

Testimony for the House Subcommittee on National Parks, Forests and Public Lands  
on  
Climate Change and Public Lands: Examining Impacts and Considering Adaptation  
Opportunities

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Protecting our public lands is a critical part of an adaptation strategy that not only safeguards these areas and the ecosystems that inhabit them, but also the ecosystem services upon which our citizens rely. Investment in the protection of public lands may be our best path to enduring access to clean air, clean and plentiful water, flood control, wildlife habitat, improved mental health, spiritual heritage, and recreational enjoyment. In my testimony I will introduce you to the ways by which we can increase the resilience of our public lands in the face of climate change and what we need to make this happen.

I would like to begin by providing some context. I am the head of a non-profit organization that is filling a very large gap—creating a climate-savvy society by innovating, facilitating and training practitioners in adaptation solutions. EcoAdapt’s<sup>1</sup> sole focus is to “meet the challenges of climate change.” That means helping everyone from foresters and marine protected area managers to city planners and public health officials apply a climate lens through which to evaluate their work and develop solutions that will allow them to succeed in meeting their mandate even as the world is changing around them. We do this through four programs. Our **State of Adaptation** program takes a research approach to assessing what activities people are undertaking, what is working and what is preventing success. Our **Climate Adaptation Knowledge Exchange**<sup>2</sup> is the largest adaptation resource database. It is available via an online, open access portal (CAKEx.org) that is accessed by thousands of people from around the world each month. **Awareness to Action** is our workshop methodology that has provided hands-on training in climate change adaptation to over 6,000 individuals representing hundreds of organizations and agencies across the country (and a few around the world). Finally, our **National Adaptation Forum**<sup>3</sup> is a biennial convening of adaptation professionals that affords the opportunity for the exchange of ideas and the innovation of the next generation of climate solutions.

In the past ten years, my team at EcoAdapt has learned a lot about good adaptation practice—on the ground and through government support. I’d like to share some of that with you today. My hope is that you will see the importance of supporting this type of work in your own Districts and

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<sup>1</sup> <http://ecoadapt.org/>

<sup>2</sup> <https://www.cakex.org/>

<sup>3</sup> <https://www.nationaladaptationforum.org/>

through the federal mechanisms that can help to make all of our lands and communities climate savvy. Because the effects of climate change that are being felt today will continue and intensify for centuries or millennia to come, every day we are afforded the opportunity to make management and planning decisions that either help us prepare for these changes or leave us more and more vulnerable. Let's take the path that leads to a better future. A path on which we take both mitigation (reducing the greenhouse gases that cause climate change) and adaptation (preparing for and responding to the climate change impacts that are unavoidable due to past emissions) seriously. These are not choices to be played against each other—both are necessary responses to climate change. Doing one without the other will lead us to a false sense of failure.

Ignoring climate change in the management of National Parks, forests and other public lands is not an option. It was not an option the first time I testified before a Congressional committee (Senate Committee on Commerce, Science and Transportation) in March of 2004, almost exactly 15 years ago, when atmospheric CO<sub>2</sub> was 378 ppm and global temperature had increased 0.6 degrees Celsius. Yet we did not take action. It was not an option when I testified in 2007 to the Senate Committee on Commerce, Science and Transportation's Subcommittee on Oceans, Atmosphere, Fisheries, and Coast Guard, when atmospheric CO<sub>2</sub> was 386 ppm. And still we did not change our trajectory. Today atmospheric CO<sub>2</sub> has reached 410 ppm and global temperature has risen one degree Celsius. I am back today hoping that we are ready to fully address this massive problem with the level of action it requires. The best place to start is somewhere, so let's start by taking action on our public lands.

## **How can we increase the resilience of public lands in the face of climate change?**

Public lands are the places where plants and animals thrive, where they have the space to move and grow. They are vital for providing intact ecosystems and connectivity, supporting high biodiversity and healthy species. Public lands also provide critical ecosystem services upon which neighboring and non-neighboring communities, non-local visitors, and others have come to rely. In particular, public lands provide abundant fresh water for human and environmental uses; building materials and other wood products; forage for livestock; clean air; water filtration and maintenance of water quality; protection from wildfire, floods, and erosion; carbon sequestration; recreational opportunities; aesthetic values from scenery; spiritual and religious values; and cultural heritage.

