the present concentration of CO<sub>2</sub> and its warming, both realized and latent, are already in the dangerous zone, that we are now in a period of carbon overshoot, and that the consequences will become severe unless urgent action is undertaken to restore energy balance at a lower atmospheric CO<sub>2</sub> concentration.

**B. Warming to date serves as a harbinger of far worse to come, absent effective action.**

Global warming to date measures “only” 0.8°C above the pre-industrial period, yet that level of warming has already led to a reduction of more than one-third of Arctic sea ice cover at the end of the melt season, and an even faster decline in sea ice thickness. *Young People, supra*, at 4. Mountain glaciers, the source of fresh water to major rivers during dry seasons, are receding rapidly. Glaciers in iconic Glacier National Park, for example, appear to be in full retreat. In 1850, Glacier had 150 glaciers measuring

---

Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 1103 (2013), *available at* [http://www.climatechange2013.org/images/report/WG1AR5\\_Chapter12\\_FINAL.pdf](http://www.climatechange2013.org/images/report/WG1AR5_Chapter12_FINAL.pdf); MIT Joint Program on the Science and Policy of Global Change, *2014 Energy and Climate Outlook*, 11 (2014), *available at* [globalchange.mit.edu/Outlook2014](http://globalchange.mit.edu/Outlook2014) (projecting a corresponding increase in global temperature of 3.3 to 5.6°C above the 1901-1951 mean).

larger than twenty-five acres. Today, it has just twenty-five.<sup>10</sup>

Tropospheric water vapor and heavy precipitation events have increased. A warmer atmosphere holds more moisture, enabling heavier precipitation and more extreme flooding. *Young People, supra*, at 8. Higher temperatures, on the other hand, increase evaporation and can intensify droughts when they occur, as can the expansion of the subtropics, yet another consequence of global warming. *Id.* More than ninety percent of California and half of Oklahoma, to take two notable examples, are now blanketed in severe to exceptional drought.<sup>11</sup>

Ocean and terrestrial ecosystems are stressed. Coral reef systems, 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<sub>2</sub>, and other human-caused stresses, resulting in a 1-2% annual decline in geographic extent. *Young People, supra*, at 7. Polar and mountain species are under increasing stress due to physical constraints on their ability to migrate poleward or upward and their evolutionary adaptation to conditions now melting at their feet, including

---

<sup>10</sup> USGS, Northern Rocky Mountain Science Center, *Retreat of Glaciers in Glacier National Park* (May 2013), available at [http://nrmsc.usgs.gov/research/glacier\\_retreat.htm](http://nrmsc.usgs.gov/research/glacier_retreat.htm).

<sup>11</sup> National Drought Mitigation Center, *U.S. Drought Monitor* (Oct. 30, 2014), available at <http://droughtmonitor.unl.edu>.

Arctic species dependent on year-round sea ice. *Id.* Altered climate zones also expand the range of vector-borne diseases. World health experts have concluded with “very high confidence” that climate change already contributes to the global burden of disease and premature death through the expansion of infectious disease vectors. *Id.* at 8.

Subtropical climate belts have expanded, contributing to more intense droughts, summer heat waves, and devastating wildfires. Further, summer 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. The probability of such extreme heat events has increased by several times because of global warming, and the probability will grow even further if emissions are not abated. *Id.* at 4.

Recent projections of sea level rise for 2100 have been on the order of one meter, which is higher than earlier assessments. However, these estimates still in part assume linear relations between warming and sea level rise. It is possible that continued business-as-usual CO<sub>2</sub> emissions will spur a nonlinear response, with a multi-meter sea level rise realized *this century*. *Id.* at 6. Our nation is not close to being prepared for that.

