PETITION FOR
A RULE CHANGE

of

Sierra Adler, Kathy Albury, Bill Barron, Pamela Lewis, Sara Ma, Scott McLeod, Sara Melnicoff, Douglas J. Roberts, Mathias Sanyer, Rebekah Sosa, Claire Uno, Kevin Uno, John Weisheit, Paul Wickelson, Shea Wickelson, Robert Wilson, Lauren Wood, Steven Wood, Nathan Zick-Smith

to the

State of Utah, including

Governor Gary Herbert
Commissioner Leonard M. Blackham, Utah Department of Agriculture and Food
Executive Director Amanda Smith, Utah Department of Environmental Quality
Chairman Ted Boyer, Public Service Commission of Utah
Executive Director John Njord, Utah Department of Transportation
Director Dennis J. Strong, Utah Division of Water Resources
Acting Executive Director W. David Patton, Utah Department of Health
Acting Executive Director Bryce Byrd, Utah Air Quality Board

For the promulgation of rules and other appropriate executive and administrative action to fulfill the state of Utah's sovereign obligation to maintain the integrity of the climate as protected by our atmosphere, a public trust resource on which the public relies for health, safety, sustenance, and security—the basic necessities for a livable future.

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**The attorneys would also like to acknowledge and thank James Grifo, University of Oregon, J.D. expected 2011, for his help researching and drafting.

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PETITION FOR A RULE CHANGE

Pursuant to Utah Code Section 63G-3-601(2) and Utah Administrative Rules 15-2-1 *et seq*., the Petitioners, Sierra Adler, Kathryn Albury, Bill Barron, Pamela Lewis, Sara Ma, Scott McLeod, Sara Melnicoff, Douglas J. Roberts, Mathias Sanyers, Rebekah Sosa, Claire Uno, Kevin Uno, John Weisheit, Paul Wickelson, Shea Wickelson, Robert Wilson, Lauren Wood, Steven Wood, and Nathan Zick-Smith respectfully submit this petition for a rule change.

As members of the youngest living generation of public trust beneficiaries, the youth petitioners have a profound interest in maintaining the atmosphere in a condition that is consistent with the historic levels of CO_2 and other greenhouse gas concentrations that allowed human civilization to emerge and flourish. The petitioners are youth and parents who want to ensure that their children benefit from a stable climate as protected by our atmosphere, a public trust resource on which we rely for health, safety, sustenance and security. In short, the youth, their parents, their grandparents, and their future children need a stable climate in order to enjoy a livable future. A livable future includes the following opportunities: to have access to sufficient supplies of clean water when thirsty, to grow food that will abate hunger, to enjoy good health, to be free from property damage caused by floods or wild fires or other climate-related extreme weather events, and to enjoy the abundant diversity of life on this planet.

In order to protect the integrity of the atmosphere, a public trust resource on which the citizens of Utah rely for their health, safety, sustenance, and security, the petitioners respectfully make the following requests:

(1) That the Department of Environmental Quality publish an annual greenhouse gas (GHG) Emissions Report, to inform the public about Utah's actual and estimated GHG emissions from the previous year;

(2) That the Department of Environmental Quality, the Utah Air Quality Board, the Public Service Commission, the Utah Department of Transportation, and any other Utah agencies or departments that the Governor deems appropriate, adopt a binding GHG Emissions Reduction Plan for reducing GHG emissions within the respective jurisdictions of the agencies by 6% annually until at least 2050 in order to fulfill Utah's proportionate share of a global goal to achieve an atmospheric concentration of 350 ppm CO_2 by 2100;

(3) That the above listed agencies evaluate and propose any changes to Utah laws and regulations necessary to achieve 6% annual GHG emission reductions;

(4) That the above listed agencies publish an annual report comparing the actual annual GHG emissions to the Emissions Reduction Plan so that the public can see accurate data as to how the State is fulfilling its public trust obligation to protect the atmosphere, a public trust resource.

(5) That the Utah Department of Agriculture and Food investigate the likely effects of climate change on food production and agriculture in Utah and as it otherwise affects Utah citizens, and publish, and periodically update, the results of the investigation for the information of Utah citizens;

(6) That the Utah Division of Water Resources investigate the likely effects of climate change on water resources and water supply in Utah and as it otherwise affects Utah citizens, and publish, and periodically update, the results of the investigation for the information of Utah citizens;

(7) That the Utah Department of Health investigate the likely effect of climate change on the health of Utah citizens, and publish, and periodically update the results of the investigation for the information of Utah citizens.

REQUEST FOR A PUBLIC HEARING

The petitioners also respectfully request a public hearing on the proposed rule. Utah Code Section 63G-3-302(2)(b)(i) directs that agencies shall hold a public hearing on a proposed rule if ten interested persons request a hearing in writing no later than fifteen days after the rule's publication. There are more than ten petitioners. This request is in writing, and it is more than 15 days before the publication date of the proposed rule. Therefore, the petitioners look forward to the opportunity to have a public hearing on the proposed rule.

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I. REASONS FOR RULE CHANGE

A. The science unequivocally shows that climate change is happening.

1. The Scientific Consensus Report[1] prepared by Governor Huntsman's Blue Ribbon Advisory Council on Climate Change concluded, "*There is no longer any scientific doubt that the Earth's average surface temperature is increasing and that changes in ocean temperature, ice and snow cover, and sea level are consistent with this global warming*."[2]

2. According to the United States Global Change Research Program,[3] global warming is occurring and changing other attributes of the Earth's climate.[4] Scientific evidence indicates that the present trend of global heating in the past several decades has occurred largely as a result of human activities that release heat-trapping greenhouse gases (GHGs) and intensify the Earth's natural greenhouse effect, thereby changing Earth's climate.[5] Global warming is unequivocal and

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[1] *Climate Change and Utah: The Scientific Consensus Report* was prepared by scientists from the University of Utah, Utah State University, Brigham Young University, and the United States Department of Agriculture, who reviewed the full scope of peer-reviewed scientific literature and summarized the present scientific understanding of climate change and its potential impacts on Utah and the western United States. "[T]he report emphasizes the consensus view of the national and international scientific community." Governor Jon Huntsman's Blue Ribbon Advisory Council on Climate Change (BRAC), *Climate Change and Utah: The Scientific Consensus* ES 1 (September 2007) (emphasis in original) [hereinafter *BRAC: Scientific Consensus*]. Throughout this petition, where we refer to the BRAC Report, we also include the underlying peer-reviewed studies that the scientists relied on for their summary report.

[2] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1; *see also* Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act; Final Rule, 74 Fed. Reg. 66495,66517 (Dec. 15, 2009) (to be codified at 40 C.F.R. pt. 1) [hereinafter *EPA, Endangerment Finding*] ("Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.").

[3] "The U.S. Global Change Research Program (USGCRP) coordinates and integrates federal research on changes in the environment and their implications for society." http://www.globalchange.gov/about. The organization's vision is to produce "[a] nation, globally engaged and guided by science, meeting the challenges of climate and global change." *Id*. The organization is comprised of "[t]hirteen departments and agencies [that] participate in the USGCRP . . . steered by the Subcommittee on Global Change Research under the Committee on Environment and Natural Resources, overseen by the Executive Office of the President, and facilitated by an Integration and Coordination Office." *Id*.

[4] United States Global Change Research Program (USGCRP), *Global Climate Change Impacts in the United States* 13 (2009) *available at* http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf [hereinafter USGCRP, *Global Climate Change Impacts*] ("Human activities have led to large increases in heat-trapping gases over the past century. Global average temperature and sea level have increased, and precipitation patterns have changed.").

[5] *Id*. ("The global warming of the past 50 years is due primarily to human-induced increases in heat-trapping gases."); *see also* Deutsche Bank Group Climate Change Advisors, *Climate Change: Addressing the Major Skeptic Arguments* 9 (September 2010) *available at* http://www.dbcca.com/dbcca/EN/_media/DBCCAColumbiaSkepticPaper090710.pdf; Intergovernmental Panel on Climate Change (IPCC), *IPCC Fourth Assessment Report: Climate Change 2007*, 1.1 (2007) *available at* http://www.ipcc.ch/publications_and_data/ar4/syr/en/mains1.html#1-1 [hereinafter *IPCC, AR4*].

primarily human-induced.[6] Climate change is damaging both natural and human systems, and if unrestrained, will alter the planet's resource base through climate-related impacts like stressed water resources, challenged crop and livestock production, increased risks to human health.[7] The impacts of climate change are occurring and projected to increase unless significant measures are taken to curtail it.[8]

3. One key observable change is the rapid increase in recorded global average surface air temperatures since 1970.[9] Global surface temperatures over the last several decades have been decidedly higher than at any time during at least the past 400 years.[10] "This temperature rise is clearly unusual in at least the last 1,000 years."[11]

4. The warmer global temperatures are measurably changing our earth. "Mountain glaciers, seasonal snow cover, and the Greenland and Antarctic ice sheets are decreasing in size, global ocean temperatures have increased, and sea level has risen about 7 inches since 1900 and about 1 inch in the past decade."[12]

5. "Cold days, cold nights, and frost have become less frequent, while heat waves have become more common."[13]

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[6] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 12 (2009).
[7] *Id*. ("Thresholds will be crossed, leading to large changes in climate and ecosystems.").
[8] *Id*. ("Future climate change and its impacts depend on choices made today."); IPCC, *AR4*, *supra* note 5, at 30 ("Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level.").
[9] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1; Environmental Protection Agency (EPA), *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act* 26-30 (December 9 2009) [hereinafter *EPA,TS Endangerment Findings*]; IPCC, *AR4*, *supra* note 5, at 30; National Aeronautics and Space Administration (NASA) & Goddard Institute for Space Studies (GISS), *Global Surface Temperature*, http://climate.nasa.gov/keyIndicators/#globalTemp (illustrating the change in global surface temperatures) (last visited April 7, 2011); National Science and Technology Council, *Scientific Assessment of the Effects of Global Change on the United States* 51 (May 2008) [hereinafter *National Science and Technology Council: Scientific Assessment*], *available at* http://www.climatescience.gov/Library/scientific-assessment/Scientific-AssessmentFINAL.pdf; USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 17, 19.
[10] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 19; *see also* The National Academies Press: Board on Atmospheric Sciences and Climate, *Surface Temperature Reconstructions for the Last 2,000 Years* 3 (2006), *available at* http://www.nap.edu/catalog.php?record_id=11676.
[11] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 19.
[12] *BRAC: Scientific Consensus*, *supra* note 1,at ES 1; *IPCC, AR4*, *supra* note 5, at 30; USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 17 ("The warming trend that is apparent in all of these temperature records is confirmed by other independent observations, such as the melting of Arctic sea ice, the retreat of mountain glaciers on every continent, reductions in the extent of snow cover, earlier blooming of plants in spring, and increased melting of the Greenland and Antarctic ice sheets."); *see also* Ian Allison et al., University of New South Wales, Climate Change Research Centre, *The Copenhagen Diagnosis: Updating the World on the Latest Climate Science* 7 (2009) *available at* http://www.ccrc.unsw.edu.au/Copenhagen/Copenhagen_Diagnosis_LOW.pdf [hereinafter *Copenhagen Diagnosis*].
[13] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1; *IPCC, AR4*, *supra* note 5.

B. The science demonstrates that anthropogenic greenhouse gas emissions are the most significant and the only controllable cause of this rapid change in climate.

1. "*Based on extensive scientific research, there is very high confidence that human-generated increases in greenhouse gas concentrations are responsible for most of the global warming observed during the past 50 years*."[14]

2. In 2007, the BRAC Scientific Consensus Report explained that "[c]arbon dioxide concentrations are now more than 35% above the pre-industrial levels and exceed the highest natural concentrations over at least the last 650,000 years."[15] More recent data, based on information retrieved from ice cores shows that the modern levels of CO_2 and methane are unprecedented in the last 800 millennia.[16] "The present atmospheric concentration of CO2 exceeds by far the natural range over the last 800,000 years (172 to 300 ppm) as determined from ice cores."[17]

3. "Almost all of the increase in the CO_2 concentration during the Industrial Era is due to anthropogenic emissions."[18]

4. These increases must be considered in light of the lifespan of carbon dioxide in the atmosphere.[19] Unlike other GHGs, CO_2 is not destroyed by chemical, photolytic, or other reaction mechanisms, but rather the carbon in the CO_2 cycles between different reservoirs in the atmosphere, ocean, land vegetation, soils and sediments.[20] The exchanges between these reservoirs are approximately balanced such that the net source or sink is near zero. "Anthropogenic CO_2 emissions released through the use of fossil fuel combustion and cement production from geologically stored carbon (e.g., coal, oil, and natural gas) that is hundreds of millions of years old, as well as anthropogenic CO_2 emissions from land-use changes such as deforestation, perturb the atmospheric concentration of CO_2 and the distribution of carbon within different reservoirs readjusts."[21] As a result, CO_2

[14] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1 (emphasis in original); *see also IPCC, AR4*, *supra* note 5, at 37 ("There is *very high confidence* that the global average net effect of human activities since 1750 has been one of warming"); *USGCRP, Global Climate Change Impacts*, *supra* note 4, at 13 ("The global warming of the past 50 years is due primarily to human-induced increases in heat-trapping gases.");
[15] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1.
[16] Laetitia Loulergue, et al., *Orbital and Millennial-Scale Features of Atmospheric CH4 Over the Past 800,000 Years*, 453 *Nature* 383-386 (2008); Dieter Luthi et al., *High Resolution Carbon Dioxide Concentration Record 650,000-800,000 years before present* 453 *Nature* 379-382 (2008); *see also EPA, TS Endangerment Findings*, *supra* note 9, at 16,18, 19 (noting rise in atmospheric concentration of carbon dioxide, methane and nitrous oxide from pre-industrial levels).
[17] *EPA, TS Endangerment Findings*, *supra* note 9, at 17.
[18] *Id*.
[19] *Id.* at 16.
[20] *Id*.
[21] *Id*.

emissions from today can remain in the atmosphere for a long time.[22] The current concentrations of GHGs in the atmosphere, therefore, are the result of both historic and current emissions, and future concentrations will depend on both CO_2 emission rates and the capacity of carbon sinks. "The rate of emission of CO_2 currently exceeds its rate of removal, and the slow and incomplete removal implies that small to moderate reductions in its emissions would not result in stabilization of CO_2 concentrations, but rather would only reduce the rate of its growth in coming decades."[23]

5. Changes in the Earth's climate system over the last century tell a coherent story: the impacts we see today are consistent with the scientific understanding of how the climate system should respond to GHG increases from human activities and how the Earth has responded in the past (reflected in such evidence as: ice cores that have trapped air from thousands and even a few million years ago, tree rings and seabed sediments that show where sea level was thousands and even millions of years ago).[24] Collectively, these changes cannot be explained as the product of natural climate variability or a tilt in the Earth's axis alone.[25] A large human contribution provides the best explanation of observed climate changes.[26]

6. "Based on extensive scientific research, there is very high confidence that human-generated increases in greenhouse gas concentrations are responsible for most of the global warming observed during the past 50 years."[27] "Very high confidence" means confidence in being right at a level of at least 9 out of 10.[28]

7. Alternative explanations for the global change in temperature have not survived rigorous scientific analysis.[29] According to the U.S. Global Climate Change Research Program, "natural factors cannot explain the warming of recent decades."[30]

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[22] *Id.* ("Carbon cycle models indicate that for a pulse of CO_2 emissions . . . 50% of the atmospheric increase will disappear within 30 years, 30% within a few centuries, and the last 20% may remain in the atmosphere for thousands of years."); John Abatzoglou et al., *A Primer on Global Climate Change and Its Likely Impacts*, in *Climate Change: What It Means for Us, Our Children, and Our Grandchildren* 11, 29 (Joseph F. C. DiMento & Pamela Doughman eds., MIT Press 2007) [hereinafter *Abatzoglou, A Primer on Global Climate Change*] ("Since CO2 has a lifetime of over one hundred years, these emissions have been collecting for many years in the atmosphere.").