Climate change presents a significant threat to our public lands and the services that they provide. Resilient public lands enable species and ecosystems and the services they provide to rebound in the face of rapid environmental change. We can increase the resilience of public lands by implementing a number of well-understood practices, including incorporating climate change impacts and adaptation into all planning efforts, improving regional coordination, assessing the effectiveness of adaptation actions and implementing those that represent the "best bets" under changing climate conditions, protecting adequate and appropriate space, reducing local and regional climate change and non-climate stressors, and reducing the rate and extent of climate change. **By implementing these practices, we are safeguarding the species, ecosystems, and services that we not only hold dear but are essential to our way of life.**

**Incorporate climate change impacts and adaptation into all planning efforts.** Incorporating climate change into planning efforts can take the form of discrete “climate action or adaptation plans” or the direct integration of climate change into existing planning processes. For example, through our vulnerability assessment and adaptation planning methodologies, EcoAdapt helps natural resource managers from state and federal agencies evaluate how the species and habitats they manage are vulnerable to climate change, reassess and revise their current actions and projects to address vulnerabilities, and identify new actions to integrate into future projects. Some examples include work in California and the Hawaiian Islands.

EcoAdapt, in collaboration with numerous other partners, worked with the Greater Farallones National Marine Sanctuary (located along the north-central California coast and ocean) to evaluate vulnerability of their species, habitats, and ecosystem services to climate change and create a Climate Adaptation Plan.<sup>4</sup> The region’s natural resources and the services they provide are vulnerable to increasing ocean temperatures, sea level rise, and extreme weather events (winds, waves, storms). The plan integrates climate adaptation into existing management frameworks and recommends over 75 adaptation strategies for regional management agencies to take to enhance coastal resilience, including implementing living shorelines, protecting and restoring habitat, limiting human disturbance, addressing invasive species, promoting education, and investing in science needs.

In Southern California, EcoAdapt worked with natural resource managers to re-examine the Ojai Community Defense Zone Project, which planned to restore and expand fuel-breaks in chaparral habitats adjacent to multiple human communities.<sup>5</sup> Chaparral habitats, as well as adjacent communities, are vulnerable to increased wildfire severity and increased extreme precipitation events projected under climate change. Increasing human populations may exacerbate these impacts, as fire ignitions in the region are primarily human-caused. While a number of existing management actions help to alleviate climate impacts, resource managers identified new actions to integrate into future projects. For example, planting native perennial grasses within fuel-breaks to reduce invasive grass establishment (invasive grasses contribute to more severe wildfires) and establishing trigger points for recreation closures and restrictions (helps reduce the number of human-caused ignitions).

In Hawaii, after going through a vulnerability assessment-adaptation planning process<sup>6</sup> with EcoAdapt, managers from the Plant Extinction Prevention Program decided to shift the amount of seeds they plant vs. store in response to projected climate threats such as increased drought risk and altered precipitation amount and timing.

**Improve regional coordination.** Improving coordination helps increase the resilience of public lands and associated ecosystem services by providing opportunities to leverage resources (e.g.,

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<sup>4</sup> Hutto, S. 2016. Climate-Smart Adaptation for the North-central California Coast and Ocean. Ed. Rachel M. Gregg [Case study on a project of the Greater Farallones National Marine Sanctuary]. Retrieved from CAKE: <https://www.cakex.org/case-studies/climate-smart-adaptation-north-central-california-coast-and-ocean>

<sup>5</sup> Kershner, J.M., L.E. Hilberg, and W.A. Reynier. 2017. The Ojai Community Defense Zone Project: A Southern California Climate Change Adaptation Case Study. Retrieved from CAKE: <https://www.cakex.org/case-studies/ojai-community-defense-zone-project-southern-california-climate-change-adaptation-case-study>