A pulse of CO<sub>2</sub> injected into the air decays by half in about twenty-five years, as CO<sub>2</sub> is taken up by the



ocean, biosphere, and soil, but nearly one-fifth remains in the atmosphere after 500 years. App., Chart 2. Indeed, that estimate is likely optimistic, in light of the nonlinearity in ocean chemistry and saturation of carbon sinks, implying that the airborne fraction probably will remain larger for a century and more.<sup>12</sup> It requires hundreds of millennia for the weathering of rocks to deposit all of an initial CO<sub>2</sub> pulse on the ocean floor as carbonate sediments. Much of the carbon from fossil fuel burning remains in the atmosphere and affects 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. 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 and likely exacerbate international conflict. *Young People, supra*, at 6.

To be clear: uncertainty about sea level rise remains, but that uncertainty is not about whether continued CO<sub>2</sub> emissions will cause large sea level rise that submerges global coastlines, as it is about how soon the large changes will begin.

Other impacts from unabated emissions will abound. Acidification stemming from ocean uptake of a portion of increased atmospheric CO<sub>2</sub> will increasingly disrupt coral reef ecosystem health, with potentially

---

<sup>12</sup> *Climate Sensitivity, supra* note 7, at 25.

devastating impacts to certain nations and communities. Inland, fresh water security will be compromised due to receding mountain glaciers and snowpack and reduced flow in major river systems.

As to human health, increasing concentrations of CO<sub>2</sub> and associated increased global temperatures will deepen impacts, with children being especially vulnerable. Climate threats to health move through various pathways, including through additional stress on clean air, clean water, and food supply. Accordingly, un-arrested climate change will increase malnutrition and consequent disorders, including those related to child growth and development; increased death, disease, and injuries from heat waves, floods, storms, fires, and droughts; and increased cardio-respiratory morbidity and mortality associated with increased ground-level ozone. *Id.* at 6-8. These impacts and risks are in addition to the toll on public health and the environment stemming from non-CO<sub>2</sub> pollution emitted or discharged in the processes of extracting, refining, producing, transporting, and burning of fossil fuels. *Id.* at 8-9.

With regard to other species, *Amici* note that climate zones are already shifting at rates exceeding natural rates of change, a trend that 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, less mobile species will be driven to extinction. The UN Intergovernmental Panel on Climate Change estimates that with global warming of 1.6°C or more relative to pre-industrial

temperatures, 9-31 percent of species will be driven to extinction, while warming of 2.9°C will drive an estimated 21-52 percent of species to extinction. These temperature/extinction thresholds will not be avoided absent concerted action on emissions. *Id.* at 7.

One year ago, *Amici* concluded that continuation on the present path would “consign our children and their progeny to a very different planet, one far less conducive to their survival.” Br. of *Amici Curiae* Scientists at 25, No. 13-5192 (D.C. Cir. Nov. 12, 2013). Research in the intervening months amplifies that concern. Glacial ice streams in Greenland appear to be speeding up their discharge to the Island’s west coast,<sup>13</sup> and the northern part of the Greenland ice sheet, previously considered stable, is beginning to discharge ice to the ocean.<sup>14</sup> Findings that Greenland’s ice-covered valleys extend far below sea level imply that its ice sheet may be a more efficient recipient of ocean heat than previously understood, and thus more vulnerable to rapid melting.<sup>15</sup> Similarly,

---

<sup>13</sup> I. Joughin, et al., *Brief Communication: Further Summer Speedup of Jakobshavn Isbrae*, 8 *The Cryosphere* 209 (2014), available at <http://www.the-cryosphere.net/8/209/2014/tc-8-209-2014.pdf>.

<sup>14</sup> Shfaqat A. Khan, et al., *Sustained Mass Loss of the Northeast Greenland Ice Sheet Triggered by Regional Warming*, 4 *Nature Climate Change* 292 (2014).

<sup>15</sup> M. Morlighem, et al., *Deeply Incised Submarine Glacial Valleys Beneath the Greenland Ice Sheet*, 7 *Nature Geoscience* 418 (2014).