[23] *EPA, TS Endangerment Findings*, *supra* note 9, at 17.

[24] USGCRP, *Global Climate Change Impacts*, *supra* note 4 at 26.

[25] *Id.*

[26] Susan Solomon et al., *Irreversible climate change due to carbon dioxide emissions*, 106 PNAS 1704, 1704 – 1709 (Feb. 10, 2009), *available at* www.pnas.org/cgi/doi/10.1073/pnas.0812721106 (last visited April 9, 2011).

[27] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1.

[28] *Id.* at Appendix B (adopting confidence and uncertainty guidelines set out by the IPCC); *IPCC, AR4*, *supra* note 5, at 27.

[29] *IPCC, AR4*, *supra* note 5, at 39 ("The observed widespread warming of the atmosphere and ocean, together with ice mass loss, support the conclusion that it is *extremely unlikely* that global climate change of the past 50 years can be explained without external forcing and *very likely* that it is not due to known natural causes alone.").

[30] *USGCRP, Global Climate Change Impacts*, *supra* note 4, at 16.

8. Since Governor Huntsman's Blue Ribbon Advisory Council on Climate Change released its report in 2007, which concluded that climate change is happening, that there is very high confidence that it is primarily human-caused, and that it will affect Utah's water supply, growing seasons, and weather patterns,[31] new evidence has strengthened that conclusion.[32]

9. According to the United States Environmental Protection Agency (EPA), "the evidence provides compelling support for finding that greenhouse gas air pollution endangers the public welfare of both current and future generations."[33] The EPA further stated that "there is good reason to act now given the urgency of the threat of climate change and the compelling scientific evidence.[34]

C. If greenhouse gas emissions are not reduced, the Earth will continue to warm, consequently altering the Earth's climate dramatically.

1. *"Ongoing greenhouse gas emissions at or above current levels will further alter the Earth's climate and very likely produce global temperature, sea level, and snow and ice changes greater than those observed during the 20th century."*[35]

2. "Climate models estimate an increase in the Earth's average surface temperature of about .8°F over the next 20 years. For the next 100 years, the projected increase is between 3° and 7°F, depending on a range of credible estimates of future greenhouse gas emissions."[36] These projections are only models, generated from computer programs. Models typically assume a linear rise in temperature; however, scientists have observed that the rate of global temperature rise is accelerating, as evidenced by increases in the rate of ice melt.[37]

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[31] *BRAC: Scientific Consensus*, *supra* note 1, at ES 1.

[32] *See e.g.,* D.S. Arndt et. al., *State of the Climate in 2009*, *Bulletin of the American Meteorological Society*, Vol. 91 No. 7 at S12 (July 2010) http://www1.ncdc.noaa.gov/pub/data/cmb/bams-sotc/climate-assessment-2009-lo-rez.pdf [hereinafter *State of the Climate 2009*] (listing weather events throughout the world for 2009, many of which are consistent with climate change predictions, for example more than a dozen nations experienced record high temperatures in the summer of 2009 while others experienced atypical cold snaps); NOAA National Climatic Data Center, *State of the Climate: Global Analysis for July 2010* (August 2010) http://www.ncdc.noaa.gov/sotc/global/2010/7 [hereinafter *NOAA, State of the Climate 2010*] (describing weather events for 2010, many of which are consistent with climate change predictions, for example, for the first time in the period of instrumental records, Moscow, Russia, experienced temperatures in excess of 100°F.); *see also* J. Hansen et al., NASA Goddard Institute for Space Studies, *Global Surface Temperature Change* (August 3, 2010); NASA, *Climate Change: Key Indicators*, http://climate.nasa.gov/keyIndicators (compilation of data).

[33] *EPA, Endangerment Finding*, *supra* note 2, at 66498.

[34] *Id*. at 66500.

[35] *BRAC: Scientific Consensus*, *supra* note 1, at ES 2 (emphasis in original); *IPCC, AR4*, *supra* note 5, at 45.

[36] *BRAC: Scientific Consensus*, *supra* note 1, at ES 2; *EPA, TS Endangerment Findings*, *supra* note 9, 64.

[37] Lonnie G. Thompson, *Climate Change: The Evidence and Our Options*, 33 *The Behavior Analyst* No. 2 (Fall) 153, 165 (2010) (clearly explaining, in layman terms, how scientists know that the rate of warming is exceeding the projections of scientific models).

3. "A variety of research studies suggest that a further 2ºF increase (relative to the 1980-1999 period) would lead to severe, widespread, and irreversible impacts."[38]

4. If expeditious action is not taken, then the future is likely to yield increases ranging from 2.4º F to 10.5º F above current temperature levels.[39] "Delayed emission reductions significantly constrain the opportunities to achieve lower stabilization levels and increase the risk of more severe climate change impacts."[40]

5. As expected and predicted by climate modeling, warmer temperatures are altering and will continue to alter the Earth's climate in the following ways. Although natural variability in temperature, precipitation, and other phenomena make it difficult to attribute individual weather and weather-related events to climate change, the pattern of changes described below are consistent with the trend of increased warming.

    a. Warming Oceans: Ocean temperatures have increased consistent with increases in global land surface temperatures.[41] This may lead to abrupt climate changes caused by a shift in the ocean's ability to circulate heat around the globe, thereby changing African and Indian monsoon rainfall, atmospheric circulation relevant to hurricanes, and changes in climate over North America and Western Europe.[42] The average temperature of the global ocean has increased significantly despite its ability to absorb huge amounts of heat before exhibiting any measurable signs of temperature change.[43]

    b. Changing Precipitation Patterns: Warmer air temperatures and warmer ocean temperatures increase the concentration of water vapor in the atmosphere.[44] Changes in water vapor concentrations alter weather patterns. As expected, precipitation patterns have changed due to increases in atmospheric moisture

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[38] *USGCRP, Global Climate Change Impacts*, *supra* note 4, at 23; Solomon, *supra* note 26, at 1705 (increasing current carbon dioxide concentration levels from current levels near 385 ppm to a level of 450 or 600 would produce irreversible dry-season rainfall reductions comparable to "dust bowl" era and inexorable sea level rise).

[39] *IPCC, AR4*, *supra* note 5, at 66 (graphs showing predicted emission levels and predicted equilibrium global average temperature increases above pre-industrial levels); Union of Concerned Scientists, *Projections of Climate Change*, *available at* http://www.ucsusa.org/global_warming/science_and_impacts/science/projections-of-climate-change.html (describing IPCC findings in layman terms).

[40] *IPCC, AR4*, *supra* note 5, at 66.

[41] *EPA, TS Endangerment Findings*, *supra* note 9, at ES-2; IPCC, *AR4*, *supra* note 5, at 30.

[42] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 26.

[43] *IPCC, AR4*, *supra* note 5, at 30 ("Observations since 1961 show that the average temperature of the global ocean has increased to depths of at least 3000m and that the ocean has been taking up over 80% of the heat being added to the climate system."); United Nations Environment Programme (UNEP), *Climate Change Science Compendium 2009* at 26 (UNEP/Earthprint, 2009).

[44] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 18; B.D Santer et al., *Identification of human-induced changes in atmospheric moisture content*, 104 *Proceedings of the National Academy of Sciences*, 15248, 15248-15253 (September 25, 2007).

levels and changes in atmospheric air circulation patterns, yet another indicator that the Earth is warming.[45] Moisture levels are expected to increase when temperature increases because warmer air generally holds more moisture. In more arid regions, however, higher temperatures lead to greater evaporation.[46] Based on the laws of physics and the past climate record, scientists have concluded that precipitation events will increase globally, particularly in tropical and high latitude regions, while decreasing in subtropical and mid-latitude regions,[47] with longer periods between normal heavy rainfalls.[48] The type of precipitation is also changing.[49] Higher altitude and latitude regions, including more mountainous areas, are seeing precipitation falling as rain rather than snow.[50] In other areas, the reverse is true. Northern Europe and the northeast United States have seen severe, uncharacteristic snowstorms in both 2009-2010 and 2010-2011 as a result of changing air currents consistent with warming in the Arctic.[51]

c. Changing Water Supply Patterns: As global weather patterns change, water supply will be affected. Some places will have more rain than normal, resulting in moister soil and increased river runoff. This could result in altered agricultural patterns and more flooding. Other places, where warmer temperatures produce more rapid evaporation, and evaporation exceeds precipitation, will see less soil moisture and lower river runoff.[52] These changes are difficult to predict accurately, but they will dramatically change water supply as we have observed it in the past.[53]

d. Increased Frequency of Extreme Weather Events: Changes in the Earth's water cycle increase the potential for, and severity of, extreme weather events. Scientists have observed more frequent and intense weather events in the past fifty years, a trend likely to continue.[54] Although individual weather events

[45] *USGCRP, Global Climate Change Impacts*, *supra* note 4, at 18.
[46] *EPA, TS Endangerment Findings*, *supra* note 9, at 34.
[47] *Id*. at ES-4, 74.
[48] *Id*.
[49] *Id*. at ES-2.
[50] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 18, 45.
[51] NOAA, *Arctic Report Card: Update for 2010*, (December 10, 2010) (last visited April 7, 2011) http://www.arctic.noaa.gov/reportcard/atmosphere.html [hereinafter *Arctic Report Card 2010*]; NOAA, *The Future of Arctic Sea Ice and Global Impacts*, http://www.arctic.noaa.gov/future/index_impacts.html#event; *see also* Climate Science Watch, *Climatologist Ben Santer on the attribution of extreme weather events to climate change*, (December 29, 2010) (last visited April 9, 2011) http://climateprogress.org/2010/12/29/ben-santer-attribution-extreme-weather-events-to-climate-change/#more.
[52] *See* Syukuro Manabe et al., *Simulated Long-Term Changes in River Discharge and Soil Moisture Due to Global Warming*, 49 *Hydrological Sci.* 625, 631 (2004).
[53] *See* Edwin P. Maurer, *Uncertainty in Hydrologic Impacts of Climate Change in the Sierra Nevada, California Under Two Emissions Scenarios*, 82 *Climate Change* 309, 310 (2007); Guiling Wang, *Agricultural Drought in a Future Climate: Results from Fifteen Global Climate Models Participating in the IPCC Fourth Assessment*, 25 *Climate Dynamics* 739, 740 (2005).
[54] Center for Health and the Global Environment, Harvard Medical School, *Climate Change Futures: Health, Ecological, and Economic Dimensions* (November 2005) *available at*

cannot be definitively attributed to climate change, observed changes in weather patterns are consistent with projections. 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.[55] Storm-prone areas are already experiencing a greater chance of severe storms. Even in arid areas precipitation may fall all at once and cause flash flooding, followed by drought.[56] Flash floods can wreak havoc by overloading dams and flood control facilities; dislocating families, towns, or even cities; killing or hurting people and animals; and destroying property.[57]

e. Increased Frequency and Intensity of Droughts and Heat Waves: Droughts in parts of the western and southwestern United States have increased in frequency and severity within the last fifty years, coincident with rising temperatures.[58] In 2009, more than half of the United States received above normal precipitation; yet the southwestern United States, Arizona in particular, had one of its driest periods, a weather pattern consistent with climate change predictions.[59] As the 2010 Russian summer heat wave graphically demonstrated, heat can destroy crops, trigger wildfires, exacerbate air pollution, and cause increased illness and deaths.[60]

f. Rising Oceans: As the ocean warms, sea level will rise due to thermal expansion and melting polar ice caps and glaciers. We are observing this sea level rise.[61] Sea levels have been rising at an average rate of 3.1 millimeters per year based on measurements from 1993 to 2003.[62] Though sea levels rose about 6.7 inches in the last century, within the last decade that rate nearly doubled.[63] In a comprehensive review of studies on sea level rise in the 21st century published by the British Royal Society, researchers estimated the probable sea level rise in this century at between .5 and 2 meters (1 ½ to 6 ½

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eetd.lbl.gov/emills/pubs/pdf/climate-change-futures.pdf [hereinafter *Center for Global Health and Environment, Climate Change Futures*] ("While no one event is conclusive evidence of climate change, the relentless pace of severe weather—prolonged droughts, intense heat waves, violent windstorms, more wildfires and more frequent '100-year' year floods—is indicative of a changing climate."); USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 27 ("Many types of extreme weather events, such as heat waves and regional droughts, have become more frequent and intense during the past 40 to 50 years."); *see also IPCC, AR4*, *supra* note 5, at 53 (chart providing examples of possible impacts of climate change due to changes in extreme weather and climate events based on projections).

[55] *National Science and Technology Council: Scientific Assessment*, *supra* note 9, at 7.

[56] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 34.

[57] *See* Heather Cooley, *Floods and Droughts*, in *The World's Water* 2006-2007, *The Biennial Report on Freshwater Resources* 91 (Peter H. Gleick et al. eds., 2006) (reporting that floods and droughts killed an estimated seventeen million people and affected over five billion between 1900 and 2005).

[58] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 33.

[59] Arndt et al., *State of the Climate 2009*, *supra* note 32, at S138.

[60] *See* NOAA Earth System Research Lab, *The Russian Heat Wave 2010* (September 2010) http://www.esrl.noaa.gov/psd/csi/moscow2010/.

[61] USGCRP, *Global Climate Change* Impacts, *supra* note 4, at 9; *EPA,TS Endangerment Findings*, *supra* note 9, at ES-3; IPCC, *AR4*, *supra* note 5, at 30.

[62] IPCC, *AR4*, *supra* note 5, at 30.

[63] NASA, *Climate Change: How Do We Know?* http://climate.nasa.gov/evidence/#no4

feet), continuing to rise for several centuries after that, depending on future CO_2 levels and the behavior of polar ice sheets.[64]

g. Increased risk of flooding and storm surges: The combination of rising sea levels and more severe storms creates the conditions for severe storm surges at high tides in coastal communities that can overwhelm coastal defenses such as levees and sea walls.[65] Additionally, as glaciers melt, the risk of flooding increases because glaciers and stable winter snow packs help moderate potential flooding by storing precipitation as ice and snow.[66] By contrast, as temperatures warm not only will such areas lose this supplemental storage, but rain falling on snow accelerates the melting of glaciers and snow packs, often causing severe flooding.[67]

h. Melting Glaciers: Mountain glaciers, which are the source of freshwater for hundreds of millions of people, are receding worldwide because of warming temperatures.[68] Today, Glacier National Park in Montana has twenty-five glaciers larger than twenty-five acres, down from 150 in 1850.[69] The year 2009 marked the 19th consecutive year in which glaciers lost mass.[70] Mountain glaciers are in retreat all over the world, from Mt. Kilimanjaro in Africa to the Himalaya to the Alps (99% in retreat) to the glaciers of Peru and Chile (92% in retreat) to the United States.[71] In the Brooks Range of northern Alaska all of the glaciers are in retreat and in southeastern Alaska 98% are in retreat.[72]

i. Melting Ice Sheets: Ice is melting around the world.[73] The IPCC projected that polar regions would experience a reduction in the thickness and extent of glaciers, ice sheets, and sea ice.[74] This change is being observed. Beginning in late 2000, the Jakobshavn Isbrae Glacier, which has a major influence over the mass of the Greenland ice sheet, lost significant amounts of ice.[75] In

[64] R.J. Nicholls et al., *Sea-level rise and its possible impacts given a 'beyond 4°C world' in the twenty-first century*, *Philosophical Transactions of the Royal Society* 161-181, 168 (2011).
[65] *EPA, TS Endangerment Findings*, *supra* note 9, at 86, 118.
[66] *EPA, TS Endangerment Findings*, *supra* note 9, at 111.
[67] *Id*.
[68] *See EPA, TS Endangerment Findings*, *supra* note 9, at 111 ("Glaciers throughout North America are melting, and the particularly rapid retreat of Alaskan glaciers represents about half of the estimated loss of glacial mass worldwide.").
[69] United States Geological Survey (Northern Rocky Mountain Science Center), *Retreat of Glaciers in Glacier National Park* (June 2010), http://www.nrmsc.usgs.gov/research/glacier_retreat.htm.
[70] Arndt et al., *State of the Climate 2009*, *supra* note 32, at S13.
[71] Thompson, *supra* note 37, at 162; USGRCP, *Global Climate Change Impacts* at 18.
[72] Thompson, *supra* note 37, at 158.
[73] *Id*. at 160("[P]olar ice sheets are slower to respond to temperature rise than the smaller mountain glaciers, but they too, are melting. . . . The loss of ice in the Arctic and Antarctic regions is especially troubling because these are the locations of the largest ice sheets in the world.").
[74] *IPCC, AR4*, *supra* note 5, at 52.
[75] Gary Braasch & Bill McKibben, *Earth Under Fire* 18-20 (2009); *see also* J.E. Box et. al., (NOAA) *Greenland*, *Arctic Report Card*, *supra* note 51 ("A clear pattern of exceptional and record-setting warm air temperatures is evident at long-term meteorological stations around Greenland.").