<sup>6</sup> Gregg, R.M., editor. 2018. Hawaiian Islands Climate Vulnerability and Adaptation Synthesis. EcoAdapt, Bainbridge Island, WA. <http://bit.ly/HawaiiClimate>

funding, data, people time), building buy-in and support for plans and on-the-ground projects, improving communication about planned and ongoing activities, and providing a shared understanding of threats, solutions, and priorities. For example, the Flagstaff Watershed Protection Project is a partnership effort between the State of Arizona, City of Flagstaff, and Coconino National Forest to help reduce the risk of devastating wildfire and post-fire flooding in neighboring watersheds.<sup>7</sup> In 2010, the Schultz Fire in Coconino National Forest severely burned thousands of acres of steep terrain; over 20 major flash flooding events occurred after the fire, destroying community drinking water and costing over \$130 million in damages. Increased fire severity and extreme precipitation events are projected to continue with climate change, requiring targeted forest restoration work and collaboration to reduce the risk of fire and flooding and subsequent impacts on the community. This project is one of only a handful of examples where restoration work on a national forest is being funded primarily by a municipality. The Northern California Climate Adaptation Project is a multi-stakeholder, collaborative effort to assess the impacts of climate change on and co-develop adaptation strategies and actions for habitats and species of northwestern California.<sup>8</sup> The USDA Forest Service and Bureau of Land Management manage over 6 million acres of public lands in the region, and plan to use findings from this project to inform revisions of their land management plans. Many tribes occur within or around these public lands and are affected by management decisions made by these two entities. Tribal input and participation have been critically important in this project, helping to identify potential conflicts with adaptation options. For example, increasing the use of prescribed burning reduces the likelihood of high-severity wildfires (a current and future threat to the region) however, increased burning in the spring has the potential to conflict with cultural values and site use during the season. Explicitly incorporating tribal considerations into adaptation planning can help build buy-in for management actions on public lands and enhance the resilience of neighboring tribal communities.

**Assess adaptation effectiveness.** The importance of making informed decisions to alleviate the environmental, financial, and emotional costs of climate change cannot be overstated. Climate change presents a variety of impacts to which managers and planners must respond, ranging from habitat restoration and designation of protected areas to increased public education and outreach and broad policy changes. Several adaptation case studies and guidebooks have been released in recent years with recommendations of suitable adaptation actions to address different climate impact concerns. However, determining when, where and how a particular action may be best implemented is more difficult to discern. Synthesizing what has worked and what has not worked, as well as why, can help identify potential modifications to current management practices and facilitate understanding of the consequences of decisions. Further, science- and evidence-based decision-making supports better management outcomes, while reducing costs and lowering the risk of implementing policies that may be based on well-intentioned but insufficient research. In addition to improving overall practice, a better understanding of which actions can be most effectively applied in different settings helps managers identify and leverage funding opportunities and create new or enhance existing partnerships to advance climate adaptation. Evaluating the science behind management approaches of the past to determine their usefulness under changing climate conditions is an evolving area of research by EcoAdapt. We have embarked on an effort to evaluate the body of scientific knowledge supporting specific

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<sup>7</sup> Flagstaff Watershed Protection Project: <http://flagstaffwatershedprotection.org>

<sup>8</sup> Northern California Climate Adaptation Project: <http://ecoadapt.org/programs/adaptation-consultations/norcal>

climate adaptation actions to determine the conditions under which particular actions may be most effective for achieving management goals. Since 2014, we have assessed wildfire, sea level rise, and ecological drought adaptation options.

**Protect open space.** Protecting adequate and appropriate space, including identifying and protecting areas of climate refugia (places with more stable climatic conditions, current and/or future), connectivity and corridors, and/or the geophysical setting continues to be a critical strategy for increasing the resilience of public lands.<sup>9,10</sup> Protecting habitats and areas of refugia provide a safe haven that species can retreat to and/or persist in under climate change, and ensures that important ecosystem services continue to be available. For example, protecting habitats such as headwater streams or groundwater sources may be critical for maintaining water supply that human communities depend on. Similarly, protecting geophysical settings may help maintain regional biodiversity with climate change.

**Reduce local and regional climate change, as well as non-climate stressors.** Reducing local and regional climate change and minimizing non-climate stressors are key to increasing the resilience of public lands.<sup>11</sup> In some cases, it may be possible to reduce local or regional climate changes. For example, replanting riparian vegetation along streams can limit water temperature increases and help keep water in the system. Non-climate stressors have the potential to exacerbate (or be exacerbated by) climate impacts. For example, invasive grasses alter the availability and continuity of fire fuels, contributing to more severe wildfires.