Antarctic ice shelves appear to be melting at an accelerating rate, resulting in significant freshwater discharge in the areas around the Amundsen Sea and the Antarctic Peninsula, with important impacts to regional surface ocean salinity and sea-level rise along the Antarctic coast.<sup>16</sup>

The consequences of large scale melting in Antarctica and Greenland will be irreversible, at least on time scales important to society, not only because the major ice sheets took many millennia to grow to their present size, but also because, once begun, the dynamics and momentum of ice sheet disintegration will not be halted by a subsequent gradual reduction of emissions. *Young People, supra*, at 13-15.

These recent findings are consistent with our understanding that, during the Eemian era – when the global average temperature was only a little higher than the Holocene maximum we have now matched – sea level reached heights several meters higher than at present. *Id.* at 4, 6.

---

<sup>16</sup> Craig D. Rye, et al., *Rapid Sea-level Rise Along the Antarctic Margins in Response to Increased Glacial Discharge*, 7 *Nature Geoscience* 732 (2014).

**C. To preserve a habitable climate system, action must be undertaken without delay.**

To restore energy balance, stabilize climate, avoid severe heating, and avert uncontrollable climate change, *id.* at 13-16, atmospheric CO<sub>2</sub> must be reduced to about 350 ppm, assuming the net of other human-made climate forcings remains at today's level, *id.* at 5, 10. The level of atmospheric CO<sub>2</sub> functions as the long-wave control knob on the planet's thermostat.<sup>17</sup> Accordingly our decision, *vel non*, to reduce emissions and rely on carbon-free sources of energy will determine the period of atmospheric carbon overshoot.

To minimize that period, *Amici* and colleagues prescribed a glide path of emission reductions that, to be effective, must be commenced without further delay. *Id.* at 10. The issue of delay is critical, as may be considered with the aid of Chart 2. App. The left side of Chart 2 illustrates the long-residence time of atmospheric CO<sub>2</sub>, reflecting the length of time it would take to return CO<sub>2</sub> to lower concentrations even if, as indicated on the right side of the chart, fossil fuel emissions were ceased entirely. Of course, an abrupt cessation of all CO<sub>2</sub> emissions, whether in

---

<sup>17</sup> Andrew A. Lacis, James E. Hansen, et al., *The Role of Long-Lived Greenhouse Gases as Principal LW Control Knob That Governs the Global Surface Temperature for Past and Future Climate Change*, 65 *Tellus B* 1 (2013), available at <http://www.tellusb.net/index.php/tellusb/article/view/19734>.

2015 or 2030, is unrealistic. Industry, other business, and consumers all need time to retool and reinvest in emission-free options to fossil fuels. Accordingly, *Amici's* proposed glide path to secure an atmosphere with a CO<sub>2</sub> concentration no higher than 350 ppm and a global mean temperature rise of no more than 1°C above the pre-industrial level, is based on annual fossil fuel CO<sub>2</sub> emission reductions of six percent, coupled with programs to limit and reverse land use emissions via reforestation and improved agricultural and forestry practices. *See App., Chart 3.*

Action to achieve these reductions could restore the atmosphere to approximately 350 ppm within this century. However, consistent with the abrupt phase out scenarios discussed in the prior paragraph, if rapid annual emission reductions were delayed until 2030, then the atmospheric CO<sub>2</sub> will remain above 350 ppm for about 700 years, and global temperature will remain more than 1°C higher than the pre-industrial level for about 400 years. If the cessation of emissions were not for another forty years, then the atmosphere would not return to 350 ppm CO<sub>2</sub> for nearly 1000 years. Considered another way, the required rate of emission reductions would have been about 3.5% per year if reductions had started in 2005, 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.