August of 2010, an enormous iceberg roughly ninety-seven square miles in size, broke off from Greenland.[76] Nine Antarctic ice shelves have also collapsed into icebergs in the last fifty years, six of them since 1996.[77] An ice shelf roughly the size of Rhode Island collapsed in 2002, and an ice bridge collapsed in 2009, leaving an ice shelf the size of Jamaica on the brink of breaking apart.[78] The 2002 collapse of the Larsen Ice Shelf, which had existed for at least 11,000 years, was "unprecedented in respect to both area and time."[79] The "sudden and complete disintegration" of the Larsen Ice Shelf took a mere 35 days.[80]

j. Melting Sea Ice: Sea ice in the Arctic oceans is expected to decrease and may even disappear entirely in coming decades.[81] During the 2007 melt season, the extent of Arctic sea ice (frozen ocean water) declined precipitously to its lowest level since satellite measurements began in 1979.[82] By the end of 2010, Arctic sea ice was at the lowest level in the satellite record for December.[83] Scientists have also documented an overall trend of sea-ice thinning.[84] The year 2010 also marked a record-low, spring snow cover in the Arctic since satellite observations first began in 1966.[85]

k. Less Snow Cover and Decreased Permafrost: The year 2010 also marked a record low spring snow cover in the Arctic since satellite observations first began in 1966.[86] "Mountain glaciers and snow cover on average have declined in both hemispheres. The maximal areal extent of seasonally frozen ground has decreased by about 7% in the Northern Hemisphere since 1900."[87]

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[76] NASA Earth Observatory, *Ice Island Calves Off Petermann Glacier* (Aug. 2010), http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=45112&src=eorss-nh.
[77] Alister Doyle, *Antarctic Ice Shelf Set to Collapse Due to Warming*, Reuters (Jan. 19, 2009) http://www.reuters.com/article/idUSTRE50I4G520090119.
[78] NASA Earth Observatory, *Wilkins Ice Bridge Collapse* (April 2009), http://earthobservatory.nasa.gov/IOTD/view.php?id=37806.
[79] U.S. Geological Survey, *Coastal-Change and Glaciological Map of the Larsen Ice Shelf Area, Antarctica: 1940-2005* at 10 (2008) http://pubs.usgs.gov/imap/2600/B/LarsenpamphletI2600B.pdf
[80] *Id*. at 10.
[81] *EPA, TS Endangerment Findings*, *supra* note 9, at 120; USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 20-21 ("Studies published after the appearance of the IPCC Fourth Assessment Report in 2007 have also found human fingerprints in the increased levels of atmospheric moisture (both close to the surface and over the full extent of the atmosphere), in the decline of Arctic sea ice extent, and in the patterns of change in Arctic and Antarctic surface temperatures.").
[82] *EPA, TS Endangerment Findings*, *supra* note 9, at 27 ("Average arctic temperatures increased at almost twice the global average rate in the past 100 years."); National Snow and Ice Data Center (NSDIC), Press Release, *Arctic Sea Ice Shatters All Previous Record Lows* (October 1, 2007), http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html (last visited April 9, 2011).
[83] NSIDC, *Repeat of a Negative Arctic Oscillation Leads to Warm Arctic, Low Sea Ice Extent, Arctic Sea Ice News & Analysis*, (January 5, 2011), http://nsidc.org/arcticseaicenews/2011/010511.html (last visited April 9, 2011).
[84] Arndt et al., *State of the Climate 2009*, *supra* note 32, at S114.
[85] J. Richter-Menge, ed., *Land*, in *Arctic Report Card*, *supra* note 5, at 29.
[86] *Id*.
[87] *IPCC, AR4*, *supra* note 5, at 30.

l. Increased Incidences of Disease: Human-caused climate change is already contributing to an increase in asthma, cancer, cardiovascular disease, stroke, heat-related morbidity and mortality, food-borne diseases, and neurological diseases and disorders.[88] "Climate change will also alter the transmission of infectious diseases such as cholera, malaria, and bubonic plague."[89] "*Negative health effects associated with climate change are expected to outweigh positive ones, particularly for those in developing countries.*"[90] Climate change is not only expected to affect the basic requirements for maintaining health (clean air and water, sufficient food, and adequate shelter) but is likely to present new challenges for controlling infectious disease and even "halt or reverse the progress that the global public health community is now making against many of these diseases."[91]

m. Changing Chemistry in the Oceans: The Earth's oceans play a significant role in keeping our atmospheric climate in the safe-zone.[92] The oceans constantly absorb CO_2 and release it back into the atmosphere at rates that maintain a balance.[93] "Since 1980, ocean uptake of the excess CO_2 released by anthropogenic activities is significant; about a third has been stored in the oceans. The rate of atmospheric CO_2 increase, however, far exceeds the rate at which natural feedbacks can restore the system to normal conditions."[94] This capacity has slowed global warming, but at a cost: the added CO_2 has changed the chemistry of the oceans, causing the oceans' average surface pH (a measurement of hydrogen ions) to drop by an average of .11 units.[95] Although this may seem relatively small, the pH scale is logarithmic, so that a

[88] *Center for Global Health and Environment, Climate Change Futures*, *supra* note 54, *passim* (report for insurance and reinsurance business community assessing health risks of climate change because "climate change will affect the health of humans as well as the ecosystems and species on which we depend, and . . . these health impacts will have economic consequences"); USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 96-98.

[89] *BRAC: Scientific Consensus*, *supra* note 1, at ES 15; *see also Center for Global Health and Environment, Climate Change Futures*, *supra* note 54, at 33, 34 (explaining link between epidemics of infectious diseases like cholera and malaria and catastrophic storms).

[90] *Id*. (emphasis in original); World Health Organization, *Climate and Health Fact Sheet* (July 2005) ("[T]he health effects of a rapidly changing climate are likely to be overwhelmingly negative."). http://www.who.int/globalchange/news/fsclimandhealth/en/index.html.

[91] World Health Organization, *Protecting Health from Climate Change: Connecting Science, Policy, and People* 02 (2009), *available at* http://www.who.int/globalchange/publications/reports/9789241598880/en/index.html.

[92] *See EPA, TS Endangerment Findings*, *supra* note 9, at 16, 38.

[93] IPCC, *AR4*, *supra* note 5, at 72.

[94] Interagency Report (National Science Foundation, National Oceanic and Atmospheric Administration, and U.S. Geological Survey) *Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers: A Guide for Future Research* 1 (June 2006) *available at* http://www.ucar.edu/communications/Final_acidification.pdf [hereinafter *Interagency Report, Impacts of Ocean Acidification*].

[95] *EPA, TS Endangerment Findings*, *supra* note 9, at 38 ("[T]he total inorganic carbon content of the oceans increased by 118 ± 19 gigatonnes of carbon (GtC) between 1750 and 1994 and continues to increase."); *Interagency Report, Impacts of Ocean Acidification*, *supra* note 94, at 1,3.

reduction of only one unit means that the solution has in fact become ten times more acidic.[96] A drop of .1 pH units means that the concentration of hydrogen ions in seawater has gone up by 30 percent in the past two centuries.[97] If CO_2 levels continue to rise to 500 ppm, we could see a further drop of .3 pH units by 2100.[98] Ocean acidification harms animals that use calcium to build their shells, as well as single-celled organisms that are an essential part of the marine food chain.[99] This is because the acidified waters affect the structural integrity and survival of shell-building marine organisms such as corals and shellfish.[100] Ocean acidification also adversely affects some kinds of algae and single-celled organisms that use calcification processes for survival.[101] Coral reefs are major habitats for ocean fauna; and calcifying algae and plankton are key components of the marine food chain.[102]

n. Loss of Marine Life: The current of level of CO_2 being taken in by the ocean decreases the ability of coral and other calcium-based marine life to produce their skeletons, which affects the growing of coral and thus coral reefs.[103] About 55 million years ago, the ocean absorbed a large amount of CO_2, likely due to a release of methane from the ocean floor that caused the Earth's temperatures to rise several degrees and led to the extinction of many species worldwide.[104] The absorption of so much CO_2 may have contributed to the death of calcifying organisms on the seafloor.[105] Although this event provides some clues about how ocean biota may react to acidification, scientists note that the rate of anthropogenic carbon input is faster than before, and so the impacts on biota may be more severe.[106]

Acidification can inhibit or slow down the biological production of other

[96] Harvey Blatt, *America's Environmental Report Card* 158 (MIT Press 2005).
[97] A. Ridgewell & D. Schmidt, *Past Constraints on the Vulnerability of Marine Calcifiers to Massive Carbon Dioxide Release*, 3 *Nature Geoscience* 196, 196-200 (2010).
[98] IPCC, *AR4*, *supra* note 5, at 52.
[99] *EPA, TS Endangerment Findings*, *supra* note 9, at 38.
[100] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 85.
[101] *Id*.
[102] EPA, *Coral Reef Biological Criteria: Using the Clean Water Act to Protect a National Treasure* 3-1 (July 2010), *available at* http://www.epa.gov/bioindicators/pdf/EPA-600-R-10-054_CoralReefBiologicalCriteria_UsingtheCleanWaterActtoProtectaNationalTreasure.pdf (last visited April 9, 2011).
[103] *Interagency Report, Impacts of Ocean Acidification*, *supra* note 94, at 69.
[104] James C. Zachos et al., *Rapid Acidification of the Ocean During the Paleocene-Eocene Thermal Maximum*, 308 *Science* 1611, 1611-1615 (June 10, 2005); *see also* Andy Ridgwell, Daniela N. Schmidt, *Past Constraints on the Vulnerability of Marine Calcifiers to Massive Carbon Dioxide Release*, 3 *Nature Geoscience* 196, 196-200 (2010); Carl Zimmer, *An Ominous Warning on the Effects of Ocean Acidification*, Yale Environment 360, (February 15, 2010), *available at* http://e360.yale.edu/feature/an_ominous_warning_on_the__effects_of_ocean_acidification/2241/ (last visited April 9, 2011) (explaining results and implications of Ridgwell and Schmidt study in non-scientific language).
[105] *Zachos et al*., *supra* note 105, at 1614.
[106] *Id*. at 1614; *see also Ridgwell & Schmidt*, *supra* note 104, at 200.

marine life, like calcifying photoplankton and zooplankton.[107] The overall reaction of marine life—both individual organisms and ecosystem functions—to ocean acidification is not yet clear, however, it is clear that calcifiers play important roles in marine ecosystems by serving as the base of the food chain, providing substrate, and helping regulate biogeochemical cycles.[108] Thus, acidification can influence the marine food web.[109]

o. Loss of Coral Reefs: The warming of oceans also contributes to the bleaching of corals.[110] Corals contain tiny algae that provide them with food and that accounts for their color.[111] When the oceans warm, the algae give off toxins, and the corals, in order to survive the toxin, expel the algae, thereby bleaching the coral.[112] If the water temperature does not fall enough to permit algae to survive within the coral without releasing the toxin, the corals will eventually die.[113] There have been several severe episodes of coral bleaching in recent years.[114] With continued warming, the coral may not be able to survive.[115]

p. Threatened Fresh Water Supplies: Mountain glaciers, which are the source of freshwater for hundreds of millions of people, are receding worldwide because of warming temperatures.[116] Glaciers act like 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 summer when rainfall is lower or absent. [117] The water systems of the western United States (particularly California) and the Andean nations of Peru and Chile, among other places, rely heavily on such natural forms of water storage. [118] In addition to providing a more reliable water supply, the storing of precipitation as ice and snow helps moderate potential flooding.[119]

6. Some of the changes listed above can also create feedback loops that may further accelerate the consequences of global warming in ways that we are only just beginning to realize. For example, Arctic sea ice plays an important role in

[107] *EPA, TS Endangerment Findings*, *supra* note 9, at 134.
[108] *Id*.
[109] *Id*.
[110] *EPA, TS Endangerment Finding*, *supra* note 9, at 103; USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 148.
[111] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 84, 151-52; *See EPA, TS Endangerment Findings*, *supra* note 9, at 138.
[112] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 84, 151-52.
[113] *See id*.
[114] *Id*. at 84.
[115] *Id*.
[116] *See EPA, TS Endangerment Findings*, *supra* note 9, at 111 ("Glaciers throughout North America are melting, and the particularly rapid retreat of Alaskan glaciers represents about half of the estimated loss of glacial mass worldwide.").
[117] Thompson, *supra* note 37, at 164.
[118] *See id*. at 155 – 160, 164.
[119] *EPA, TS Endangerment Findings*, *supra* note 9, at 111; USGRCP, *Global Climate Change Impacts* at 64.

stabilizing the global climate, because it reflects back to space much of the solar radiation that the region receives.[120] In contrast, open ocean water absorbs much more heat from the sun, thus creating an increased warming effect.[121] As sea ice melts and is replaced by ocean water during the 24-hour Arctic summer, warming will further increase. As arctic sea ice decreases, the region is less capable of stabilizing the global climate and may act as a feedback loop (thereby aggravating global warming).[122]

7. Similarly, there has been a general increase in permafrost temperatures and permafrost melting in Alaska and other parts of the Arctic, particularly in the last five years.[123] Scientists in Eastern Siberia and in Canada have documented methane releases as the permafrost melts.[124] Because much of the Arctic permafrost overlays old peat bogs, scientists believe (and are concerned) that the melting of the permafrost[125] may release methane that will further increase global warming to even more dangerous levels.[126]

8. "*[C]atastrophic, abrupt climate change represents the greatest potential risk from rising greenhouse gas concentrations*."[127] Unfortunately, we do not know where the "tipping points" for catastrophic abrupt changes lie. "At the current level of understanding, it is unclear where these tipping points are or if they have already been passed."[128]

D. Utah's average temperature will likely increase more than the global average, with potential effects including more heat waves, droughts, water scarcity, and wildfires; decreased snowpack; altered growing seasons; and increased pests and disease.

1. The BRAC reported that climate change is happening; it is most likely the result of the anthropogenic release of GHG emissions; and failure to curb our GHG emissions will affect Utah's water supply, snow pack, food supply, agriculture, forests, wildlife resources, soils, fish, and the health of its citizens.