Restoration of habitat structure, function, and processes continues to be one of the best ways to address both climate and non-climate stressors. However, it is not enough to engage in restoration activities as we have done in the past and, in fact, “restoring” ecosystems to some former state will likely make them ill-equipped to deal with the challenges of climate change. Instead, restoration activities now need to be designed with climate impacts integrated from the start. For example, planting drought-tolerant native species in areas projected to get drier rather than planting the species that have historically been there under wetter conditions, or implementing a landscape-scale approach that combines thinning, prescribed burning, and managed wildfire to reduce tree densities and understory vegetation in an area projected to see more high-severity fires, rather than relying only on forest thinning.

Wildfires, particularly in the West, are increasing in frequency and severity. With increasing air temperatures and decreasing summer soil moisture levels, the probability of widespread, catastrophic wildfires continues to rise, threatening habitats, species, and public health and safety.<sup>12,13</sup> Several approaches are used to manage wildfire risk, including prescribed fire,

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<sup>9</sup> Hansen, L.J. and J.R. Hoffman. 2011. *Climate Savvy: Adapting Conservation and Resource Management to a Changing World*. Island Press, Washington DC.

<sup>10</sup> Hansen, L.J., J.R. Hoffman, C. Drews and E.E. Mielbrecht. 2010. Adapting conservation to climate change. *Conservation Biology*, 24:63-68.

<sup>11</sup> Hansen, L.J. and J.R. Hoffman. 2011. *Climate Savvy: Adapting Conservation and Resource Management to a Changing World*. Island Press, Washington DC.

<sup>12</sup> Westerling, A., H. Hidalgo, D. Cayan, and T. Swetnam. 2006. Warming and earlier spring increase western U.S. forest wildfire activity. *Science* (313)5789: 940-943. DOI: 10.1126/science.1128834

<sup>13</sup> Gregg, R.M., J. Behan, L.J. Gaines, W. Reynier, N. DeCrappeo, and R. Fiegenger. 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.

thinning, mechanical fuel treatments, and wildfire managed for multiple objectives. For example, prescribed fire has been used for decades to reduce fuel loads, promote more open and diverse forest structure, maintain or increase biodiversity, and preserve defensible space around infrastructure and human communities.<sup>14</sup> As a climate adaptation action, prescribed fire reduces the risk of catastrophic or stand-replacing fire by targeting and reducing surface and ladder fuels, allows for the re-introduction of natural fire regimes, and prepares the landscape for the re-establishment of fire-tolerant native species that may be better adapted to shifting fire regimes.<sup>13,15</sup> Managers are already modifying their use of prescribed fire in responses to changing conditions, such as earlier spring burn windows, although institutional and sociopolitical constraints, such as a lack of funding and trained staff, liability issues, and public acceptance of smoke, limit its application across the landscape.<sup>13</sup>

In coastal systems, sea level rise is causing saltwater intrusion into freshwater ecosystems and aquifers, habitat conversion, infrastructure loss, and in some cases, forced relocation of coastal communities, such as in Alaska (e.g., Native Alaska Villages of Kivalina and Newtok) and Washington State (e.g., Hoh Tribe). The primary adaptation approaches employed to address sea level rise, flooding, and erosion issues include: engineered structures (rip rap, bulkheads, tide gates), natural and nature-based approaches (natural habitats such as wetlands or engineered natural features such as living shorelines), and policy and regulatory techniques (tools that either prevent infrastructure in at-risk areas, such as conservation easements, managed retreat; or modify how activities are implemented to reduce risk such as rolling easements, minimum development buffers, real estate disclosures).<sup>16</sup> Natural and nature-based approaches are being increasingly used throughout the United States, especially in lieu of structural approaches that are experiencing limited and declining use, largely due to their cost, lifetime, and the potential for negative ecological consequences.<sup>16</sup> New and novel approaches, including prioritizing, protecting and restoring coastal wetlands with room to migrate inland as sea levels rise, as well as purchasing inland/upland land to create new opportunities for coastal habitat migration, are also important.<sup>16</sup>

**Reduce the rate and extent of climate change.** Decreasing greenhouse gas emissions, planting trees, restoring vegetative cover, and preserving open space can help to reduce climate change. If we are looking for solutions to climate change, ending fossil fuel extraction from public lands is a fine place to start. For every barrel of oil not extracted from U.S. public lands, it has been estimated that global demand decreases by half a barrel, leading to a reduction in U.S. emissions of 280 million tons annually by 2030.<sup>17</sup> This is the essential climate change mitigation role for our public lands. Fossil fuels left in the ground will not be entering our atmosphere as greenhouse gases, however the carbon storage potential of biological carbon is not so certain. For

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<sup>14</sup> Scott, G., M.F. Mahalovich, S. Rinehart, and J. Krueger. 2013. Reforestation-Revegetation Climate Change Primer: Incorporating Climate Change Impacts into Reforestation and Revegetation Prescriptions. U.S. Department of Agriculture, Forest Service, Northern Region.

