Project Title:

From Awareness to Action: A Vulnerability Assessment and Adaptation Strategies for Focal Resources of the Sierra Nevada

Project Leader:

Lara Hansen, Chief Scientist and Executive Director
EcoAdapt
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Scope & Budget:

Location: Sierra Nevada
Duration in months: 12
Requested Funding: $100,000.00
Leveraged Funding: $25,000.00

Partners:

Geos Institute - Marni Koopman Conservation Biology Institute - Dominique Bachelet U.S. Forest Service - Bruce Goines and Diana Craig

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Briefly summarize the goals of the project, what products will result, and how the products support decision-making and conservation delivery for natural resource management within the CA LCC.

We propose to support a collaborative, multi-stakeholder effort led by the U.S. Forest Service (USFS) to develop a large-scale vulnerability assessment and associated adaptation strategies for focal resources of the Sierra Nevada. The purpose of this effort is to provide information and tools for Forest Planning and management (e.g., NEPA analyses, Forest Plan revisions, Climate Scorecard) and other natural resource management (e.g., SWAP) and conservation efforts to prepare for climate change impacts in the Sierra Nevada. Specifically, our objectives are to: (1) assess the vulnerability of focal resources to climate change, (2) use spatial analysis and expert input to prioritize conservation areas or actions, and (3) identify implementable management responses to climate change. To achieve these objectives, we will facilitate a two-workshop series and create comparative maps. Workshops will be designed to inform specific management needs and strategies developed will result in actionable responses by conservation partners. Comparative maps will help identify spatially explicit recommendations on the most suitable management options for each focal resource addressed. Managers and conservation planners from state and federal agencies, local governments, non-governmental organizations, and universities will be invited to participate throughout this project in order to develop products in an open, collaborative fashion. Anticipated products include: (1) a digital database of vulnerability assessment results for focal species and habitats and peer-reviewed references to support conclusions; (2) maps (digital, hard copy, online tool) comparing existing distributions of focal resources with spatial climate projections to identify where and how these resources may be most vulnerable or resilient to climate impacts; and (3) a portfolio of adaptation options for focal resources that helps prioritize where, when, and how to implement actions. We will develop a final peer-reviewed report documenting the results of the vulnerability assessment, recommended adaptation strategies and actions for decreasing the vulnerability of focal resources to climate change, and the ways in which different organizations can implement actions that facilitate adaptation across management boundaries. All products will be posted online through CA LCC websites and sent directly to workshop participants to publicize completion and facilitate use.

Briefly describe how the project team (main PIs) provides the range of experience, expertise, and organizational capacity needed to accomplish the project.

Dr. Lara Hansen (EcoAdapt) has directed research on the biological effects of global change since 1995 and is co-author of Climate Savvy: Adapting Conservation and Resource Management to a Changing World – one of the most comprehensive and practical books on adaptation. Hansen also co-pioneered the development of Awareness to Action workshops, which bring those engaged in the early stages of adaptation from awareness to implementation. Dr. Marni Koopman (Geos Institute) helped develop and implement the ClimateWise process, which helps communities develop ecologically sound adaptation strategies that are integrated across natural and human communities. In this context, Koopman leads scientists, managers, elected leaders, and socioeconomic experts through workshops and focused discussions to identify vulnerabilities and develop strategies for adaptation. Dr. Dominique Bachelet (CBI) has been working as a simulation modeler of climate change impacts since 1989, co-led the development of the MC1 dynamic

global vegetation model (DGVM), and has been involved in the creation of web-based tools to facilitate the distribution of climate change information. Hansen: 2012-2012 Innovate and Foster Climate Adaptation ($500K; 0.15 FTE); 2012 State of Adaptation in the United States ($40K; 0.1 FTE); 2011-2012 Modeling climate change effects on hydrology in PNW ($99K; 0.05 FTE). Koopman: 11/2011-05/2012 Testing Yale Framework for Pacific Coastal Rainforest ($91K; 0.2 FTE); 2011 Integrated climate change adaptation planning in Missoula County ($60K; 0.5 FTE); 2011 Conservation blueprint for the Colorado Plateau Ecoregion ($35K; 0.25 FTE). Bachelet: 11/2011-05/2012 Predicting future habitat conditions and distributions of two Sierra Nevada forest carnivores ($100K; 0.1 FTE); 2011-2013 Soil vulnerability to climate change in Southern Rockies ($200K; 0.1 FTE); 2010-2012 Prioritize fuel treatments by estimating restoration potential ($249K; 0.05 FTE).