2. "*In Utah, the average temperature during the past decade was higher than observed during any comparable period of the past century and roughly 2°F*

[120] EPA, *Climate Change Indicators in the United States*, 45 (2010), *available at* http://www.epa.gov/climatechange/indicators/pdfs/ClimateIndicators_full.pdf [hereinafter *EPA, Climate Change Indicators*]; *see also EPA, TS Endangerment Findings*, *supra* note 9, at 40.
[121] *EPA, Climate Change Indicators*, *supra* note 120, at 52; USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 39; Thompson, *supra* note 37, at 166 (describing feedback loops).
[122] *EPA, Climate Change Indicators*, *supra* note 120, at 46.
[123] *Id*.
[124] Arndt et al., *State of the Climate 2009*, *supra* note 32, at S116.
[125] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 139, 142 ("The higher temperatures are already contributing to . . . permafrost warming.").
[126] *See* IPCC, *4.4.6 Tundra and Arctic/Antarctic Ecosystems*, *Climate Change 2007: Fourth Assessment Report, Working Group II, Impacts, Adaptation, and Vulnerability* 231 (2007).
[127] *BRAC: Scientific Consensus* , *supra* note 1, at ES 17.
[128] *Id*.

higher than the 100 year average."[129]

3. *"Utah is projected to warm more than the average for the entire globe and more than coastal regions of the contiguous United States. The expected consequences of this warming are fewer frost days, longer growing seasons, and more heat waves*."[130]

4. *"[O]ngoing greenhouse gas emissions at or above current levels will likely result in a decline in Utah's mountain snowpack and the threat of severe and prolonged episodic drought in Utah is real*."[131]

5. "*It is highly likely that increases in greenhouse gas concentrations are contributing to several significant climate trends that have been observed over most of the western United States during the past 50 years*."[132]

6. "These trends are: (1) a several day increase in the frost-free growing season, (2) an earlier and warmer spring, (3) earlier flower blooms and tree leaf out for many plant species, (4) earlier spring snowmelt and runoff, and (5) a greater fraction of spring precipitation falling as rain instead of snow."[133]

7. Utah is also projected to experience the following specific effects.

8. Threatened and/or Decreased Water Supply: In the western United States, most annual precipitation falls in the form of winter snowfall in the mountains, and is primarily stored in snow pack (rather than artificial reservoirs). "Most of Utah's water resources originate in mountainous areas above 6500 feet in elevation, which cover about 19% of the state. The primary source of this water is snowpack. "[134] Snow accumulates through the winter then melts in the spring and early summer releasing months of stored precipitation. In Utah, the spring runoff usually takes place over 4-8 weeks and accounts for the majority of streamflow across the state.[135] Scientists expect that with rising temperatures, more precipitation in the west will fall as rain, rather than snow. This will result in less snowfall in lower elevations. This means that peak runoff will occur earlier in the spring, and the rate of evapo-transpiration will increase. As a result, stream flows will decrease, and we will have less water in our reservoirs.[136] These changes will have profound

[129] *BRAC: Scientific Consensus*, *supra* note 1, at ES 2 (emphasis in original).
[130] *Id.*
[131] *Id.*
[132] *Id.* at 1 (emphasis in original).
[133] *Id.* at 1-2.
[134] *Id*. at 9-10.
[135] *BRAC: Scientific Consensus*, *supra* note 1, at ES 10.
[136] *Id*., ES 18; Tim P. Barnett et al., *Human-Induced Changes in the Hydrology of the Western United States*, 319 *Science* 1080 (2008); N.S. Christensen & D.P. Lettenmaier, *A Multimodal Ensemble Approach to Assessment of Climate Change Impacts on the Hydrology and Water Resources of the Colorado River Basin*, 3 *Hydrology & Earth Sys. Sci.* 3727 (2007); Phillip W. Mote, *Climate-Driven Variability and Trends in Mountain Snowpack in Western North America*, 19 *J. Climate* 6209, 6209 (2006).

consequences for water use, especially as our growing population demands more water, hotter temperatures and earlier springs require more irrigation, and lower river flows require thoughtful management of instream flows to maintain healthy fish populations.

9. Droughts: There is wide consensus that the southwest will become drier, the serious droughts of the past will become the norm, and even more severe droughts are likely.[137] Although Utah-specific trends of precipitation patterns show no clear pattern, estimates show that sustained droughts are a defining feature of the upper Colorado River Basin.[138] All models, including the most conservative ones, agree that the Colorado River Basin runoff will decline by eight to eleven percent.[139] Some models predict a decline by as much as forty five percent.[140]

10. Forest Fires: Utah will likely experience drier conditions and increased wildfire intensity as a result of climate change.[141] The "number and frequency of forest fires and insect outbreaks are increasing in the interior West."[142] Large wildfires in the Western United States have quadrupled in recent years, a result of hotter temperatures and earlier snowmelt that contributes to dryer soils and vegetation.[143] As fires burn hotter, more frequently, and more unpredictably, the magnitude of damage from forest fires will increase.[144]

11. Increased incidences of pests: Climate change is also predicted to result in more insect outbreaks and reduced forest health.[145] For example, climate change in the United States 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.[146] The expansion of the forest beetle population has killed millions of hectares of trees across the United States and Canada and resulted in millions of dollars lost from decreased timber and

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[137] Richard Seager et al., *Model Projections of an Imminent Transition to a More Arid Climate in Southwestern North America*, 316 *Science* 1181 (2007).
[138] *BRAC: Scientific Consensus*, *supra* note 1, at ES 10.
[139] *See* Christensen & Lettenmaier, *supra* note 136; Gregory J. McCabe & David M. Wolock, *Warming May Create Substantial Water Supply Shortages in the Colorado River Basin*, 34 *Geophysical Res. Letters* L22708, 3 (2007), *available at* http://www.agu.org/pubs/crossref/2007/2007GL031764.shtml.
[140] Martin Hoerling & Jon Eischeid, *Past Peak Water in the Southwest*, *SW. Hydrology* Jan-Feb. 2007, at 18; *see generally* Bureau of Reclamation, Climate Technical Work Group, *Review of Science and Methods for Incorporating Climate Information into Reclamation's Colorado River Basin Planning Studies Report* (2007).
[141] *BRAC: Scientific Consensus*, *supra* note 1, at ES 20.
[142] *EPA, TS Endangerment Findings*, *supra* note 9, at 41.
[143] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 95.
[144] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 131.
[145] *BRAC: Scientific Consensus*, *supra* note 1, at ES 20.
[146] U.S. Climate Change Science Program (USCCSP), *Weather and Climate Extreme in a Changing Climate, Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [hereinafter *Weather and Climate Extremes*] 15 (June 2008) *available at* http://www.climatescience.gov/Library/sap/sap3-3/final-report/sap3-3-final-all.pdf.

tourism revenues.[147]

12. Threats to Agriculture: Climate change can affect agriculture because plants need particular conditions to germinate, pollinate, and fruit.[148] For example, apricot trees need to remain below chilling temperatures for a certain amount of time in order to fruit. If the trees are not sufficiently chilled, they will not fruit. This problem is already occurring in California.[149] Changes in water supply and water quality will also impact agriculture.[150] Additionally, increased heat and associated issues such as pests, crop diseases, and weather extremes, will impact crop and livestock production and quality.[151]

    In Utah, agriculture contributes more than $15 billion to our economy—nearly 14% of the State's total output.[152] Agriculture is also responsible for 66,500 jobs, which generate income of $2.4 billion. In comparison, according to Governor Herbert's Ten Year Strategic Energy Plan, energy and natural resource industries employ 22,926 employees (1.9% of the total workforce) and generate total wages of $1.3 billion.[153] Therefore, disruption of agriculture and food supply would have profound consequences on the economy of Utah. Climate change could produce increased per-acre crop yields if, and only if, water remains available for irrigation and temperatures do not rise above crop tolerance. For those farmers without sufficient irrigation, pasture yields will decrease. Similarly, livestock foraging on non-irrigated land will also decline in productivity.[154] Climate change could also harm agriculture indirectly through changes in the distribution of plants and animals that affect pollination or crop damage.[155]

13. Drier Soils: "Because of increasing temperature, soils are expected to dry more rapidly, which will likely increase soil vulnerability to wind erosion. This will increase dust transport during high wind events, particularly from salt flats and dry lake beds such as Sevier Lake. Dust deposited on mountain snowpack also accelerates spring snowmelt."[156]

14. Threats to the Ski Industry: Ongoing GHG emissions at or above current levels will likely result in a decline in Utah's mountain snowpack for the winter recreation industry, particularly those mountain areas located in lower-to-mid

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[147] *Id*.
[148] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 72.
[149] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 134.
[150] USGCRP, *Global Climate Change* Impacts, *supra* note 4, at 126; *See* United States Department of State (USDS), *U.S. Climate Action Report 2010, Fifth National Communication of the United States of America Under the United Nations Framework Convention on Climate Change* [hereinafter *U.S. Climate Action Report*] 87 (June 2010) *available at* http://www.state.gov/documents/organization/140636.pdf.
[151] *U.S. Climate Action Report*, *supra* note 150, at 87.
[152] *Utah Agriculture Statistics and Utah Department of Agriculture and Food Annual Report* 3 (2010).
[153] Governor Gary R. Herbert, *Energy Initiatives & Imperatives: Utah's 10-Year Strategic Energy Plan* 19 (2011) [hereinafter *Utah's 10-Year Strategic Energy Plan*].
[154] *BRAC: Scientific Consensus*, *supra* note 1, at ES 19.
[155] *Id*.
[156] *BRAC: Scientific Consensus*, *supra* note 1, at ES 20.

elevation areas.[157] Earlier spring will result in shorter ski seasons. Decreases from 40 to 90% are likely in end-of-season snowpack in counties with major ski resorts from Mexico to California if emissions continue to rise.[158] In addition to shorter seasons, warmer temperatures could produce earlier wet snow avalanches, obligating ski resorts to close as much as six weeks earlier by the end of this century.[159] Because resorts require a certain number of days to break even, cutting the season short, or eliminating their opportunity to capitalize on spring skiing could easily render the resorts unprofitable.[160] Furthermore, with less snow, colder nights, and more precipitation as rain, ski resorts may have to rely on artificial snowmaking more, driving up costs.[161] More artificial snowmaking may also drive up water demand.

15. Threats to fish and other aquatic life: Warmer lakes and rivers can be expected to have more algal blooms and fish habitat will shift upstream.[162]

16. Threats to Species and Habitats: "*Estimates of the influence of climate change on biodiversity suggest that 20-30% of all known plant and animal species will be more vulnerable to extinction in the next century*."[163] Plants and animals are affected by direct changes to their climate, like heat waves, warmer winters, earlier springs, less precipitation, and more intense storms. They are also affected by changes to their habitat caused by fires, insect outbreaks, and the invasion of non-native species. All of these impacts are consistent with global warming.[164] Climate change already appears to be influencing both natural and managed ecosystems in the Southwest. For example, the combination of hotter temperatures and drought conditions in the Four Corners region has resulted in substantial die-off of pinon pine trees across 4,600 square miles of pinon-juniper woodland.[165] In Utah, climate change may affect habitat availability and may exacerbate the challenges faced by threatened and endangered species like the Utah Prairie Dog and the Canada Lynx.[166]

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[157] *BRAC: Scientific Consensus*, *supra* note 1, at ES 18.
[158] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 133.
[159] *Id*.
[160] *Id*.
[161] *Id*. at 110.
[162] *BRAC: Scientific Consensus*, *supra* note 1, at ES 18.
[163] *BRAC: Scientific Consensus*, *supra* note 1, at ES 16 (emphasis in original); IPCC, *AR4* at 48 ("For increases in global average temperature exceeding 1.5 to 2.5°C and in concomitant atmospheric CO_2 concentrations, there are projected to be major changes in ecosystem structure and function, species' ecological interactions and shifts in species' geographical ranges, with predominantly negative consequences for biodiversity and ecosystem goods and services, e.g. water and food supply.").
[164] *BRAC: Scientific Consensus*, *supra* note 1, at ES 8.
[165] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 131.
[166] U.S. Fish & Wildlife Service, *Utah Prairie Dog*, *Draft Revised Recovery Plan*, 1.7-12 (August 2010) *available at* http://www.fws.gov/mountain-prairie/species/mammals/utprairiedog/DraftRevisedRecoveryPlan_Sept%202010.pdf; Department of the Interior, Fish & Wildlife Service, *Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule*, 74 Fed. Reg. 8616, 8617 (Feb. 25, 2009) (to be codified at 50 C.F.R. pt. 17) (acknowledging that

17. Earlier Warming in the Spring Affecting Plants and Animals: Grasses and trees are greening earlier, plants are flowering earlier, and birds and insects are migrating and laying eggs earlier as a result of climate change. This has led to mismatches between bird migration timing and insect food sources, between insects and plant food sources, and between plants and the birds and insects that help them reproduce.[167] These mismatches in timing can affect populations, breeding, and pollination.

18. Reduced Air Quality: Rising temperatures will further degrade air quality in urban areas that already experience poor air quality.[168] This will have a heavy impact in areas that already suffer from ground-level ozone problems like Salt Lake and Uintah Basin. "The production of near-surface ozone and associated cardio-respiratory diseases is expected to increase."[169] Additionally, rising temperature and carbon dioxide concentration increase pollen production and prolong the pollen season in a number of plants with highly allergenic pollen, aggravating asthma and allergies.[170]

19. Human Health: Climate change can affect human health by producing an increase in heat-related illnesses and mortality, increasing the number of cardio-respiratory diseases associated with ground-level ozone, and changing the distribution and morbidity of diseases transmitted by insects and animals.[171] Utahns will not be immune from the increased incidences and spreading range of infectious diseases like cholera, malaria, Lyme disease, and West Nile virus, here and in other parts of the world.[172] A large percentage of Utah citizens travel and live abroad both for pleasure and to serve ecclesiastical missions. As the rate of infectious disease increases, these citizens will face greater health risks from disease outbreaks as they travel abroad, and they could also bring infectious diseases back to Utah. Climate change is also expected to exacerbate asthma. Increased amounts of allergenic plant pollens and some soil fungi, and dust clouds containing particles and microbes from expanding deserts compound the effects of air pollutants and smog from burning fossil fuels to exacerbate asthma.[173]

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climate change may be an issue of concern for the future conservation of lynx because distribution and habitat is likely to shift upward in elevation as temperatures increase).

[167] *BRAC: Scientific Consensus*, *supra* note 1, at ES 8-9.

[168] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 134.

[169] *BRAC: Scientific Consensus* , *supra* note 1, at ES 15.

[170] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 89; *BRAC: Scientific Consensus*, *supra* note 1, at ES 15 (anticipating an increase in health problems caused by allergy-causing pollen); *Center for Global Health and Environment, Climate Change Futures*, *supra* note 54, at 48-53 (reporting ways in which the changes in atmospheric chemistry and climate increase presence of pollen and fungi in the air and therefore heighten risk of allergic symptoms and asthma).

[171] *BRAC: Scientific Consensus*, *supra* note 1, at ES 19; *Center for Global Health and Environment, Climate Change Futures*, *supra* note 54, *passim*.

[172] *Center for Global Health and Environment, Climate Change Futures*, *supra* note 54, at 32-53 (case studies on increased risks of infectious and respiratory diseases focusing on malaria, West Nile Virus, and Lyme disease).

[173] *Id*. at 9.

20. Heat waves: Heat waves increase the demand for air conditioning. If air conditioning is not available, heat related illnesses and mortalities are expected to increase.[174] Alternatively, longer-lasting and more intense heat waves will deplete electricity supplies as more people use air conditioning, increasing the risk of brownouts and blackouts. This could become even more problematic as the timing of river flows decreases the capacity of hydroelectric systems.[175]

21. Threats to the Great Salt Lake: The Great Salt Lake is a tremendous resource for migrating birds, providing globally important habitat for breeding and feeding.[176] Because the Great Salt Lake is very shallow, its shoreline can change dramatically with small changes to the elevation of the lake.[177] As a result, it is possible for large portions of the lake to become desiccated stretches of land . This reduces habitat and food supply for migrating birds. It also threatens to aggravate air quality problems for Salt Lake City by contributing an additional source of dust, perhaps with high concentrations of mercury and selenium to the airshed. As temperatures increase and mountain snowpacks decline, we will likely see lower average lake levels on the Great Salt Lake along with an increase in average salinity. "These changes will affect wetland habitat and wildlife as well as commercial and recreation activities that rely on the lake."[178]

E. The Earth's atmosphere is a public trust resource that has been degraded, threatening ecosystems on which Utahns depend.