### **III. The federal government's failure to preserve a viable climate system violates the public trust.**

In their 2013 *amicus* brief to the D.C. Circuit, *Amici* Scientists noted that the present U.S. climate plan fails even to address a path to achieve the emission reductions necessary to stabilize and reduce atmospheric CO<sub>2</sub>, and thus to preserve a viable climate system for our children and future generations. Br. of *Amici Curiae* Scientists at 21 n.18, No. 13-5192 (D.C. Cir. Nov. 12, 2013). *Amici* note the enormous national contribution to the problem, with U.S. sources accounting for the largest share of carbon emissions over time<sup>18</sup> and the United States providing the largest absolute financial subsidy of any nation to the fossil fuel industry.<sup>19</sup>

Further delay in the institution of binding commitments and effective policy to sufficiently reduce fossil fuel emissions will consign our children to a vastly diminished future. The practically irreversible nature of ice sheet melting, lost coastal cities, and widespread species extinction, among other effects,

---

<sup>18</sup> James E. Hansen, *Storms of My Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity* 189, Fig. 27 (2009); see also *id.* at 177, Fig. 24. Updated figures available at [www.columbia.edu/~mhs119/UpdatedFigures](http://www.columbia.edu/~mhs119/UpdatedFigures).

<sup>19</sup> International Monetary Fund, *Energy Subsidy Reform: Lessons and Implications* 13 (Jan. 28, 2013), available at [www.imf.org/external/np/pp/eng/2013/012813.pdf](http://www.imf.org/external/np/pp/eng/2013/012813.pdf).

will not be avoided absent effective action. The federal government's delay and then dalliance in the face of the impending calamity cannot be reconciled with its fundamental duty to hold the atmosphere in trust for present and future generations.

*Amici* believe that the federal public trust doctrine is best conceived as grounded in the reserved powers doctrine. As applied to the climate crisis, this requires action by the U.S. government (and other sovereigns) to preserve a viable climate system conducive to civilization and natural systems.<sup>20</sup> Failure to so act, on the other hand, will deprive any future legislature of power to protect the health, safety, and welfare of U.S. citizens from the ravages of an inhospitable climate system.

Petitioners have pointed to cases indicating that, with respect to a number of sovereigns, the source of the public trust may run very deep, indeed to the very nature of self-government and freedom. Pet. at 19-24.<sup>21</sup> But the effect of the doctrine is similar in each

---

<sup>20</sup> See also United Nations Framework Convention on Climate Change, pmb., art. 2, May 9, 1992, 1771 U.N.T.S. 107 (Parties to the Convention “[d]etermined to protect the climate system for present and future generations” by stabilizing atmospheric GHG concentrations “at a level that would prevent dangerous anthropogenic interference with the climate system.”).

<sup>21</sup> See, e.g., *Robinson Twp. v. Commonwealth*, 83 A.3d 901, 947-948 (Pa. 2013) (plurality opinion) (Limits on legislative power are “inherent in the form of government chosen by the people of this Commonwealth” and “the rights of the people . . .

(Continued on following page)



instance: sovereigns are required under it not to lay waste, or allow others to lay waste, to an essential public resource such that its beneficial use is rendered unavailable in the future.<sup>22</sup>

In *Illinois Central*, the trust principle was grounded within the broader terms of the reserved powers doctrine. The Court, in invalidating the legislative grant of submerged lands to a private railroad, recounted the prerogatives of a future legislature that “must, at the time of its existence, exercise the power of the State in the execution of the trust devolved upon it.” *Ill. Cent. R.R.*, 146 U.S. at 460; see also Douglas L. Grant, *Underpinnings of the Public Trust Doctrine: Lessons from Illinois Central Railroad*, 33 *Ariz. St. L.J.* 849, 867-868 (2001).

With respect to the climate crisis, the doctrine describes the federal sovereign’s inherent authority, and prescribes its fundamental duty, to protect the atmosphere as an essential national resource. Action, or inaction, by the U.S. government in contravention of that public trust works to throw our planet out of energy balance, dangerously disrupting global and regional climate. Continued failure to act with all

---

are inherent in man’s nature and preserved rather than created by the Pennsylvania Constitution.”); *In re Water Permit Applications*, 9 P.3d 409, 443 (Haw. 2000) (The public trust is an “inherent attribute of sovereign authority that the government . . . cannot surrender.”).