Identify which National LCC Performance Measure(s), if any, your project addresses.

A risk and vulnerability assessment
A population and habitat assessment
A biological planning and conservation
A management evaluation action

Project Description

The natural landscapes of the Sierra Nevada include iconic mountains, forests, lakes, and rivers. The region's ecosystems are rich in biodiversity, providing a range of natural resources and services on which millions of people rely, including a large portion of the state's water supply, and important cultural and recreational amenities. However, projected climate change in the region is expected to significantly impact the natural systems on which wildlife and human communities both depend. Projected changes are likely to result in myriad impacts, including reduced and/or lost habitats and connectivity; shifts in species distribution, composition, and abundance; changes in vegetation communities; increased frequency and intensity of fires and area burned; and significant changes in water availability and supply[1,2]. Sierra Nevada ecosystems already suffer from severe air pollution, resource extraction, and invasive species influx. Ongoing conflict over water resources for agriculture, residences, and ecosystems; encroachment by residential development; and competing uses for federal lands will only be exacerbated by climate change. Managers and conservation planners in the Sierra Nevada are currently struggling with how to address these threats and stressors.

In response to this challenge, we propose to bring informed structure to an existing stakeholder engagement process led by the U.S. Forest Service (FS) to develop a large-scale vulnerability assessment and associated adaptation strategies for focal resources of the Sierra Nevada. We will involve scientists and managers as equals throughout this process in order to create user-generated information and tools targeting those engaged in Forest Planning and other conservation and land management efforts. Specifically, our objectives are to: (1) assess the vulnerability of focal resources to climate change, (2) use spatial analysis and expert input to prioritize conservation areas or actions, and (3) identify implementable management responses to climate change in the Sierra Nevada. The proposed work includes:

(1) Hosting a multi-day workshop for scientists, managers and conservation practitioners from state and federal agencies, local governments, universities, private lands, and non-governmental organizations (NGOs). We will use a modified version of the Northeast Association of Fish and Wildlife Agencies (NEAFWA) expert elicitation model[3] to: (a) refine our existing list of specific regional management action opportunities (e.g., SWAP, Forest Plan revisions) that this project could inform; (b) finalize a list of focal resources (e.g., species, habitats, or ecosystems) that inform the specific management opportunities (i.e., who, what, where, and when) identified by participants; and (c) assess the vulnerability (i.e., exposure, sensitivity, and adaptive capacity) of focal resources. While we have a preliminary list of types of management opportunities that this project could inform, these will be refined during the workshop to identify specific, concrete opportunities that this project will be tailored to inform. **Product 1**: a digital database of climate change vulnerabilities for focal species and habitats of the Sierra Nevada based on the expert elicitation process and the scientific literature. Vulnerability assessments typically result in a ranked list, a numeric score, or a narrative evaluation reflecting both quantitative and qualitative information. We anticipate a hybrid model (i.e., both a numeric score and narrative), although we will work directly with participants to create the product that best suits the targeted action opportunities.

(2) Developing comparative maps based on identified management opportunities and vulnerability assessment results from Workshop One. **Product 2:** The wealth of existing CA LCC and other regionally supported research will provide spatial climate projections (e.g., temperature, precipitation) and projected landscape-scale ecological change data (e.g., vegetation change), which will be overlaid with focal species and habitat distribution information to identify where and how these resources may be most vulnerable or resilient to climate impacts. This information will help identify spatially explicit recommendations on the most suitable management options for each focal resource addressed.

