Responses to Questions for the Record
Relating to 13 February 2019 Testimony on
"Climate Change and Public Lands: Examining Impacts and Considering Adaptation Opportunities"
Dr. Lara Hansen

1. Both your and Dr. Gonzalez's work and testimony suggests the need to protect more places from the dangers of climate change.

    a. As policy-makers, are there any places that we should prioritize for protection?

Climate change is already affecting natural and cultural resources and the human communities that depend on them, and is projected to continue for centuries to come. Impacts include loss of habitats and connectivity, shifts in animal and plant species distribution and abundance, alteration of natural communities, and significant changes in water availability and supply. Places to prioritize for protection in terrestrial systems include areas of climate refugia, wildlife corridors, enduring features, and headwater and groundwater sources. In particular, it is essential that we implement a portfolio of prioritization approaches to better cope with climate-related uncertainty. Protecting these places will help maintain habitat and species diversity, as well as the services they provide to people, over the long term.

Climate refugia, or areas relatively buffered from contemporary climate change over time, provide locations that species can retreat to, persist in, and potentially expand from under changing climate conditions.[1] Protecting areas of climate refugia can include identifying places that have remained relatively stable from historic to current conditions or places that are projected to remain stable with future climate change. For example, identifying places that have effectively maintained soil moisture levels over the last 100 years, even in the face of episodic droughts, or identifying places that are likely to continue to maintain adequate soil moisture levels even under hot and dry future climate conditions. Protecting wildlife corridors (both current and potential future routes) as well as habitat linkage areas (i.e. those places that connect intact or core habitats to one another) allows species to move across the landscape in response to changing conditions, helping to facilitate gene flow and decrease extinction risk. This could also include planning along latitudinal and elevational gradients. Enduring geophysical features (e.g., topography, soils, geology) seem to be the factors that help create species diversity in the first place.[2] Protecting areas with a diversity of geophysical features provides species and communities with the space to move and reorganize in response to climate change. Lastly, given the inherent uncertainty associated with precipitation projections (amount, timing, type), it is critical to prioritize the protection of our headwater and groundwater sources as it will help minimize the impacts of other non-climate stressors. Because the locations of many groundwater sources are currently unknown, an important first step will be providing the resources necessary to find and

[1] Morelli TL, Maher SP, Lim MCW, Kastely C, Eastman LM, Flint LE, Flint AL, Beissinger SR, Moritz C. 2017. Climate change refugia and habitat connectivity promote species persistence. Climate Change Responses 4(8).
[2] Lawler JJ, Ackerly DD, Albano CM, Anderson MG, Dobrowski SZ, Gill JL, Heller NE, Pressey RL, Sanderson EW, Weiss SB. 2015. The theory behind, and the challenges of, conserving nature's stage in a time of rapid change. Conservation Biology 29(3): 618-629

map these locations. It is also important to protect the area around these sites such that they are buffered and connected to the greater landscape.

b. How might we work with the federal land management agencies to identify and prioritize the protection of these places?

It is important to note that effective natural resources management includes a balance between "hands off" preservation of some natural areas and the conservation of natural areas for continued and sustainable use. While preservation efforts may be appropriate in protecting specific sites to eliminate all human activity, the vast majority of conservation efforts require some active management of natural lands to ensure the continued availability and use of ecosystem services, such as food, timber, water supply, and cultural heritage. This is particularly true for climate adaptation practices wherein reducing vulnerability to both climate and non-climate stresses (e.g., pollution, water and oil withdrawals) is key. Congress has several tools at its disposal to support natural resources management in a changing climate—legislation, appropriations, oversight, and public hearings.