<sup>15</sup> Spies, T.A., T.W. Giesen, F.J. Swanson, J.F. Franklin, D. Lach, and K.N. Johnson. 2010. Climate change adaptation strategies for federal forests of the Pacific Northwest, USA: ecological, policy, and socio-economic perspectives. *Landscape Ecology* 25(8): 1185-1199.

<sup>16</sup> Gregg R.M., W. Reynier, L.J. Gaines, and J. Behan. 2018. Available Science Assessment Process (ASAP): Sea Level Rise in the Pacific Northwest and Northern California. Report to the Northwest Climate Adaptation Science Center. EcoAdapt (Bainbridge Island, WA) and the Institute for Natural Resources (Corvallis, OR).

<sup>17</sup> Erickson, P., and M. Lazarus. 2018. Would constraining US fossil fuel production affect global CO<sub>2</sub> emissions? A case study of US leasing policy. *Climatic Change* 150: 29-42.

example, the carbon storage of coastal wetlands decreases significantly as sea levels rise, drown existing wetlands, and release carbon back into the atmosphere<sup>18</sup>.

### **How are adaptation efforts on public lands threatened?**

Despite the urgent need for climate-informed action, the science and practice of adaptation in the United States is at risk from recent intentional and systematic disruptive actions. Public lands are threatened by energy development interests, and federal climate programs and regulations are being defunded and dismantled.

Energy development and mining interests—oil, gas, coal, uranium, vanadium, cobalt—have driven the reduction of boundaries of Bears Ears and Grand Staircase-Escalante National Monuments by 85% and 45%, respectively. Bears Ears in particular is rich with cultural significance for Native Americans, featuring over 100,000 well-preserved cultural and archaeological sites. It is an area that is more than tracts of land—it is a profoundly sacred place of spirituality and subsistence. Bears Ears is also home to forests, grasslands, and headwaters, and 18 species listed under the Endangered Species Act, including the California condor and greenback cutthroat trout.<sup>19</sup> A recent study found that this area provides unrivaled ecological connectivity, which is essential for species resilience as well as biodiversity and ecological function preservation in a changing climate.<sup>19</sup> The Navajo people describe such intact landscapes as *Nahodishgish* or “places to be left alone.”<sup>20</sup>

In 2009, President Obama enacted Executive Order 13514, which mandated the evaluation and assessment of vulnerabilities that climate change may pose to federal agency operations and missions, as well as the creation and implementation of agency-specific climate adaptation plans. During that Administration’s tenure, many federal agencies and departments developed individual plans and policies, and collaborated through interagency working groups to facilitate funding of climate science and adaptation projects, resources, and tools to support on-the-ground action by other governmental and nongovernmental entities. Over the last two years, there has been a notable shift in the support for federal action on climate change, largely due to a growing politicization of science by elected and appointed officials. Federal regulations have been dismantled, climate programs defunded, and critical climate resources and tools removed, altered, or obfuscated, all of which directly impacts the country’s ability to prepare for, respond to and recover from the effects of climate change. In addition to the threatened withdrawal of the United States from the Paris Agreement under the United Nations Framework Convention on Climate Change, numerous Executive Orders have been enacted to roll back climate policies (e.g., reversal of the Federal Flood Risk Management Standard, requiring federal agencies to account for sea level rise in building infrastructure; Executive Order 13693 on Planning for Federal Sustainability in the Next Decade was revoked in May 2018<sup>21</sup>). In 2017 alone, the

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<sup>18</sup> Thorne K, MacDonald G, Guntenspergen G, Ambrose R, Buffington K, Dugger B, Freeman C, Janousek C, Brown L, Rosencranz J, Holmquist J, Smol J, Hargan K, Takekawa J. 2018. U.S. Pacific coastal wetland resilience and vulnerability to sea-level rise. *Science Advances* 4:eao3270