1. The world's population relies on the atmosphere for survival. GHGs in the atmosphere act somewhat like a blanket over the Earth that prevents some of the heat reflected off the surface of the earth from escaping into space.[179] The Earth's atmosphere is unique. It has a lower concentration of GHGs than the atmosphere of Venus, which is too hot for life that has developed on this planet, and a higher concentration than the atmosphere of Mars, which is too cold to support life as we

[174] *BRAC: Scientific Consensus*, *supra* note 1, at ES 19.
[175] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 134.
[176] *See* Edwin v. Rawley, *Wildlife of the Great Salt Lake*, in *Great Salt Lake: A Scientific, Historical & Economic Overview* 287, 288 (J. Wallace Gwynn ed., 1980) ("The marshes of Great Salt Lake are probably among the most important single breeding ground for waterfowl that now remains in the United States."). The lake is home to some 257 species of birds, almost half of which are permanent residents (or nesting species). *Id*. at 287, 298-99; *see also*, William H. Behle, *The Bird Life of Great Salt Lake* (1958).
[177] *See* Ted Arnow, *Water Budget and Water-Surface Fluctuations*, in *Great Salt Lake*, *supra* note 176, at 255; Ted ARnow & Doyle Stephens, U.S. Dep't of the Interior, Hydrologic Characteristics of the Great Salt Lake, Utah, 1847-1986 (1990).
[178] *BRAC: Scientific Consensus*, *supra* note 1, at ES 18-19. For more information about the Great Salt Lake and pressures that it will experience as a result of climate change, see *2010 Great Salt Lake Issues Forum: Keeping the Lake Wet: A Water Appropriation for Great Salt Lake*, available at http://www.fogsl.org/issuesforum/2010/forum-presentations/, particularly presentations by Fredric H. Wagner, *Whither the Great Salt Lake in a Warming Climate*, and Peter Pumphrey, *Dust Storms from a Dry Lakebed Drives Ownes Lake Mitigation and Restoration Efforts*.
[179] *Abatzoglou, A Primer on Global Climate Change*, *supra* note 22, at 22.

know it.[180] Absent anthropogenic changes, our atmosphere contains the right range of concentrations of GHGs, including CO_2 and water vapor, to support life as we know it.[181] Because we all depend on the atmosphere for life, it is a shared public trust resource, and all governments, including Utah's have an obligation to protect it for the benefit of its citizens.

2. More GHGs in the atmosphere mean more heat being retained on Earth, with less radiating out into space.[182] Without any greenhouse effect, the global average surface temperature of our planet would be about 0°F (-8°C) instead of 59°F (15°C).[183] Scientists have understood this basic mechanism of global energy balance since the late-nineteenth century.[184]

3. Between the time since humans evolved and before the industrial age, the carbon dioxide concentration in our atmosphere fluctuated around 280 ppm.[185] Those levels defined the conditions under which human societies and the ecosystems on which they depend developed.

4. For the past 12,000 years, coastlines and sea levels and global average temperatures have remained relatively constant, allowing the development of ports and commerce as well as large-scale agriculture.

5. With the advent of the industrial age, humans began burning fossil fuels at a rate that outpaced the earth's capacity to re-absorb carbon dioxide through oceans, plants, and forests.[186] Primarily as a result of this human-induced global energy imbalance, global surface temperatures have been rising dramatically since 1951.[187]

6. Humans not only continue to add GHGs into the atmosphere at a rate that outpaces their removal through natural processes,[188] but the current and projected CO_2 increase is about one hundred times faster than has occurred over the past 650,000 years.[189]

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[180] *Id*. at 17.
[181] *Id*. at 23.
[182] *Id*. at 16-17.
[183] *Id*. at 17.
[184] *See id*. at 35 (describing the research of Swedish chemist Svante Arrhenius).
[185] *IPCC, AR4*, *supra* note 5, at 37.
[186] *EPA, TS Endangerment Findings*, *supra* note 9, at 17.
[187] NASA, *Global Climate Change – Global Surface Temperature*, http://climate.nasa.gov/keyIndicators/index.cfm#globalTemp (last visited April 10, 2011) ("Global surface temperatures in 2010 tied 2005 as the warmest on record."); NASA, *Global Climate Change*, http://climate.nasa.gov/ (last visited April 10, 2011) ("January 2000 to December 2009 was the warmest decade on record.").
[188] *Id*. at ES-2 ("Atmospheric GHG concentrations have been increasing because anthropogenic emissions have been outpacing the rate at which GHGs are removed from the atmosphere by natural processes over timescales of decades to centuries.").
[189] *Interagency Report, Impacts of Ocean Acidification*, *supra* note 94, at 3.

7. Human beings have significantly altered the chemical composition of the Earth's atmosphere.[190] The current CO_2 concentration in our atmosphere is about 390 ppm[191] (compared to the pre-industrial concentration of 280 ppm).[192] "The present agmospheric concentration of CO_2 exceeds by far the natural range over the last 800,000 years (172 to 300 ppm) as determined from ice cores."[193] The increased concentration of GHGs resulting from historic and current human activities has altered the Earth's ability to maintain the delicate balance of the energy it receives from the sun and radiates back into space.[194] This change has degraded the atmosphere as a public trust resource, resulting in climatic changes with effects that threaten to alter key resources and ecosystems on which human societies depend.

F. We must take expeditious and effective action to prevent and mitigate the threat of climate change.

1. The well-documented and observable impacts from the changes in Earth's climate system show that we are already in the danger zone.[195] The Earth will continue to warm in reaction to concentrations of CO_2 from past emissions as well as future emissions.[196] Warming already in the pipeline is mostly attributable to climate mechanisms that slowly heat the Earth's climate system in response to atmospheric CO_2.[197]

2. Current and anticipated atmospheric CO_2 levels raise the specter of abrupt climate change or crossing climatic tipping points, such as the loss of arctic sea ice and the West Antarctic Ice Sheet or the rapid disintegration of the Greenland Ice Sheet.[198] If we continue business as usual, we can expect the atmospheric concentration of CO_2 to increase by about 2 ppm each year. Absent expeditious and effective action to reduce CO_2 emissions, atmospheric CO_2 may reach levels as high as 1130

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[190] Naomi Oreskes, *The Scientific Consensus on Climate Change*, in *Climate Change: What It Means for Us, Our Children, and Our Grandchildren* 65, 93 (Jospeh F. C. DiMento & Pamela Doughman eds., MIT Press 2007) ("We have changed the chemistry of our atmosphere, causing sea level to rise, ice to melt, and climate to change. There is no reason to think otherwise.").

[191] NOAA, Atmospheric CO_2: Monthly & Annual Mean CO_2 Concentrations (ppm), March 1958 – Present, *available at* http://co2now.org/Current-CO2/CO2-Now/Current-Data-for-Atmospheric-CO2.html (showing an atmospheric CO_2 concentration of 392.40 for March, 2011).

[192] *EPA,TS Endangerment Findings*, *supra* note 9, at 17; IPCC, *AR4*, *supra* note 5, at 37 ("The global atmospheric concentration of CO_2 increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005."); *National Science and Technology Council, Scientific Assessment*, *supra* note 9, at 2 (same).

[193] *EPA, TS Endangerment Findings*, *supra* note 9, at 17.

[194] *Abatzoglou, A Primer on Global Climate Change*, *supra* note 22, at 15.

[195] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 23.

[196] *EPA, TS Endangerment Findings*, *supra* note 9, at 26.

[197] Fred Pearce, *With Speed and Violence: Why Scientists Fear Tipping Points in Climate Change* 101-104 (Beacon Press 2007); IPCC, *AR4*, *supra* note 5, at 72.

[198] *BRAC: Scientific Consensus*, *supra* note 1at ES 17; *Copenhagen Diagnosis*, *supra* note 12, at 40; *EPA, TS Endangerment Findings*, *supra* note 9, at 76-78; James E. Hansen et al., *Target Atmospheric CO_2: Where Should Humanity Aim?* 2 *Open Atmos. Sci.* 217 (2008) *available at* http://www.benthamscience.com/open/toascj/articles/V002/217TOASCJ.pdf [hereinafter Hansen, *Target Atmospheric CO_2*].

ppm[199] and global average temperature increases of up to 5° C by 2100.[200] This would produce a warmer climate than has existed since human beings have existed on Earth, with unknown but likely unprecedented global impacts.[201]

3. Paleoclimate data provides sobering evidence that major climate change can occur in decades, and that the consequences would be much more severe, and even violent, if a 2°C (3.6°F) change occurs over decades rather than hundreds of years.[202]

4. "If, as predicted, global temperature rises another 3º C (5.4 º F) by the end of the century, the earth will be warmer than it has been in about 3 million years. . . . such a drastic change would, at the very least, put severe pressure on civilization as we know it."[203]

5. Despite the devastating risk associated with increasing the concentration of CO_2 in the atmosphere, Utah's carbon emissions continue to increase. In 2005, Utah emitted approximately 69 million metric tons (MMt) of gross carbon dioxide equivalent (CO_{2e}) emissions. Although this accounts for only about 1% of total U.S. gross GHG emissions, on a per capita basis, Utah emits more than the national average.[204] Per capita, Utahns emit about 27 metric tons (Mt) of CO_{2e} annually, compared to the national average of 25 $MtCO_2e/yr$.[205] This is about twice as high as per capita emissions in some states.[206]

6. Utah's GHG emissions are increasing at a much faster rate than the rest of the nation. "Statewide, emissions increased 40% from 1990 to 2005. Nationally emissions rose only 16% during the same period."[207] By 2020, Utah's emissions are projected to be 95% above 1990 levels.[208] In comparison, in order to mitigate the effects of climate change, humanity should be aiming for a global goal of 350

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[199] *IPCC, AR4*, *supra* note 5, at 66-67.
[200] *IPCC, AR4*, *supra* note 5, at 46.
[201] *See* James E. Hansen & Makiko Sato, *Paleoclimate Implications for Human-Made Climate Change* 18 (January 18, 2011), *available at* http://www.columbia.edu/~jeh1/mailings/2011/20110118_MilankovicPaper.pdf (last visited April 10, 2011).
[202] *Id.*
[203] Thompson, *supra* note 37, at 167 (citing H.J. Dowsett et al., *Joint Investigations of the Middle Pleistocene Climate 1: PRISM Paleoenvironmental Reconstructions*, 9 *Global and Planetary Change*, 169-195 (1994).
[204] Governor John Huntsman, *Blue Ribbon Advisory Council on Climate Change (BRAC): Executive Summary* 4 (2007) [hereinafter *BRAC: Executive Summary*].
[205] *Id.* at 4.
[206] Elizabeth A. Stanton, Frank Ackerman, & Kristen Sheeran, *Greenhouse Gases and the American Lifestyle: Understanding Interstate Differences in Emissions* 14 (May 2009) *available at* http://www.e3network.org/papers/NRDC_state_emissions_report.pdf.
[207] *BRAC: Executive Summary*, *supra* note 204, at 4.
[208] *Id.*

ppm concentration of carbon dioxide by the end of the century, which means striving to get below 1990 emission levels by 2050.[209]

7. On August 25, 2006, Governor Huntsman convened the Blue Ribbon Advisory Council on Climate Change (BRAC). The multi-stakeholder group, composed of government, industry, environment, and community voices, was charged with the task of considering the science of climate change and generating policy recommendations based on an understanding of "what we are trying to leave for the next generation."[210] After considering the science, BRAC explored GHG reduction options with the intent of adopting a GHG goal as part of Utah's responsibility to the Western Climate Initiative.[211] The Western Climate Initiative webpage shows that Utah adopted a GHG Reduction Goal of reducing GHG emissions to 2005 levels by 2020.[212]

8. Rather than pursuing this goal, the State of Utah has instead pursued a policy that will *increase* CO_2 emissions. Governor Herbert's 10-Year Strategic Energy Plan projected a 20% increase in electricity use (primarily coal), a 17% increase in natural gas use, and a 15% increase in petroleum use, without any significant proposals to reduce GHG emissions from those sources or to offset them by reducing emissions from other sources.[213]

9. Furthermore, Governor Herbert's Strategic Plan, adopted into law by the Utah Legislature, included aggressive language limiting the State's ability to pursue effective and strategic carbon reduction strategies, like phasing out coal or avoiding new carbon-intensive energy development, like tar sands. Utah Code § 63M-4-301(1)(b)(i) ("Utah will promote the development of nonrenewable energy sources, including natural gas, coal, oil, oil shale, and tar sands"). The statute also eliminates the opportunity for citizens to challenge a state agency action that is inconsistent with the promotion of these carbon-intensive energy uses. Utah Code § 63M-4-301(3). This strategy will further increase Utah's absolute and per capita GHG emissions because fossil fuels account for a large percentage of Utah's carbon emissions. The combustion of fossil fuels for transportation and in-state electricity use accounted for 61% of Utah's gross GHG emissions in 2005.[214]

10. We have already delayed our response to climate change. In 1993, the Utah Department of Environmental Quality Division of Air Quality and the Utah

[209] *See* Hansen, *Target Atmospheric CO_2*, *supra* note 198; *see also* Declaration of James Hansen, May 3, 2011, attached as Exhibit A and incorporated herein.
[210] *BRAC: Executive Summary*, *supra* note 204, at 1.
[211] Brigham Daniels & Etan Gumerman, *An Evaluation of Utah's Greenhouse Gas Reduction Options* 11 (2009) [hereinafter *Utah's Greenhouse Gas Reduction Options*].
[212] *See* Utah Greenhouse Gas Reduction Goal, http://www.deq.utah.gov/Climate_Change/GHG_goal.htm (site last visited April 24, 2011).
[213] *Utah's 10-Year Strategic Energy Plan*, *supra* note 153, at 10.
[214] Center for Climate Strategies, *Final Utah Greenhouse Gas Inventory and Reference Case Projections*, 1990-2020 at 17 (July 2007) *available at* http://www.deq.utah.gov/BRAC_Climate/docs/Final_Report/Sec-B-GHG_INVENTORY.pdf (last visited April 24, 2011) [hereinafter *2007 Utah GHG Inventory*].