Legislation. Congress can support climate-informed action by passing climate change legislation, creating amendments to existing legislation, integrating climate change into National Environmental Policy Act (NEPA) processes, and designating public lands that support climate change mitigation and adaptation goals. For example, Congress could create an amendment to the Coastal Zone Management Act, calling for the Coastal and Estuarine Land Conservation Program to not only protect coastal areas with "significant conservation, recreation, ecological, historical, or aesthetic values" (16 U.S. Code § 1456–1), but also to explicitly protect areas of climate adaptation significance (e.g., refugia, corridors). Congress should encourage all NEPA-related environmental analyses to consider both the effects of climate change on projects and the effects of projects on climate change (e.g., how a proposed project may exacerbate greenhouse gas emissions). A tool like the Climate Change Adaptation Certification[3] could be employed. In addition, Congress may designate public lands and review designations made by Executive Order to ensure that public lands maintain ecological functions and services in a changing climate. For example, Congress can create national monuments on public lands (e.g., Tule Springs Fossil Beds in Nevada) or review and reverse national monument decisions (e.g., Mount Olympus National Monument was re-designated as Olympic National Park in 1938[4]). Congress can establish other public lands—national parks, national conservation areas, wilderness areas—to support climate mitigation and adaptation efforts. These decisions may be made in consultation with federal land management agencies to ensure protection of sites that include climate refugia, wildlife corridors, enduring features, and headwater and groundwater sources.

Appropriations. Congressional appropriations should be viewed through a climate lens to ensure that the agencies, departments, and research programs most qualified and poised to meet the challenges of climate change are adequately funded. Sufficient budgets and staffing of federal agencies are needed to facilitate institutional capacity for climate action. Adequate funds also need to be available to support on-the-ground

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[3] Justus Nordgren, S. and L.J.Hansen. 2018. Climate Change Adaptation Certification. EcoAdapt. https://www.cakex.org/adaptation-certification

[4] National Park Service. 2018. Monuments List. National Park Service Archaeology Program, https://www.nps.gov/archeology/sites/antiquities/MonumentsList.htm

climate action by other governmental and nongovernmental entities. Congress can also eliminate riders that are contrary to climate mitigation and adaptation and conservation goals (e.g., blocking consideration of the economic costs of carbon pollution, repealing clean water rules). Congressional appropriations can be used to fund the scientific research, data collection, mapping, modeling, and staff time necessary to identify climate refugia, wildlife corridors and linkage areas, enduring features, and headwater and groundwater sources. Appropriations also allow federal land managers to manage the best they can; for example, while the majority of federal dollars goes towards fire suppression rather than prevention activities, most land managers recommend getting fire back onto the landscape through both natural and prescribed burns to better support ecological functions and reduce wildfire risk.[5]

Oversight. Congress can use its oversight powers to review, monitor, and otherwise supervise federal agencies, programs, and activities to ensure that climate change mitigation and adaptation are adequately integrated. For example, Congress can hold polluters accountable for carbon emissions and other sources of pollution. Reducing these non-climate stresses, many of which can exacerbate the effects of climate change (e.g., temperature affects the toxicity of various chemicals[6]), increases overall resilience.

***Public Hearings*.** Congress can give a voice to the land managers and everyday Americans experiencing climate change on the ground. In addition to inviting scientists to present their findings, we would encourage you to amplify the voices of the managers of these public lands who are making the everyday decisions in light of climate change as well as the administrative restrictions they are under. Part of EcoAdapt's role as climate adaptation facilitators is to identify the ways in which managers can make modifications to current practices and co-produce (with the relevant stakeholder communities) new, innovative strategies to address the climate challenge. No one is more passionate about protecting public lands than the people who work on them every day. Giving them the space to share their challenges, needs, and successes will be critical to informing federal action.

2. Dr. Hansen, when you say "protection adequate and appropriate space for ecosystems to function under changing condition" what kind of actions would that include

    - This means protecting ample space for **ecosystem services** such as hydrological function under changing precipitation patterns. For example, what are the new requirements the recharge of groundwater or flow of surface water.
    - This means protecting locations that appear to be climate **refugia**, meaning those locations that are changing less quickly and may afford natural systems the ability to respond on their own.
    - This means supporting **connectivity** across landscapes so species (animal and plant) can move in response to changing climatic conditions. This includes thinking about latitudinal and elevational gradients.

[5] Gregg RM, Behan J, Gaines LJ, Reynier R, DeCrappeo N, Fiegener R. 2016. Available Science Assessment Project: Prescribed Fire and Climate Change in Northwest National Forests. Report to the Department of the Interior's Northwest Climate Science Center.

[6] Gregg RM, Hansen LJ, Feifel KM, Hitt JL, Kershner JM, Score A, Hoffman JR. 2011. The State of Marine and Coastal Adaptation in North America: A Synthesis of Emerging Ideas. EcoAdapt, Bainbridge Island, WA.