<sup>19</sup> Dickson, B.G., M. McClure, and C.M. Albano. 2017. A landscape-level assessment of conservation values and potential threats in the Bears Ears National Monument. A report to The Center for American Progress. [http://www.csp-inc.org/wp-content/uploads/2017/03/CSP-BENM\\_Landscape\\_Assessment\\_032717.pdf](http://www.csp-inc.org/wp-content/uploads/2017/03/CSP-BENM_Landscape_Assessment_032717.pdf)

<sup>20</sup> Bears Ears Coalition. 2016. Bears Ears: A Native perspective on America’s most significant unprotected cultural landscape. [http://www.bearscoalition.org/wp-content/uploads/2016/03/Bears-Ears-bro.sm\\_.pdf](http://www.bearscoalition.org/wp-content/uploads/2016/03/Bears-Ears-bro.sm_.pdf)

<sup>21</sup> Executive Order 13834 Regarding Efficient Federal Operations: <https://www.whitehouse.gov/presidential-actions/executive-order-regarding-efficient-federal-operations/>

current administration undertook 60 actions aimed at removing or altering environmental regulations, laws, policies and protections.<sup>22</sup>

Funding has also been stripped from most climate-related federal programs, which limits not only our federal partners' capacity to support or implement climate action, but that of by those tribal, state, and local governments and nongovernmental entities that depend on resources and services produced at the federal level. For example, the Landscape Conservation Cooperatives (LCCs), housed within the Department of the Interior, were established to provide capacity and technical expertise to 22 regional networks of federal, tribal, state, and local governments, NGOs, universities, and private organizations. Today, most LCCs are in limbo without dedicated funding and some have been redesigned and renamed (i.e., Landscape Conservation Partnerships) in instances where there were non-federal partners that could provide interim support. In addition, federal advisory panels have been dismantled or simply not continued, including those for the National Climate Assessment, Interagency Land Management Adaptation Group, the Environmental Protection Agency's Board of Scientific Counselors, and the Department of the Interior's Advisory Committee on Climate Change and Natural Resource Science.<sup>23,24</sup> Finally, resources developed by federal agencies and their partners are now vulnerable or have been altered or removed.<sup>25,26</sup> While action is being taken by many non-governmental groups to protect climate data, there is less attention being paid to protecting the tools, reports, and metadata that are the resources relied on by civil society.<sup>27</sup> And even where it has been "rescued" it become harder for users to find when it is no longer on a federal website.

### **What is needed to ensure we optimize adaptation?**

When access to sound science and case studies, technical experts and peer networks, and funding streams is restricted, decision-makers are severely limited in their ability to adequately engage in climate adaptation. Organizations such as EcoAdapt and our partners are working every day to prevent this stagnation. Crucial to advancing adaptation and the climate-informed management of public lands are:

1. Access to sound science and technical experts
2. Clear climate-informed mandates, laws, and policies
3. Accessible and sustained finance streams for adaptation initiatives
4. Increased capacity, coordination, and collaboration

**Access to sound science and technical experts.** Natural and cultural resource managers are faced with various challenges on how to avoid, minimize and/or recover from the effects of climate change. Decision-making can be complicated by uncertainty in the rate and extent of climate change impacts over time, as well as knowledge gaps in terms of which adaptation actions are best suited for different conditions, most effective in reducing climate change

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<sup>22</sup> Eilperin, J. and D. Cameron. 2017. "How Trump is rolling back Obama's legacy." The Washington Post, 24 March 2017.

<sup>23</sup> Eilperin, J. 2017. "The Trump administration just disbanded a federal advisory committee on climate change. The Washington Post, 20 August 2017.

<sup>24</sup> Doyle, M. and B. Patterson. 2017. "Climate advisory group died quietly." Climatewire, 17 August 2017.

<sup>25</sup> Kahn, B. 2017. "The EPA has started to remove Obama-era information." Climate Central, 2 February 2017.