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[1] PRBO Conservation Science. 2011. Projected Effects of Climate Change in California: Ecoregional Summaries Emphasizing Consequences for Wildlife. Version 1.0. http://data.prbo.org/apps/bssc/climatechange

[2] Moser, S.C. et al. 2008. *The Future is Now: An Update on Climate Change Science, Impacts, and Response Options for California.* A report from the California Climate Change Center. California Energy Commission's Public Interest Energy Research Program. http://www.energy.ca.gov/2008publications/CEC-500-2008-077/CEC-500-2008-077.PDF

[3] Galbraith, H. et al. 2011. Assessing the Likely Impacts of Climate Change on Northeastern Fish and Wildlife Habitats and Species of Greatest Conservation Need. http://rcngrants.org/content/assessing-likely-impacts-climate-change-northeastern-fish-and-wildlife-habitats-and-species

(3) Reconvening the same group of participants to explore and finalize results of comparative maps and vulnerability assessment. Participants will develop a portfolio of adaptation options for focal resources and prioritize where, when, and how to implement actions, as well as work collaboratively to identify adaptation options that extend across jurisdictional boundaries. For example, each adaptation strategy will include information on implementation, such as who could implement and where, and what steps to take. **Product 3:** We will develop a final peer-reviewed report documenting the results of the vulnerability assessment as well as recommended adaptation strategies, which will be disseminated to project participants and through CA LCC websites. We will also develop a spatially explicit and interactive web tool that helps people identify adaptation strategies for their area or resource of interest.

CA LCC Priorities addressed (2012 CA LCC priorities appear in **bold**)

We will **add value to an existing, collaborative effort** among state and federal agencies (USFS, USFWS, NPS, CalFire, CDFG), environmental interests (National Forest Foundation, Sierra Forest Legacy), NGOs (Sierra Club, TWS, TNC), and universities (UC Davis) to develop a joint vulnerability assessment and adaptation strategy for the Sierra Nevada. Our project addresses multiple priorities highlighted by this group, including assessing the vulnerability of focal resources in the Sierra Nevada, creating maps to inform conservation priorities, and developing adaptation actions that are needed for on-the-ground management of cross-boundary resources. Workshops will **translate new and existing scientific data** for natural resource managers to directly support implementation of actions and management goals, including the FS Climate Scorecard. Further, this information will provide the knowledge and capacity necessary for managers to conduct their own vulnerability assessments and develop adaptation options that extend beyond this project. Comparative mapping will **help managers allocate limited resources based on prioritization**, and we will use their input to facilitate buy-in and incorporation of map results into future planning processes. The results of this project will be used to inform several FS planning processes including implementation of the new Forest System Planning Rule, NEPA analyses, and the FS Climate Scorecard.

CA LCC Criteria addressed

(1) Addresses Natural Resource Management Need – This project directly supports an effort initiated by the FS to assess the vulnerability of focal species, habitats, and ecosystems to climate change and identify potential adaptation strategies to help build resistance, enhance resilience, or facilitate ecological transitions. The purpose of this effort is to provide information and tools for Forest Planning and management (e.g., NEPA analyses, Forest Plan revisions, FS Climate Scorecard) and other natural resource management (e.g., NPS) and conservation efforts (e.g., county or private lands) to prepare for climate change impacts in the Sierra Nevada. Additionally, the recently updated FS Planning Rule emphasizes the importance of incorporating direct and indirect climate change effects and broader stakeholder involvement in management planning. Workshops will be designed to inform these specific management needs and strategies developed will result in actionable responses by conservation partners and other managers in California.

(2) Ecosystem Response to Projected Change – The comparative map products and results of the vulnerability assessment will improve understanding about *where* and *how* species, ecosystems, and habitats may respond to projected changes. Comparative mapping also helps planning across the landscape to identify connectors, buffers, and land facets. This will lead to integrated strategies and common approaches across jurisdictions that could result in higher efficacy.

(3) Integrative in Nature – The project will include physical (e.g., temperature) and biological data (e.g., species, habitats), multiple taxa, and several climate components. We will assess the vulnerability of multiple taxa and use existing and projected biological and climate data from previously funded CA LCC and regional projects to inform conservation priorities.

(4) Accessibility – Detailed results from the vulnerability assessment, comparative mapping, and recommended adaptation strategies for focal resources will be posted online through CA LCC websites (e.g., California Climate Commons, Environmental Change Network) as well as other relevant websites (e.g., Cal Adapt, Data Basin). All products will be designed using input from land managers and

conservation planners in order to facilitate their use and implementation. Limitations, uncertainties, and assumptions for the comparative maps will be discussed in detail during Workshop Two and in the final report, and will include a discussion about appropriate scales for management planning.