- This means keeping systems as **intact** as possible so natural diversity can allow for the greatest number of potential response avenues.
- This means designing **restoration** efforts for not only current and future conditions, not reach for a past that cannot exist again given the elevated levels of carbon dioxide in our atmosphere.

3. Dr. Hansen, in your testimony you mentioned that we need to provide our agencies with clear, informed mandates to begin preparing for climate change.

    a. Has this administration provided these?

In short, no. The administration has intentionally and systematically worked to eliminate or repeal climate-informed mandates, policies, and regulations. Furthermore, federal climate programs have been defunded or dismantled, and scientific advisory groups dedicated to advising the federal government on best approaches to prepare for and respond to climate change have been disbanded[7].

This administration has taken more than 70 actions aimed at removing or altering environmental and climate mandates, regulations, and policies[8]. From international actions, such as announcing the withdrawal from the Paris Climate Accord, to revoking an Obama-era Executive Order setting Federal Flood Risk Management Standards, climate mandates put in place by previous administrations are under attack. Under the explanation of streamlining the approval process for building infrastructure, the current administration signed an Executive Order eliminating Obama-era planning step to make roads, bridges and buildings more resilient to climate and flood dangers. The current administration has also dissolved the federal advisory panel for the National Climate Assessment, a group that helps policymakers and private-sector officials incorporate the government's climate analysis into long-term planning. In addition, the EPA and Department of Interior have followed suit, with the EPA dismissing dozens of scientists from their Board of Scientific Counselors and Interior is not renewing the charters of numerous scientific advisory panels. Beyond these actions, the agencies are failing to enforce existing regulations and limiting enforcement mechanisms by others.

The loss of adaptation resources (and government services in general) is further exacerbated by recent changes in funding streams through changing tax law. Reduced federal tax revenue will result in further cuts to federal programs, and changes in state tax deductions will likely erode local tax revenue streams. With state and local programs being touted as the backstop to lost federal action this may undermine that potential. Should charitable contribution tax deductions be changed that would also undermine NGO adaptation activities, leaving American society with little access to information or support as it faces the perils of climate change.

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[7] www.washingtonpost.com/news/energy-environment/wp/2017/08/20/the-trump-administration-just-disbanded-a-federal-advisory-committee-on-climate-change/?utm_term=.5d89df6ed69d

[8] https://www.washingtonpost.com/graphics/politics/trump-rolling-back-obama-rules/?utm_term=.0aec397d6676

b. What type of mandates might we give to help the Government begin to address the impacts of climate change?

Through EcoAdapt's State of Adaptation Program, we have found that the leading motivations for adaptation action on public lands is clear agency mandates, laws, and policies.

We recommend mandates focus on:

1) Changing goal of public land management from short-term, multi-use industry concerns to a focus on the maintenance of the long-term health of our public lands for ecosystem services (which themselves have strong fiscal value) and public health. This shift in focus will enable agencies to embrace and prioritize planning for long-term uses including insurance against the effects of climate change, over short term uses that often exacerbate climate change. We should definitely ensure that our public lands are not being used to make climate change worse by increase greenhouse gas emissions either through fossil fuel extraction or unmitigated use.

2) Focus on science, research, and techincal experts
   - Prioritization of science and research is crucial because most agencies current mandates direct them to use the best available science. This science needs to reflect current and up to date understanding of current and future climate conditions and the implications of those conditions.
   - Techinical experts are curucial to moving beyond research and planning into implementation. Without specific and clear direction from technical experts, federal mandates will not translate into effective on-the-ground actions.

3) Require agencies to capture, share, and translate climate adaptation knowledge
   - Capture and Share: Most crucial to on-the-ground adpatation success are lessons learned from practitioners around the field. Given the scope of the lands managed by federal agencies, these managers play a key role in building and advancing the field of adaptation.
   - Translation and synthesis: Managers often cite relevance, scale, and context as a barrier to the usablity of climate science. Translation, or knowledge brokers, of climate science and adaptation research such as the Climate Adaptation Knowledge Exchange (CAKE), are vital to ensure on the ground managers have access to digestable and actionable information.