<sup>22</sup> Mary Christina Wood, *Nature’s Trust: Environmental Law for a New Ecological Age* 208-257 (2014).

deliberate speed, so as to dial back the thermostat within the short remaining time, risks eliminating the option of preserving a habitable climate system. The clearly anticipated, legitimate claims of “our Posterity”<sup>23</sup> can be met, if at all, only by effective action undertaken today. Succeeding legislatures and presidents, in whom our Constitution vests authority no less than in the present federal government, must not, in violation of the public trust, be deprived of power to protect the people.

---

◆

### CONCLUSION

For the foregoing reasons, this Court should grant the writ of certiorari.

Respectfully submitted,

DANIEL M. GALPERN  
2760 Onyx Street  
Eugene, OR 97403  
(541) 968-7164

dan.galpern@gmail.com

CHARLES M. TEBBUTT  
*Counsel of Record*

941 Lawrence Street  
Eugene, OR 97401

(541) 344-3505

charlie.tebbuttlaw@gmail.com

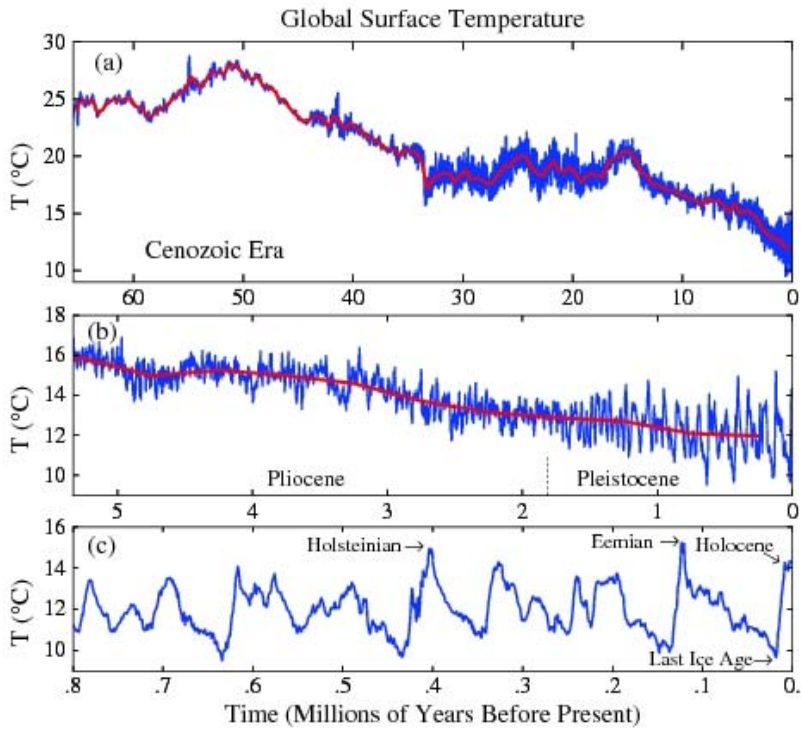
*Counsel for Amici Curiae*

November 6, 2014

---

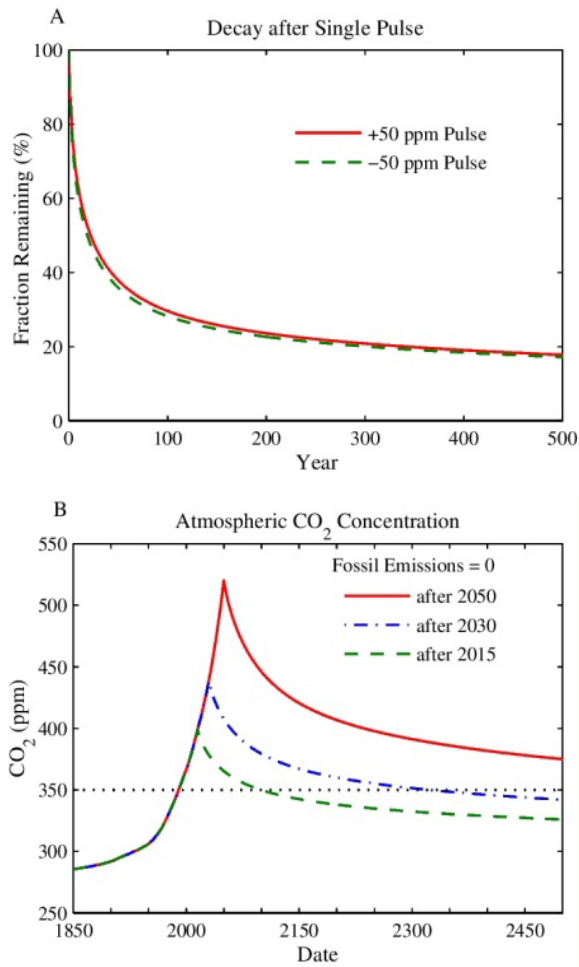
<sup>23</sup> U.S. Const. pmb.

## APPENDIX TO CLIMATE SCIENTISTS AMICUS BRIEF

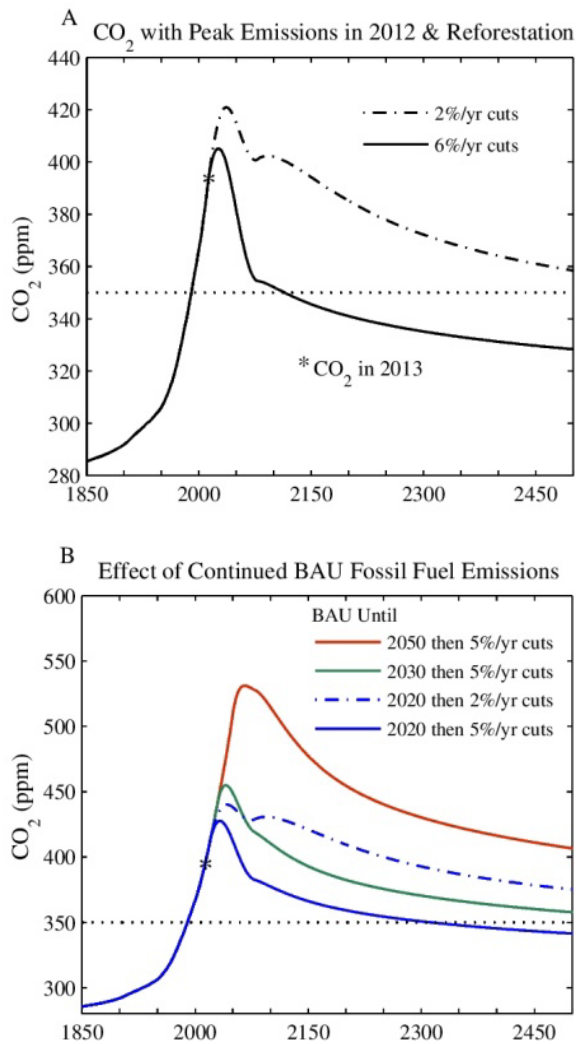


Surface temperature estimate for the past 65.5 million years, including an expanded time scale for the Pliocene and Pleistocene periods (middle), and for the past 800,000 years (bottom). Material from *Climate Sensitivity*, op. cit. nte 7.

## 2a



Decay of atmospheric CO<sub>2</sub> perturbations. (A) Instantaneous injection or extraction of CO<sub>2</sub> 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. Material from Fig. 4 in *Young Children*, op. cit. nte 3.



Atmospheric CO<sub>2</sub> if fossil fuel emissions reduced. (A) 6% annual cut and 100 GtC reforestation drawdown occurs in 2031-2080, (B) effect of delaying onset of emission reduction. Material from Fig. 5 in *Young Children*, op. cit. nte 3.

---