Department of Natural Resources Office of Energy and Resource Planning issued a report on Utah Greenhouse Gas Emissions.[215] The first paragraph of the foreword recognized the scientific consensus about anthropogenic climate change and the importance of initiating mitigation strategies. It noted, "barely a month passes without a story of new research confirming suspicions that, in fact, human activity contributes measurably to the Earth's warming. Seemingly, with each new report, yet another heart in the scientific community is won over and the public's interest is heightened."[216] The report summarized, "It is now generally accepted that the Earth is being warmed by human activities, in particular greenhouse gas emissions from the burning of fossil fuels."[217]

11. Further delay will increase the costs and reduce the effectiveness of essential efforts to mitigate climate change. The 1993 Emissions Inventory estimated that the costs associated with stabilizing GHG emissions below the 1990 levels could range from zero to six percent of the U.S. GNP and reported that "a National Academy of Sciences panel has concluded that the potential exists to reduce greenhouse gas emission in the United States by 10 to 40% of 1990 levels at a very low cost and possibly a net savings."[218] Instead, however, the state of Utah *increased* its emissions by 40%.[219]

12. Never before has humanity faced such a dramatic change to the climate. Past global warming and cooling of a similar magnitude occurred before human civilization existed.[220] Moreover, global warming is happening far more rapidly than in past occurrences,[221] giving both humans and other forms of life only a short time to adapt to the changes. Human civilization and the crops and foods on which it depends have developed within a very narrow set of climatic conditions.[222] With the human population so large, with civilization so complex, centered around coastal cities, and dependent on water supplies fed by distant ice and snow melt, and with the great disparities in wealth between and within countries and regions, it will be nearly impossible to adapt to all of the climate change impacts in the quick time-frame in which they will occur.[223]

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[215] The Utah Department of Environmental Quality Division of Air Quality and Utah Department of Natural Resources Office of Energy and Resource Planning, *Utah Greenhouse Gas Emissions: Estimates for 1990 and 1993* (1993) available at http://www.deq.utah.gov/BRAC_Climate/documents_repository.htm [hereinafter *1993 Utah GHG Inventory*].
[216] *Id*. at 1.
[217] *Id*. at i.
[218] *Id*. at 7.
[219] *BRAC: Executive Summary*, *supra* note 204, at 4.
[220] Hansen, *Paleoclimate Implications*, *supra* note 201; Hansen, *Target Atmospheric CO_2*, *supra* note 198.
[221] *Id*.
[222] *Abatzoglou*, *A Primer on Global Climate Change*, *supra* note 22, at 15.
[223] *See generally* United States Agency International Development (USAID), *Adapting to Climate Variability and Change: A Guidance Manual for Development Planning* (August 2007) (discussing difficulty of adapting to climate change) http://pdf.usaid.gov/pdf_docs/PNADJ990.pdf; *See also* USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 12 ("Climate change will combine with pollution, population growth, overuse of resources, urbanization, and other social, economic, and environmental stresses to create larger impacts than from any of these factors alone.").

13. Renowned climatologist Lonnie G. Thompson recently concluded that in the face of this crisis, "we have three options: mitigation, adaptation, and suffering."[224] This petition is a request for agency action to initiate expeditious and effective rules related to mitigation and adaptation.

14. We can solve this problem: The climate change we are now experiencing is caused largely by human activity.[225] This means that (unlike past climate change events) by changing our activities humans can mitigate or even halt this warming before it causes catastrophic and irreversible effects.[226] Stopping, or at least greatly curtailing, the activities that discharge GHGs into the air, such as the burning of fossil fuels and deforestation, and encouraging activities that remove CO_2 from the atmosphere (such as reforestation), can mitigate global warming and its accompanying consequences within the lifetimes of today's children.[227]

15. States Can Play a Meaningful Role in Addressing Climate Change: In 1993, the DEQ succinctly explained the effectiveness and importance of state action in addressing climate change.

> "There are several reasons why states can significantly affect their emissions of greenhouse gases. First, state governments hold direct regulatory authority over the sources of more than half of all CO_2 emissions: gas and electric utilities. Second, states also determine the acceptability of building specifications and land-use planning, thereby affecting emissions from the residential, commercial, and transportation sectors. Third, states also have jurisdiction over determining regulations concerning the use and recycling of paper, glass, and plastic products, the management of municipal solid wastes (and consequently methane emissions) and the promotion of energy savings from secondary manufacturing. Finally, many states currently regulate forestry practices on non-federal lands."[228]

DEQ and other Utah state agencies have adequate authority, capacity, and responsibility for addressing climate change on a state level by reducing annual

[224] Thompson, *supra* note 37, at 153.
[225] *See* USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 20; *EPA, TS Endangerment Findings*, *supra* note 9, 47-51; *IPCC, AR4*, *supra* note 5, at 39.
[226] USGCRP, *Global Climate Change Impacts*, *supra* note 4, at 107 ("By mid-century and beyond, however, today's emissions choices would generate starkly different climate futures: the lower the emissions, the smaller the climatic changes and resulting impacts."); Hansen, *supra* note 198, at 226 ("A CO_2 amount of order 450 ppm or larger, if long maintained, would push Earth toward the ice-free state. Although ocean and ice sheet inertia limit the rate of climate change, such a CO_2 level would likely cause the passing of climate tipping points and initiate dynamic responses that could be out of humanity's control.")
[227] *See id*. at 12 ("Future climate change and its impacts depend on choices made today.").
[228] *1993 Utah GHG Inventory*, *supra* note 215, at 5.

GHG emissions and increasing natural carbon sinks.

16. The State Agencies included in this petition have jurisdiction over the largest sources of carbon emissions by sector. According to the emissions inventory conducted for DEQ and used by BRAC, electricity use, transportation, and residential/commercial/industrial fossil fuel combustion are the State's principal GHG emission sources.[229] Electricity use accounts for 37% of Utah's GHG emissions.[230] This number does not include the amount of GHG emissions produced by the energy exported (28% of energy produced) to other states, like California.[231] On the transportation side, gasoline vehicles account for 55% of transportation GHG emissions, while diesel vehicles account for 25% and air travel accounts for 17%.[232]

G. Failing to address climate change is a dereliction of the sovereign responsibility of all levels of government.

1. To protect Earth's natural systems, average global surface heating must be limited.[233] Today, the atmospheric concentration of CO_2 is about 392.4 ppm and rising.[234] To prevent further global warming, concentrations of atmospheric CO_2 must decline to less than 350 ppm within this century.[235]

2. The longer the concentration of CO_2 remains above 350 ppm, the greater the likelihood that humans will witness and experience significant impacts from climate change.[236] As described above, continued degradation of the atmosphere by further contributing to the excess accumulation of GHGs will cause significant impacts to many parts of society. Therefore, the atmospheric concentration of GHGs is a subject of public concern, and should be managed by the government as a part of the public trust, just as the laws of most nations recognize that the sea and navigable rivers are part of the public trust because they are necessary for survival.[237]

3. Protection of public trust resources is an inherent attribute of sovereignty that cannot be abdicated.[238] Under well-established principles of trust law, trustees

[229] *1993 Utah GHG Inventory*, *supra* note 215, at 17. More recent but generally consistent data on emissions per source category, in Utah and other states, are presented in *Stanton, Ackerman & Sheeran supra* note 206.
[230] *Id*. at 18.
[231] *Id*.
[232] *Id*. at 19.
[233] *IPCC, AR4*, *supra* note 5, at 48.
[234] CO_2Now, *Earth's CO_2 Homepage*, Atmospheric CO_2 for March 2011, http://co2now.org/ (last visited April 10, 2011).
[235] *See* Hansen, *supra* note 198, at 217-231.
[236] *Id*.
[237] *Illinois Cent. R. Co. v. State of Illinois*, 146 U.S. 387, 456-458 (1892).
[238] *In re Water Use Permit Applications*, 9 P.3d 409, 442-43 (Haw. 2000) (citing *Illinois Cent.*, 146 U.S. at 453-44).

have a duty to protect and preserve the trust property from damage or destruction.[239] The trustee "is obligated to the beneficiary to do all acts necessary for the preservation of the trust res which would be performed by a reasonably prudent man employing his own like property for purposes similar to those of the trust."[240] In this case, the beneficiaries of the atmospheric trust are the youth, some of whom will still be in their thirties when the IPCC predicts that some of the more dramatic effects of climate change will have occurred unless we take immediate action to reduce our carbon emissions. A fiduciary must not let trust property "fall into ruin on his watch"[241] and yet, that is exactly what has happened and will continue to occur without expeditious and effective action curbing GHG emissions.

4. The atmosphere, essential to human existence, is an asset that belongs to the citizens of Utah, just as other essential assets have been recognized as common assets since the time of the Romans.[242] The public trust doctrine imposes a longstanding legal obligation recognizing that some resources are so vital to the well-being a government's citizens, that they must be protected by the government.[243] The Utah Supreme Court has recognized that "[t]he 'public trust' doctrine . . . protects the ecological integrity of public lands and their public recreational uses of the public at large."[244] Because the atmosphere protects our most precious shared resource—a stable climate—it is a crucial public asset that the government holds in trust for its citizens.[245]

5. The public trust doctrine holds the government responsible, as perpetual trustee, for the protection and preservation of the atmosphere for the benefit of both present and future generations.[246] Agencies should manage the resources within their jurisdiction consistent with the obligation to protect public trust resources.[247] Today the citizens of Utah, together with the rest of the world, are confronted with an atmospheric emergency that can only be averted through individual and collective action at all government levels. Utah has a fiduciary, and perpetual, affirmative duty to preserve and protect the atmosphere for the beneficiaries of this trust asset—the present citizens and future generations of the State of Utah. This obligation to manage public trust

[239] *See* George T. Bogert, *Trusts and Trustees* § 6th Ed. (1987) § 582.
[240] *Id.*
[241] *United States v. White Mountain Apache Tribe*, 537 U.S. 465, 475 (2003).
[242] Institutes of Justinian 2.1.1 ("By the law of nature these things are common to mankind—the air, running water, the sea, and consequently the shores of the sea.").
[243] Charles F. Wilkinson, *The Public Trust Doctrine in Public Land Law*, 14 U.C. Davis L. Rev. 269, 315 (1980) ("[T]he public trust doctrine is rooted in the precept that some resources are so central to the well-being of the community that they must be protected.").
[244] *National Parks and Conservation Ass'n*, 869 P.2d at 919; *see also Colman v. Utah State Land Bd.*, 795 P.2d 622, 645-56 (Utah 1990).
[245] Mary Christina Wood, *Nature's Trust: A Legal, Political, and Moral Frame for Global Warming*, 34 Boston College Envt'l Affairs L. Rev. 577, 595 (May 2007).
[246] *In re Water Use Permit Applications*, 9 P.3d 409, 442-43 (Haw. 2000); *Illinois Cent. R. Co*. v. Illinois, 146 U.S. 387, 453-44 (1892)
[247] Wood, *supra* note 245, at 596.

resources for the benefit of the public and future generations cannot be disclaimed.[248]

6. Because the atmosphere protects the entire planet equally, it is a planetary public trust resource in which all sovereigns are co-tenants. Each co-tenant has an equal obligation not to commit waste.[249] It is now clear that maintaining an atmospheric concentration of CO_2 above 350 ppm wastes the atmospheric public trust.[250] Therefore, in order to avoid waste, each co-tenant must immediately halt any increase in CO_2 emissions, and must begin reducing GHG emissions by 6% annually in order to bring the atmospheric concentration of CO_2 back down to 350 by 2100.

7. As one of the largest global emitters, the United States should lead the way. As a part of the United States, Utah is responsible for its proportionate share of United States emissions. Especially because Utah's per capita GHG emission rates are higher than other states, Utah cannot be excused from undertaking this obligation immediately. The United States, including the State of Utah, has the capacity and the technology to reduce emissions by 6% annually.[251]

8. In order to fulfill the sovereign obligation to protect the atmospheric trust by reducing the concentration of carbon dioxide back to 350 within this century, as proper management of the atmosphere as a public trust resource requires, all levels of government must work together on the following steps in order:

    i. Create a reliable inventory of GHG emissions that can be used to create an accurate plan for reducing our GHG emissions.

    ii. Produce a plan that will reduce GHG emissions by 6% annually until 2050. The plan must also increase the capacity of carbon sinks.

    iii. Publish annual reports comparing actual annual emissions to the GHG reduction plan so that the public can evaluate the effectiveness of the government's response.

II. PETITIONERS' INTEREST IN THE RULE

1. Petitioners have a fundamental interest in this rule.

2. Sierra Adler is a citizen of Utah who resides in Salt Lake City. She is 16 years

[248] *Illinois Cent.*, 146 U.S. at 453-44.
[249] George G. Bogert et al., *Tenancy in Common and Joint Tenancy*, § 28 *Bogert's Trusts and Trustees* (6th Ed. 1987) (explaining that co-tenants have duties to each other similar to the fiduciary duties that trustees have to beneficiaries).
[250] Hansen, *Target Atmospheric CO_2*, *supra* note 198; Exhibit A.
[251] *See* Arjun Makhijani, eUtah: A Renewable Energy Roadmap (2010) *available at* http://www.ieer.org/reports/eUtah2010.pdf.

old and she wants to look forward to a livable future. As she grows older, she wants to continue to explore and experience all parts of the world uninhibited by climate change. She wants future generations to have the same opportunities for adventure that she has had. Sierra wants to feel the leisure of youth, but instead she feels a sense of urgency about the future, as though there are certain aspects of the world that she needs to see right away—before she loses the opportunity. For example, when Sierra was nine, she went glacier climbing in Norway and now she knows that the glacier has likely receded significantly, like most of the glaciers around the world. Similarly, she has always wanted to visit Asia, and feels some urgency to visit before rising sea levels overtake low lying areas, as predicted by the IPCC.[252] Closer to home, Sierra loves hiking and skiing, but she gets asthma when there is bad air quality, a side effect of burning fossil fuels for energy and transportation. Sierra wants a life filled with adventure, not spent remembering, or hearing stories, about how the world used to be. In 2050, by which time many of the dire climate change effects predicted by the IPCC are expected to have occurred, Sierra will be 55.

3. Kathryn Albury is a citizen of Utah who lives in Holladay. She is 66 years old, and she is concerned about what the future holds for her children and grandchildren. As a gardener, she enjoys the benefits of the intricate irrigation system put in place by earlier residents when Holladay was known for its fruit orchards. She admires how the pioneers who built the irrigation system cared for the land and their water. Like them, she wants to maintain a clean, adequate water supply, but she knows that as the snow pack diminishes it will be more difficult to hold the winter precipitation for the dry summer months when water is critical to crops, livestock, and people. She also knows that the water in the Colorado River is expected to decrease 8-14% in the next four decades. She is frustrated about plans to squander our water resources on climate change exacerbating projects like the development of energy intensive oil shale and tar sands. She wants the government to exercise the same foresight as the pioneers who dug the ditches in Holladay by adopting a plan to address climate change consistent with what the science requires to protect a livable future for her, her children, her grandchildren, and beyond to the seventh generation.

4. William ("Bill") Barron is a citizen of Utah who lives in Salt Lake City. He is 44 and he wants to protect the health and welfare of his eight year old daughter as she grows up. His daughter has dealt with childhood asthma and has a heightened sensitivity to our air quality, so an increase in frequency and intensity of bad ozone days will directly harm her. Additionally, the pollution that fills our skies as we recklessly burn fossil fuels also exacerbates her asthma. Bill worries about the dramatic weather events and weather patterns stemming from our collective impact on the atmosphere and wonders how that will affect his daughter's future. He enjoys sharing the beauty and wonder of nature with his daughter, and feels strongly that it cannot be taken for granted as it continues to be compromised by

[252] *IPCC, AR4*, *supra* note 5, at 65, 72.

climate change. He also believes future generations should have the opportunity for this same type of experience. In 2050, by which time many of the dire climate change effects predicted by the IPCC are expected to have occurred, Bill will be 83 and his daughter will be 47.

5. Pamela Lewis is a citizen of Utah who lives in Salt Lake City. She wants the State of Utah and its agencies to adopt innovative and progress-oriented policies that promote living as though our future matters. She is tired of looking back at what the world was, because it is still here today to see, breathe, and enjoy. She wants to see the State of Utah taking a proactive stance on climate change, adopting policies that address both mitigation and adaptation. She dreams of state policies that promote biodegradable materials rather than plastics, organic rather than genetically engineered foods, and transportation that incorporates alternative fuels like hydrogen-powered cars.

6. Sara Ma is a citizen of Utah who lives in Salt Lake City. Nature is her second home. She is an active sportswoman who loves spending her time outside on Utah's public lands camping, rock climbing, and hiking. She feels that losing special places, like her favorite place to camp at Bear Lake, would kill her. As an avid scuba diver, Sara looks forward to a promise from her father that she can visit the coral reefs when she graduates from high school. She knows, however, that the coral reefs are slowly decaying due to ocean acidification and warming oceans. Sara wants to continue enjoying the beauty of nature and know that future generations have the chance to do the same. In 2050, by which time many of the dire climate change effects predicted by the IPCC are expected to have occurred, Sara will be 55.