4) Require all phases of the adaptation process (assessment, planning, implementation, monitoring and evaluation) as well as thorough reporting on progress (including successes, failures, and modified approaches or lessons learned).

- Include thorough reporting/oversight processes on progress including successes and failures, and modified approaches.
- Reported progress should be tied to previous planning phase (e.g. planning should be tied to reducing vulnerability identified in assessment phase).
- Mandate needs to identify accountablilty for progress, as well as highlight champions and leadership.

Finally, mandates need to be coupled with climate adaptation capacity at the agency and external partner level, appropriations and funding, and accountability and oversight. This means that federal staff need appropriate training in climate change adaptation, which is often required through professional continuing education opportunities as much of the federal workforce has no formal training in this area of science and management practice. This should be supported through the National Conservation Training Center, Sea Grant, a national adaptation extension service, and other venues such as the National Adaptation Forum. Congress must ensure that there is sufficient funding to not only support training of federal staff, but the funding for sufficient staff and the inclusion of funds to design, implement, monitor and share adaptation actions.

4. Dr. Hansen, you suggest in your testimony that federal funding for project that don't account for climate change is often money misspent.
    a. Can you please elaborate on this claim?
    When climate change is not recognized, and a project (or policy) is design or implemented without explicitly considering the implications of climate change, the project (or policy) is vulnerable to the effects of climate change. When those vulnerabilities become realities the climate uninformed project (or policy) will no longer be effective. It will then need to be repaired, replaced, removed or repeated elsewhere. This means that the initial projected or policy was taxpayer dollars not delivering the outcome they paid for.
    Additionally, citizens, businesses, communities and ecosystems may incur harm from the project (or policy) that did not deliver on its intended and advertised outcome.

    There are at least two major categories in by which this can happen.
    1. Funds (or federal employee effort) are expended in a manner that assumes conditions today are the same as they were in the past and will not change in the future. As a result, the work will not garner the desired effects given the reality that climate change will mean that today is different from yesterday and tomorrow will be different than today. For example, consider a coastal infrastructure investment such as a road, an estuary restoration project, or a coastal sewage treatment plant that are designed without taking sea level rise projections (relevant to the project lifetime) into account. You could also consider building standards or land use management in increasingly fire prone regions that does not take into account the increasing risk therefore

putting new structures, communities and associated ecosystems at risk. You could also consider changing frequencies of flood events, wherein older flood projection maps continue to be used to make land use decisions or allow for the use of FEMA funds to rebuild in harm's way—again putting people, property, business and government function at risk.

Uninformed decisions such as all of these (and many more) may result in either the need to spend additional funds to redesign the project when the vulnerability becomes an "event" that renders the project ineffective. For example, the restoration project fails because the site is inundated or the species used for the project has moved out of the region as temperatures change. Similarly, if a road is inundated it may require a sea wall, drains or pumps; or it may require that the road is moved to an entirely new location. In all cases there is an additional expenditure of funds to provide the same service as the initial outlay before the lifetime of the project should have ended.

2. Funds are not spent to address the challenges of climate change leaving existing efforts vulnerable to the impacts of climate change. Often there are existing investments or resources that need new actions to protect them. This can include creating living shorelines to protected coastal infrastructure, funding the application of prescribed fire to protect our forest lands, upgrading culverts and bridges to avoid flood and erosion damage, funding enforcement to protect natural habitats and species from illegal poaching and destruction.

b. How do we best ensure we're getting a fair return on taxpayer funded infrastructure projects?

First of all, it is not just infrastructure projects that may be vulnerable to these issues. The simplest path to this is to both build the capacity of federal agency staff and Congress about climate science and adaptation, and to create explicit review mechanisms that require evaluation of the implications of climate change on any federal expenditure, project or other action. Using a tool such as the Climate Change Adaptation Certification,[9] provides a structure for how to do this, along with direction to readily available climate science to use in the evaluation, and a structure around how to make decisions based on what this analysis indicates. This is very similar to how current analyses are done to the financial or environmental impact of a project (or policy).

[9] Justus Nordgren, S. and L.J. Hansen. 2018. Climate Change Adaptation Certification. EcoAdapt. Bainbridge Island, WA. www.CAKEx.org/Adaptation-Certification