<sup>26</sup> Sabin Center for Climate Change Law, Silencing Science Tracker: <http://columbiaclimatelaw.com/resources/silencing-science-tracker>

<sup>27</sup> Varinsky, D. "Scientists are banding together to fight a looming threat from the Trump administration." Business Insider, 19 January 2017.

impacts, and supported by scientific evidence.<sup>28,29,30,31</sup> Numerous federal statutes call for using the “best available science” to inform natural resource management (e.g., Magnuson-Stevens Fishery Conservation and Management Act, U.S. Endangered Species Act), and scientists and decision-makers consistently agree that the best available science improves the quality of management decisions.<sup>32</sup>

Making climate-informed decisions requires the integration of science, including evidence of effectiveness. The presence of and access to high-quality research, including data collection, analysis, and synthesis, supports optimal decision-making conditions for managers and planners, particularly in light of climate change. Identifying what approaches are being implemented and to what degree of success expands the list of options for managers seeking to address climate change impacts. Part of this critical need for research is understanding and learning from past and ongoing efforts. Since 2009, EcoAdapt has engaged in a sustained research initiative—the State of Adaptation Program—to identify, evaluate, and assess climate adaptation activities in planning and underway. These projects have included identification and synthesis of best available science on historic, observed, and projected future climatic changes and impacts, extensive reviews of federal, tribal, state, and local climate change planning documents, over 4,000 interviews with practitioners in order to identify trends and barriers to climate adaptation action, and over 400 case studies.

Knowledge transfer and sharing of lessons learned among managers is fundamental to ensuring effective, successful adaptation outcomes. Federal (Climate Resilience Toolkit<sup>33</sup>) and nongovernmental (EcoAdapt, Climate Adaptation Knowledge Exchange<sup>34</sup>) knowledge brokers play central roles in gathering, synthesizing, and contextualizing science into digestible and actionable information sources. Action must be taken to preserve what credible federal resources are still available and support non-federal adaptation science providers and brokers. Over the past two years, as federal websites were stripped of mentions of climate change and access to adaptation guidance and examples were moved, key boundary organizations stepped up to fill these gaps. To protect access to sound science, EcoAdapt implemented a multi-phased plan to ensure the public could continue to rely on federal resources through the CAKE database. While other groups focused on basic climate data rescue, we prioritized adaptation resources including reports, guidance, tools, and records of projects and case studies.

**Clear climate-informed mandates, laws, and policies.** Through the State of Adaptation Program interviews, we have found that one of the leading motivations of adaptation action on

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<sup>28</sup> Bayliss, H.R., A. Wilcox, G.B. Stewart, and N.P. Randall. 2012. Does research information meet the needs of stakeholders? Exploring evidence selection in the global management of invasive species. *Evidence and Policy* 8(1): 37-56

<sup>29</sup> Cook, C.N., M. Hockings, and R.W. Carter. 2009. Conservation in the dark? The information used to support management decisions. *Frontiers in Ecology and the Environment* 8(4): 181-18

<sup>30</sup> Eriksen, S., P. Aldunce, C.S. Bahinipati, R.D. Martins, J.I. Molefe, C. Nhemachena, K. O'Brien, F. Olorunfemi, J. Park, L. Sygna, and K. Ulsrud. 2011. When not every response to climate change is a good one: Identifying principles for sustainable adaptation. *Climate and Development* 3(1).

<sup>31</sup> Sutherland, W.J., A.S. Pullin, P.M. Dolman, and T.M. Knight. 2004. The need for evidence-based conservation. *Trends in Ecology & Evolution* 19(6):305-308

<sup>32</sup> Sullivan, P.J., J. Acheson, P.L. Angermeier, T. Faast, J. Flemma, C.M. Jones, E.E. Knudsen, T.J. Minello, D.H. Secor, R. Wunderlich, and B.A. Zanetell. Defining and Implementing Best Available Science for Fisheries and Environmental Science, Policy, and Management. Marine Sciences Faculty Scholarship. Paper 30.

<sup>33</sup> Climate Resilience Toolkit: <https://toolkit.climate.gov/>

<sup>34</sup> Climate Adaptation Knowledge Exchange: <http://www.CAKEx.org>

public lands is clear agency mandates, laws and policies. To move agencies and departments beyond planning into needed implementation projects on public lands, bringing back agency mandates to intentionally address and incorporate climate change in all their management decisions is critical. These mandates and policies should require agencies to work across jurisdictions to increase the likelihood of success.