7. Scott McLeod is a citizen of Utah who lives in Salt Lake City. He has a one-year old son, Desmond. Scott recognizes that the impending climate crisis threatens Desmond's future more than his own. He worries about how climate change will threaten national security; disrupt food supply as weather patterns shift global agriculture; diminish fresh water supplies; and produce more extreme weather patterns. He also worries about the insurmountable financial liabilities associated with mitigating the crisis, particularly if the government does not take expeditious action. What bothers Scott most, however, is that Desmond did nothing to deserve this. Scott would like to see the government incentivize innovation and clean energy solutions rather than maintaining the status quo by continuing to think of fossil fuels as an indispensable part of our energy supply and economy. In 2050, by which time many of the dire climate change effects predicted by the IPCC are expected to have occurred, Scott's son, Desmond, will be 41.

8. Sara Melnicoff is a citizen of Utah who resides in Moab. She recently won the Governor's Silver Bowl award for the countless service hours that she has spent picking up garbage, initiating recycling programs, and sorting recycling. She is passionate about taking action on important items, and she is not worried about getting her hands dirty in the process—she just rolls up her sleeves. Sara also

works with homeless men and women through an informal, small business, the "Quiet Lawn Care Company," which provides Moab residents lawn and garden care without the use of motors, and also provides a way for the homeless co-workers to earn some money. The homeless also help her collect trash and recycling from the five mile in-town parkway system on a weekly basis. Sara knows that the homeless she works with, who live outside, will be directly harmed as the number and intensity of heat waves increases. Sara also knows that small steps, like recycling beverage containers, can make a measurable difference in GHG emissions. For example, a beverage recycling program she admires in Newfoundland prevented 8,768 metric tonnes of GHG in one year—an amount equivalent to taking 1,461 cars off the road.[253] Sara would like to see the government fulfill its fiduciary obligation to the citizens of Utah to manage and preserve public trust resources, like the atmosphere.

9. Douglas J. Roberts is a citizen of Utah who resides in Bountiful. He knows that climate change affects him less than it affects the people that he cares most deeply about—his children and his grandchildren. He knows that here in Utah they will experience increased drought and heat, resulting in water scarcity and a greatly diminished Great Salt Lake. The fact that we may also see the number of great ski days in the mountains dwindle makes him sad because his grandchildren will very likely not enjoy skiing like he did. He also recognizes that if the water level of the Great Salt Lake decreases, dust from the lake bed, which has been polluted with sewage, insecticides, and fertilizers, could blow into the cities along the shores of the Great Salt Lake. He is also concerned that his grandchildren will experience water shortages. And he wonders whether immigration issues in Utah will worsen as Mexico's climate becomes unlivable. When he stops to think about himself, Doug worries about how exacerbated air quality will affect him, because he likes to breathe. Doug would like to avoid the worst effects of climate change and mitigate the unavoidable effects. That is why he wants the state of Utah to produce and implement a plan for reducing GHG emissions at a rate that will fulfill Utah's share of the global effort to minimize the effects of climate change.

10. Mathias ("Mats") Sanyer is an eighteen-year old citizen of Utah. Growing up in Salt Lake City, he developed exercise-induced asthma that has gotten worse over the years due to the inversion and the poor air quality in the Salt Lake Valley. Sometimes during the winter he wakes up having trouble breathing. He is worried that in the coming years, if Salt Lake continues to rely on fossil fuels, the air quality will further deteriorate and he will not be able to spend winters here. In the summer, he is worried that he will not be able to run or play soccer without feeling out of breath because climate change will exacerbate ground level ozone. With the snowpack melting, changing, and sliding earlier, he worries that the quality of Utah's legendary snow pack will deteriorate, backcountry skiing will

[253] Press Release, Government of Newfoundland and Labrador, Canada, *Used Beverage Container Recycling Program Reports Record High Results and Reduces Carbon Footprint* (October 20, 2010) *available at* http://www.releases.gov.nl.ca/releases/2010/env/1020n05.htm (site last visited April 23, 2011).

become less safe, and he will lose the opportunity to ski the way he wants to. He worries about water shortages for himself and his children in the years to come. When Mats sees the government pursuing business as usual rather than planning for the future in the face of these challenges, he is scared about what will happen to him and his friends as they grow up.

11. Rebekah ("Bekah") Sosa is a citizen of Utah who grew up in rural southern Utah but currently resides in Salt Lake. Bekah works as a photographer with local and international non-profit organizations. She has experienced and documented the impact of climate change in developing countries around the world. Bekah understands the urgency in addressing climate change on both a grassroots and governmental level. She would like to see Utahns at the forefront of this movement. Recently, Bekah spent four months in Kenya, she saw women walking for six hours a day to find water. This personal interaction with water scarcity was heart breaking to observe. Bekah's southern Utah roots have also taught her the critical role of water in the landscape. She knows that rural places in Utah, like her home town of Bluff, are at serious risk of water scarcity if droughts become the norm. Growing up in Bluff, she had friends who lived on and near the Navajo reservation in homes without running water. Drought and water scarcity will directly affect places like Bluff by making irrigation water and water that is trucked in more expensive, and obligating people to rely on expensive and limited water supplies to continue their family tradition of agriculture and livestock raising. This threatens the ability of rural Utahns to take care of themselves, a tradition with deep roots in Utah's cultural heritage.

12. Claire Uno is a citizen of Utah who lives in Salt Lake City. One week before filing this petition, Claire gave birth to a baby boy, Max Tomio Uno. Claire is deeply concerned about the bringing Max into a world threatened by climate change, especially with state and local governments unwilling and unable to mitigate the threat. She also worries about the health effects of both climate change and poor air quality due to burning fossil fuels in the Salt Lake valley. Claire does not want to raise Max in Salt Lake, knowing that his lifespan may be cut short by as much as two years due to the poor air quality. In her professional life, Claire advocates for a sustainable local food supply. She worries that climate change will affect the growing seasons and availability of water to the point that it threatens agriculture in Utah on both the large and small scale. She wants her state government to plan for the future when managing its water, air and land resources.

13. Kevin Uno: Is a citizen of Utah who lives in Salt Lake City. He is 31 years old. Kevin is an earth scientist whose research focuses on climate change, landscapes, and mammals in the earth's past. Kevin's research has given him the opportunity to see how different atmospheric compositions have affected vegetation. He worries about how vegetation patterns will shift in response to the unprecedented levels of CO_2 in our atmosphere, and whether the shift in vegetation patterns will affect Utah's ability to produce food without irrigation. In his personal life,

Kevin enjoys being outside, whether it is on skis, a bike, or his own two feet hiking in Utah's wilderness areas. Last week, he and his wife, Claire, welcomed their first child, Max, into this world. Kevin would like Max to experience the natural world and be assured access to clean water, healthy food, and safe, clean air. In 2050, when the IPCC report projects that some of the worst effects of climate change will become evident, Kevin will be 70, and Max will be 39.

14. John Weisheit is a citizen of Utah who lives in Moab, Utah next to the Colorado River. John is 56 years old and has been a professional river guide for 32 years. He has shared his love and knowledge of the Colorado River unselfishly to thousands of people. Cumulatively, he has spent 15 years sleeping on its sandy beaches under starry skies. Climate change will affect the Colorado River basin more than any river in North America. John sees that the Colorado River has nothing left to give, yet the demand for its water ever increases, causing harm to the water quality of the Colorado River and its tributaries. The slow death of the Colorado River is something John has witnessed in his lifetime and he worries that the river will never be restored before his natural death, and future generations will never have the opportunity to see and understand the river as he remembers.

15. Paul Wickelson is a citizen of Utah who lives in Salt Lake City. When Paul considers the role that climate change will have on his life and his family, he thinks of one word: uncertainty. He worries about higher prices for food as weather patterns disrupt food supplies. He worries about resource scarcity triggering conflicts across the world, which could affect our national security and increase the possibility that his son, Otis, and other young people will be required to fight in wars triggered by resources scarcity. In Paul's mind, local and global are not distinct from each other, but are intertwined and interdependent because we all share the global commons and he believes that its disruption cannot be contained within artificial political borders.

16. Shea Wickelson is a citizen of Utah who lives in Salt Lake City. Shea teaches science to middle and high school students, including creative classes like food science and urban foraging. Shea intimately understands the critical ecosystem functions on which we rely for our food supply. She also understands how fragile those systems can be. The Jordan River runs through Shea's backyard, which includes a small plot of urban farm land. When the Chevron oil pipeline broke, the oil eventually flowed into the Jordan River. Shea and her family could smell the oil in their backyard. Shea and Paul Wickelson have a son, Otis, who will be two years old in June of 2011. They want him to grow up enjoying clean water, healthy food grown in their backyard, and faith in our political system of representative governance. In 2050, when the IPCC report projects that some of the worst effects of climate change will become evident, Otis will be 41 and Shea will be fifty-five.

17. Robert Wilson is a citizen of Utah who lives in Salt Lake City. Robert is 39. Two of his greatest passions are fishing and hunting waterfowl. He wants to be able to pursue these passions as long as he is physically able. He also wants to protect these sports for future generations. He is concerned that global warming may result in a loss of access to good waters and wetlands, to a loss of fish stock, and to fewer healthy birds. Robert wants to have fresh water from his tap, healthy food on his table, forests to explore, fish and wildlife for enjoyment and sport, snow for skiing, and a prosperous world that he can promise to his children.

18. Lauren Wood is a citizen of Utah who lives in Salt Lake City during the winter and works as a river rafting guide throughout southern Utah during the summer. Lauren is a sixth generation Utahn. Her family came to Utah as pioneers and to this day, they share a deep connection with the land. Lauren's grandfather founded the second oldest river rafting company in Utah. For the past three generations, this successful family business has shared Utah's natural beauty with vacationers willing to yield their fate to the grace and flow of the river as a part of their vacation. Lauren recognizes that she will not inherit the world that her grandfather enjoyed. The rivers that she rafts are threatened by current and proposed fossil fuel and nuclear development. With climate change, river flows will also become more uncertain, likely resulting in fast and furious spring runoffs that will dwindle to a trickle by mid-summer. These conditions threaten the viability of river rafting and threaten Lauren's opportunity to carry on the family business.

19. Steven ("Steve") Wood is a citizen of Utah who resides in Salt Lake City. He is 31 years old. As an artist and inventor, Steven wants Utah to reap the benefits of the current green industrial revolution. He wants Utah to promote sustainable jobs that will survive the impending shift away from a fossil fuel economy. Steve sees that Utah's current energy and environmental policies are making Utah woefully unprepared to deal with foreseeable problems due to climate change. Steve also worries that the policies will sacrifice Utah's opportunity to catch the growing economic gains of the green economy. Steve's family has suffered health problems associated with airshed degradation. Last year, two family members under 2 years old, a niece and a nephew, had to be hospitalized because their lungs could not absorb enough oxygen. Steve feels frustrated, because breathing is necessary for survival, but Utah's reliance on fossil fuels has blighted the air quality in the Salt Lake valley. When it comes to climate change, Steve wants the Utah government to show the same courage, fortitude, and prudence that his ancestors did when they settled in this valley. Just as they benefited from leadership and guidelines to adapt to life in a desert, he would like to benefit from astute leadership and science-based guidelines that address the foundations of Utahns' health—clean water, clean air, and food security. He believes that the task of our government is to form economic and energy policies that will thoughtfully and strategically move Utah into the future.

20. Nathan Zick-Smith is a citizen of Utah who resides in Salt Lake City. He is eighteen years old, with a full life ahead of him. He is concerned that if climate change continues unabated, it will limit the fullness of life that he could experience. Throughout his life, he hopes to spend days on end running, hiking, biking, camping, river rafting, and doing any other activity outside surrounded by the wild diversity of abundant life. He does not want to see rivers run dry or animal species become extinct, but if climate change continues unabated, he will. He does not want to see public land sold to oil and gas companies in the reckless pursuit of short term profit at the expense of his future on this great Earth. In 2050, when the IPCC report projects that some of the worst effects of climate change will become evident, Nathan will be 57.

III. APPROXIMATE WORDING OF THE REQUESTED RULE CHANGE

1. The petitioners request that the Utah Department of Environmental Quality adopt the following rule requiring an annual report of actual, or estimated actual, GHG emissions for the State of Utah, based on the best available data and modeling methods.[254]

    a. The Department of Air Quality shall compile information gathered through the Mandatory Reporting and Verification Rule, and using that information in combination with modeling, estimates, and voluntary information, publish an annual Emissions Inventory, reporting the GHG emissions of Utah by source category.

    b. The annual report shall be called the Utah GHG Emissions Report.

    c. The Utah GHG Emissions Report shall be published annually and be made available to the public on the internet no later than December 1 each year.

2. The petitioners request that the Governor of Utah, the Utah Department of Environmental Quality, the Utah Air Quality Board, the Utah Public Service Commission, and the Utah Department of Transportation create and adopt a binding GHG Reduction Plan, pursuant to their respective executive or rulemaking authorities.[255]

    a. Using the results of the Final Utah Greenhouse Gas Inventory conducted for the Blue Ribbon Advisory Committee on Climate Change (BRAC)[256] and taking into account the emissions reduction strategies evaluated in the

[254] For purposes of this request, and to reduce administrative implementation costs, the Department may choose to use methods similar or identical to those it has already developed for other kinds of emissions for purposes of compliance with section 110 of the Clean Air Act, 42 U.S.C. § 4210.
[255] For purposes of this request, and to reduce administrative implementation costs, the departments may choose to use methods similar or identical to those the Department of Environmental Quality has already developed for other kinds of emissions for purposes of compliance with section 110 of the Clean Air Act, 42 U.S.C. § 4210.
[256] *Utah's Greenhouse Gas Reduction Options*, *supra* note 211.

analysis performed by the Nicholas Institute for Environmental Policy Solutions for the State of Utah,[257] each agency shall develop and adopt a binding GHG Reduction Plan for activities within its jurisdiction that will reduce total GHG emissions by 6% annually until 2050, taking into account any increased emissions from new or expanded sources. The 6% reduction standard shall be reevaluated when scientific evidence shows that the annual reduction target must be reconsidered in light of the latest scientific data.

b. The GHG Reduction Plan shall be published and go into effect no later than January 1, 2012.

c. Each agency shall report its progress to the public annually. Each agency shall compile an "Effectiveness Report" comparing the actual GHG emissions from the past year by source category to the emission targets set by the GHG Reduction Plan. The Effectiveness Report shall be summarized in a simple graph that compares the GHG Reduction Plan to the actual annual emissions as reported in the GHG Emissions Inventory.

d. The Effectiveness Report shall be published annually on January 1.

e. Agencies shall take corrective action if the Effectiveness Report shows that actual GHG emissions from the year exceed the GHG Reduction Plan in order to be sure that Utah's emissions return to 1990 levels by 2050, with the ultimate goal of achieving an atmospheric concentration of 350 ppm CO_2 by 2100.

f. In the event that any of the above-listed agencies determine that they do not have adequate authority to adopt or enforce a binding GHG Reduction Plan, they shall evaluate and propose any statutory changes necessary to achieve 6% annual GHG emission reductions from the sources within their authority;

g. In the event that the above-listed agencies do not collectively have jurisdiction over sufficient activities to reduce Utah's aggregate GHG emissions by 6% annually, the Governor, with advice and assistance from the Department of Environmental Quality, shall identify such other state agencies as necessary to achieve that goal, and charge them with responsibilities equivalent to those laid out above.

3. The Petitioners further request that the following agencies initiate investigations into the potential effects of climate change on food supply, water resources, and health.

[257] *1993 Utah GHG Inventory*, *supra* note 215.

a. Department of Agriculture and Food: The Department of Agriculture and Food shall initiate and conduct an investigation into the following topics: (1) how climate change will affect agriculture and food production in Utah; (2) whether there are effective measures that can be implemented to protect Utah's food supply from disruption caused by climate change; (3) whether there are ways to increase production and agriculture in Utah by mitigating climate change; and (4) whether there are ways in which the agricultural industry can reduce annual carbon emissions by 6% as its contribution to mitigating climate change. The results of the investigation shall be published by January 1, 2012 and shall be updated periodically.

b. Utah Division of Water Resources: The Division of Water Resources shall initiate and conduct an investigation into the following topics: (1) how will climate change affect water resources in Utah?; (2) does climate change alter the accuracy of models used to predict future water resources; and (3) should Utah adopt a new, more accurate modeling scenario that takes climate change into account when considering future water resources? The results of the investigation shall be published by January 1, 2012 and shall be updated periodically.

c. Utah Department of Health: The Department of Health shall initiate and conduct an investigation into the following topics: (1) how will climate change affect the health of Utah citizens; (2) does climate change have the potential to increase the incidence or severity of epidemic, infectious, communicable, and other diseases or illnesses in Utah, taking into account disproportionate impacts to the children, the elderly, or other sensitive subpopulations as well as the population at large; (3) will the effects of climate change exacerbate risk factors that may cause injury, sickness, death, and disability within the state; (4) does the threat of climate change, and its predicted effects, pose a specific hazard that may affect the health and wellness of the population in Utah; (5) should rules be adopted or other actions be taken to mitigate the health risks and adapt to the health hazards associated with climate change? The results of the investigation shall be published by January 1, 2012, and shall be updated periodically.

IV. THE PROPOSED ACTION IS WITHIN THE AGENCIES' JURISDICTION AND APPROPRIATE TO THE AGENCIES' POWERS

1. The Governor of Utah and the petitioned agencies not only have jurisdiction, they have a legal obligation to adopt these rules in order to protect the stability of our climate as protected by the atmosphere, a public trust resource.

2. The Utah Constitution vests the executive power of the state in the Governor "to see that the laws are faithfully executed." Utah Const. Art. VII, Sec. 7(1).

The public trust doctrine is a part of Utah law,[258] and as such, it should inform the Governor's responsibility to faithfully execute the laws of the state.

3. The Utah Constitution also recognizes that "All political power is inherent in the people; and all free governments are founded on their authority for their equal protection and benefit." Utah Const. Art. I, Sec. 2. Therefore, the governor has authority to execute laws to protect the atmospheric public trust in order to ensure that the youth and future generations enjoy equal protection and benefit of the atmospheric public trust.

4. As part of the executive branch, agencies have delegated authority to protect the atmospheric public trust from waste.

5. If the Governor of Utah and the listed state agencies do not take expeditious and effective action to take responsibility for Utah's part to protect, preserve, and bring the Earth's atmosphere back into balance, future beneficiaries of the atmospheric public trust, the children in Utah and future generations of children will suffer continually greater injuries and damaging consequences. Continued inaction would be a violation of Utah's fiduciary obligation to protect our most precious public trust resource—a stable climate.

6. Just as a financial trustee's fiduciary duty is defined by the duty of loyalty and the duty of prudence, Utah's atmospheric public trust duty is defined by scientists' concrete prescriptions for carbon reductions that are necessary to maintain a stable climate. Scientists have determined that in order to minimize the extent of global warming and to avoid abrupt climate change, we must reduce the atmospheric concentration of carbon dioxide to 350 ppm by the end of this century.

7. As described poignantly by the interests of the Petitioners laid out above, the youth in Utah are already experiencing environmental, economic, physical, emotional, and aesthetic injuries as a result of Utah's failure to fulfill its obligation as a trustee. These injuries will only intensify if Utah continues to waste public trust resources. Once certain tipping points of energy imbalance and planetary heating have been exceeded, we will not be able to prevent or avoid the disruption of planetary systems on which we rely health, welfare, and sustenance.

8. In addition to authority arising out of the fiduciary obligation to properly manage public trust resources, including the atmosphere, the following agencies have statutory authority to adopt the proposed rule changes based on their organic statutes, as described below.

[258] *Nat'l Parks and Conservation Ass'n v. Board of State Lands*, 869 P.2d 909, 919 (Utah 1993); *Colman v. Utah State Land Bd.*, 795 P.2d 622, 635 (Utah 1990).

a. Public Service Commission: The Public Service Commission (PSC) has rulemaking authority to discharge the duties committed to it by law. Utah Code Ann. § 54-1-1. The rule requiring a GHG Reduction Plan falls squarely within the agency's authority because it is a long-range plan for developing and conserving Utah's utility resources in light of the threats associated with climate change. *Id*. § 54-1-10 ("The Public Service Commission shall engage in long-range planning regarding public utility regulatory policy in order to facilitate the well-planned development and conservation of utility resources."). Because it would be impossible to "facilitate well-planned development and conservation of utility resources" without acknowledging and responding to the risks posed by climate change, the request for a GHG Reduction Plan that reflects the best available science is within the authority of the PSC.

It is appropriate to ask the Public Service Commission to adopt a GHG Reduction Rule because the largest single source of Utah's GHG emissions is electricity use, accounting for 37% of total state gross GHG emissions in 2005.[259] The Legislature granted the Public Service Commission (PSC) power and jurisdiction to supervise and regulate every public utility in the state of Utah. *Id*. § 54-4-1. Among other things, the PSC has authority over corporations that supply gas, electricity, water, and heat. *Id*. § 54-2-1(16). The PSC also has authority to set just and reasonable standards, regulations, practices, and services that shall be followed by all public utilities including electrical, gas, and water corporations. *Id*. § 54-4-18. We therefore request that the PSC adopt a just and reasonable standard that all public utilities reduce their CO_2 emissions by 6% annually in order to prevent additional climate change.

It is also within the authority of the PSC to adopt a rule requiring the publication of the Effectiveness Report, comparing the GHG Reduction Plan with the actual annual emissions. *Id*. § 54-1-1.5. The PSC is required to prepare and submit an annual report to the Legislature and the Governor that includes facts, suggestions, and recommendations that the PSC deems necessary. *Id*. The most recent annual report did not mention climate change even though climate change is very important to developing a long-range plan for the development and conservation of resources.

b. Department of Environmental Quality: The Department of Environmental Quality (DEQ) has authority to "establish and operate programs, as authorized by [the Environmental Quality Code], necessary for the protection of the environment and public health from environmental hazards." Utah Code Ann. § 19-1-201(2)(d). The GHG Reduction Plan is a program that is necessary for the protection of the environment and

[259] *BRAC: Executive Summary*, *supra* note 204, at 4.

public health from the environmental hazard of climate change, therefore it falls within the authority of the DEQ. The authorization, within the Environmental Quality Code, for this type of program is evident because the GHG Reduction Plan falls squarely within the purposes of the code. The GHG Reduction Plan will help DEQ "provide effective, coordinated management of state environmental concerns." *Id*. § 19-1-102(2). Because the GHG Reduction Plan will avoid or mitigate harms to Utah's public health, agriculture, water supply, environment, wildlife, forests, and snowpack, it falls within DEQ's authority to "safeguard public health and quality of life" while considering benefits to public health, the impacts on economic development, property, wildlife, tourism, business, agriculture, forests and other interests, and the costs to the public and industry." *Id*. § 19010102(3). Therefore, the GHG Reduction Plan is the type of program authorized by the Environmental Quality Code.

It is also within the authority of the DEQ to adopt a rule requiring compilation and publication of the annual GHG Emissions Report. *Id*. § 19-1-201 (2)(c) (authorizing DEQ to "prepare, publish, and disseminate information to inform the public concerning issues involving environmental quality."). As described thoroughly in this petition, the GHG emissions of Utah are an issue involving environmental quality. For the same reason, the DEQ also has authority to adopt a rule requiring publication of the "Effectiveness Report."

c. Air Quality Board: The Utah Air Quality Board (AQB) is a policymaking board within the Department of Environmental Quality with authority to enact rules "regarding the control, abatement, and prevention of air pollution from all sources and the establishment of the maximum quantity of air contaminants that may be emitted by any air contaminant source." Utah Code Ann. §§ 19-1-106(1); 19-2-104(1)(a). The AQB also has authority to "prepare and develop a comprehensive plan or plans for the prevention, abatement, and control of air pollution in this state." *Id*. § 19-2-104(3)(e). According to the EPA, GHGs are pollutants.[260] Because the GHG Reduction Plan is a comprehensive plan for preventing, controlling, and abating air pollution, it falls squarely within the rulemaking authority of the AQB.

Furthermore, it is appropriate for the AQB to adopt a rule requiring a GHG Reduction Plan. Utah state policy is "to achieve and maintain levels of air quality that protect human health and safety, and to the greatest degree practicable prevent injury to plant and animal life and property, foster the comfort and convenience of the people, promote the economic and social development of this state, and facilitate the enjoyment of the natural attractions of this state." U.C.A. § 19-2-101(2).

[260] *EPA, Endangerment Finding*, *supra* note 2.

The purpose of the proposed rule is to achieve and maintain air quality by reducing GHG emissions at a rate of 6% annually in order to protect the public's health and safety by preventing and mitigating climate change. The purpose of the GHG Reduction Plan is to prevent injury to plant and animal life and property by mitigating the risks of drought, flood, wildfire, and pest infestations that may occur due to climate change. The rule also fosters the comfort and convenience of people and promotes the economic and social development of Utah by mitigating and reducing the risk of deaths caused by heat waves, thirst caused by water scarcity, and hunger caused by food supply disruption. Finally, the GHG Reduction Plan facilitates the enjoyment of the natural attractions of Utah by avoiding and mitigating the risk of species and habitat loss and reduced fish and aquatic life. Therefore, the AQB has ample authority and jurisdiction to adopt a rule requiring a GHG Reduction Plan.

d. Utah Department of Transportation: UDOT is responsible for planning, developing, and maintaining state transportation systems that are safe, reliable, environmentally sensitive, and serve the needs of the traveling public, commerce, and industry. U.C.A. § 72-1-201(4). Additionally, UDOT shall "establish standards and procedures regarding the technical details of administration of the state transportation systems as established by statute and administrative rule." *Id*. § 72-1-201(5). Emissions from transportation account for 24% of Utah's GHG emissions.[261] Transportation emissions continue to rise at an average rate of slightly over 3%. Between 1990 and 2005, onroad gasoline use grew by 45% and onroad diesel use more than doubled during the same period, while aviation use grew by 32%.[262] Obviously, reducing GHG emissions from transportation is critical for planning, developing and maintaining environmentally sensitive. However, mitigating climate change by reducing GHG emissions is also critical to maintaining a transportation system that is safe, reliable, and serves the needs of the traveling public. Unpredictable and intense weather events threaten the safety and reliability of the state transportation systems. Floods can wipe out roads, produce erosion or subsidence, and result in mudslides. Blizzards or unseasonable storms can produce traffic hazards, as well as shut down roads and airports. Therefore, UDOT has authority to produce and implement a plan for reducing GHG emissions from transportation within Utah.

Furthermore, reducing GHG emissions by reducing the number of vehicle miles traveled by commuters is consistent with the policy of this state. It is the policy of this state to "reduce the number of vehicle miles traveled, thereby reducing gasoline consumption" because heavy commuting burdens Utah's freeways, single occupant driving is the predominant mode of transportation used by commuters, and single

[261] *Utah GHG 2007 Inventory*, *supra* note 214, at 19.
[262] *Id*.

occupant driving is "the most costly and most excessive use of dwindling petroleum reserves," and the increasing cost of energy burdens commuters' work-related expenses. Utah Code Ann. § 72-12-102.

e. Department of Agriculture and Food: The Department of Agriculture and Food shall "inquire into and promote the interests and products of agriculture and its allied industries" U.C.A. § 4-2-2(1)(a). The Legislature also tasked the Department of Agriculture and Food with promoting "methods for increasing the production and facilitating the distribution of the agricultural products of the state." *Id.* § 4-2-2(1)(b). "The mission of the Utah Department of Agriculture and Food is to 'Promote the healthy growth of Utah agriculture, conserve our natural resources and protect our food supply.'"[263] It is in the interest of agriculture and its allies to understand how climate change may affect the production of agricultural products in this state. Changing weather patterns may affect germination and pollination. Flooding and droughts both harm crops, as would increases in pests and plant diseases. Rising temperatures affect the viability of certain crops, and increase water demand for others. Water scarcity will affect both irrigated and non-irrigated agriculture. Understanding how climate change will affect agriculture is also consistent with the Department's mission of promoting the healthy growth of Utah agriculture and protecting our food supply because there may be preventative actions that can be taken to avoid the disruption of our food supply. Therefore, the requested investigation falls squarely within the authority of the Department to "inquire into and promote the interests and products of agriculture and its allied industries" U.C.A. § 4-2-2(1)(a).

f. Utah Division of Water Resources: The Director of the Utah Division of Water Resources has the authority to "initiate and conduct water resource investigations, surveys and studies, prepare plans and estimates, make reports thereon, and perform necessary work to develop an all-over state water plan." U.C.A. § 73-10-19(2). Climate change will affect the water resources of Utah. As summarized by the BRAC Report, Utah can and should expect more droughts, more water scarcity, altered spring runoff, and changed water flow patterns. These changes affect the accuracy of predictions made by the Division of Water Resources as to the availability of future supplies of water. Therefore, understanding how climate change will affect Utah's water resources is critical the ability of the Division of Water Resources to fulfill its statutory function as "the water resource authority for the state of Utah." U.C.A. § 73-10-18. Understanding the effects of climate change is also critical to the mission of the Division of Water Resources, "Plan, Conserve, Develop, and Protect Utah's Water Resources" because inaccurate projections foil even the most ingenious

[263] 2010 *Utah Agriculture Statistics and Utah Department of Agriculture and Food Annual Report available at http://ag.utah.gov/news/publications/documents/10annualreport.pdf*

plans. Therefore, the requested investigation falls squarely within the authority and jurisdiction of the Division of Water Resources.

g. Utah Department of Health: The Department of Health shall promote and protect the health and wellness of the people within Utah. Utah Code Ann. § 26-1-30(2)(a). To fulfill this responsibility, the Department has extensive authority to investigate the causes of epidemics, infectious, communicable, and other diseases; to collect and report on causes and risk factors of injury, sickness, death; and to collect, prepare, publish and disseminate information to the public concerning specific hazards and risks that may affect the health and wellness of the population. *Id*. §§ 26-1-30(2)(c), (e), (f). Climate change and its predicted effects may harm public health. The BRAC report summarized likely effects as including deaths, disease, and injuries due to heat waves, extreme weather events, malnutrition (caused by crop failure), intestinal disease, and allergy-causing pollen. . . . Climate change will also alter the transmission of infectious disease such as cholera, malaria, and bubonic plague. The production of near-surface ozone and associated cardio-respiratory diseases is expected to increase."[264] The Department also has authority to take action to protect public health by adopting rules, abating nuisances, and abating public health hazards. *Id*. §§ 26-1-30(2)(b) & (j); *id*. § 26-1-12. In light of this authority, it is also within the jurisdiction of the Department to investigate and report whether it should exercise its rulemaking authority to mitigate the health risks and adapt to the health hazards associated with climate change.

[264] *BRAC: Scientific Consensus*, *supra* note 1, at 15; *Center for Global Health and Environment, Climate Change Futures*, *supra* note 54, *passim* (reporting how climate change will affect human health and how that will affect the economy).

V. CONTACT INFORMATION

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