**Accessible and sustained finance streams for adaptation initiatives.** One of the biggest barriers to adaptation action is a lack of funding<sup>35</sup>, inability to apply funding to adaptation efforts, or a lack of access to sustained funding. Adaptation is a multi-phased process that includes scientific assessments, planning, implementation, and monitoring and evaluation. Funding directed to just one of these phases will not deliver the results needed to comprehensively address climate change. Therefore, it is imperative that the federal government increase its capacity to provide sustained funding to all stages of the adaptation process, particularly to implementation where upfront costs tend to be higher. Emphasis must also focus on increasing the capacity of boundary organizations, such as nongovernmental partners, to execute climate adaptation work. These organizations are sources of highly specialized and locally relevant expertise, and execute on-the-ground work from technical decision support to facilitating community discourse through workshops. Additional funding sources include foundations and local and state governments. However, many of these initiatives have resulted in piecemeal, fragmented, and disparate approaches, as well as a lack of movement beyond assessment and planning into implementation and evaluation. Federal finance plays a key role in funding all phases of the climate adaptation process. In fact federal funding that is used to support projects that are not inherently taking climate change into account is likely to be money misspent—unable to create the benefits it was intended to achieve when the effects of climate change erode the target efforts.

**Increased capacity, coordination, and collaboration.** One the greatest resources we have to address climate change is the collective capacity of scientists and managers in our federal, tribal, and state agencies and nongovernmental institutions. The knowledge, experience, and ingenuity brought by our federal partners cannot be undervalued as a key part of the solution to climate change. To capitalize on this asset, we need increased capacity, coordination, and collaboration among and between federal agencies and their non-federal partners, including tribal nations, nonprofits, small businesses, frontline communities, and academic institutions.

## **Concluding Thoughts**

The problems presented by climate change are vast and the solutions are innumerable and already overdue. With a challenge as urgent and pervasive as climate change, any delay in action is harmful. We have been underachieving for decades. Further prevention of progress will result in backsliding with irreversible and in some cases deadly consequences. What we need is someone to step forward. As a co-equal branch of government, this Congress has the ability to right the ship and advance climate action like never before—at a rate appropriate for the scale and speed of this problem. Key items for prioritization include:

- Continued protection and restoration of existing public lands and, where possible, expansion of these areas to maintain ecological functions, ecosystem services, and overall

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<sup>35</sup> Archie, K.M., L. Dilling, J.B. Milford, and F.C. Pampel. 2012. Climate change and western public lands: a survey of U.S. federal land managers on the status of adaptation efforts. *Ecology and Society* 17(4)

resilience. These efforts should include prioritizing areas that may serve as refugia—places that are likely to maintain more stable conditions over time—for plant, fish, and wildlife species, and eliminating energy development.

- Increased investments in science- and evidence-based approaches to climate adaptation while allowing for flexibility to identify, develop, and test promising, novel approaches. This includes not just funding for modeling and data collection, but also increased funding for implementation of activities with requirements for the evaluation of effectiveness, and capturing and sharing lessons learned.
- Increased coordination and collaboration between federal entities and non-federal partners (including international partners) to advance climate adaptation objectives. For example, the majority of federal dollars goes towards fire suppression rather than prevention activities. Getting fire back onto the landscape (both natural and prescribed burns) to support ecological functions is critical, especially as a means to reduce wildfire risk. This includes supporting tribal cultural burning practices across the landscape.
- Discontinue (and certainly do not expand) the extraction of fossil fuels from federal lands for use in energy generation. Not only does the practice of fuel extraction cause environmental degradation that reduces resilience, but the burning of those fuels literally adds insult to injury causing the changes that require even greater resilience. Simply put, we need to stop increasing the rate and extent of climate change in order to protect our public lands and the services they provide to us.

Congress' power to appropriate funds can be wielded as one of the most effective tools to ensure the protection of public lands and the prioritization of climate adaptation overall. Appropriations should be viewed through a climate lens to ensure that the agencies, departments, and research programs most qualified and poised to meet the climate challenge are adequately funded, and that any investments of tax payer dollars are not mis-spent on efforts that are likely to be undermined by the effects of climate change. We need simultaneous action at the scale required to solve the problem on climate change mitigation and adaptation. Approaches like the Green New Deal present the types of opportunities we need to seize to take action on mitigation, while working to integrate investments in climate adaptation across all agencies to address the effects of climate change we are and will experience due to the past emissions we did not curb.

I invite the current Congress to have the fortitude your predecessors have lacked. The time to take meaningful action on climate change to protect not only our public lands but our citizens and our neighbors around the globe is upon us. It is your job as elected officials to recognize the scope of this crisis and make the changes that are needed. Be brave. Be bold. Take action today for a better tomorrow.