(5) *Partnerships/Leveraging* – This project will bring together experts in climate change adaptation and conservation research and planning (EcoAdapt, Geos Institute, Conservation Biology Institute - CBI) with the FS. Bruce Goines' and staff time (estimated at 1 month) will be contributed by the FS at no cost, and will include planning of a dialog session – as part of the Sierra Cascades Dialog Sessions – for broader public outreach around climate change and Sierra Nevada focal resources. EcoAdapt is applying for additional funding from the Yale Science Panel that would enhance the modeling and mapping components of this project[4].

(6) *Transferability* – This project is based on an established process and guidebook (i.e., *Scanning the Conservation Horizon* and the USFWS National Conservation Training Center (NCTC) vulnerability assessment trainings) currently recognized by federal and state agencies and conservation organizations. By demonstrating how to move from vulnerability assessment to adaptation, this project will provide a highly transferable model and will provide products applicable to other regions within the CA LCC as well as other LCCs.

(7) *Capacity* – EcoAdapt staffers have been actively engaged in the field of climate adaptation for over a decade. We help governments, organizations, and individuals determine how to do what they do effectively, even in the face of climate change. We have pioneered a series of interactive adaptation workshops to bring those engaged in the early stages of adaptation from awareness to implementation. EcoAdapt staff helped develop the vulnerability assessment guidebook *Scanning the Conservation Horizon* and associated training, and contributed to the 2009 CA Climate Adaptation Strategy. In partnership with the Geos Institute, we have created a series of decision-support tools that identify priority areas and strategic conservation actions likely to increase resilience to climate impacts. CBI also brings its extensive conservation research and spatial modeling experience in the Sierra Nevada.

Scope of Work – Approach & Integration with Related Projects

We will facilitate an expert elicitation-like process and create comparative maps to support an existing partnership of over 35 stakeholders to conduct a large-scale vulnerability assessment and develop adaptation strategies for focal resources of the Sierra Nevada. All 35 stakeholders – and other scientists, land managers, and conservation practitioners – will be invited to provide input throughout this project with the goals of creating a more integrated assessment, of building buy-in and capacity across a range of stakeholders, and of ensuring that both the scientific and managerial viewpoints are integrated throughout[5].

Step 1 – Workshop and vulnerability assessment. The foci of Workshop One will include: a science synthesis of projected biotic and abiotic climate changes and impacts in the Sierra Nevada; creating a list of specific, concrete management decisions to be informed by this project; finalizing a list of focal resources to inform these decisions (initial list provided by USFS; includes marten, Pacific fisher, northern goshawk, five-needle pines, giant sequoia groves, hydrologic resources, and others); and assessing the vulnerabilities of focal species, habitats, and ecosystems to climate change. Land managers, scientists, and conservation practitioners from state and federal agencies, local governments, private lands, NGOs, and universities will be invited to participate.

Day 1: Regional climate experts will discuss the present and projected effects of climate change in the region with a focus on key issues such as hydrology and snowpack, invasive species, fire, vegetation changes, and wildlife. Following presentations there will be a group discussion about the science so that participants can ask questions and share information and insights with the goal of developing a common understanding of the science for the region. A science synthesis will be provided to all participants. We will also cover basic concepts and practices in vulnerability assessment, including assessing exposure,

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[4] Yale Science Panel. 2012. A Framework and Guidance for Integrating Climate Adaptation and Landscape Conservation Planning. http://databasin.org/yale

[5] A similar process was applied by the Manomet Center for Conservation Sciences and Massachusetts Division of Fisheries and Wildlife and was very successful. See Case Study 4 in *Scanning the Conservation Horizon*.

sensitivity, and adaptive capacity. Later that day, participants will break out into groups to refine our existing list of regional management action opportunities that this project could inform (e.g., SWAP, Forest Plan revisions, FS Climate Scorecard). Groups will finalize a smaller suite of specific, concrete opportunities that identify who, what, when, and where implementation could occur. The remainder of the project will be tailored to inform these specific management opportunities.

Day 2: We will use a modified expert elicitation process – based on guidance from *Scanning the Conservation Horizon,* the Pacific Northwest Vulnerability Assessment[6], and the NEAFWA model – for the vulnerability assessment. Expert elicitation approaches have a long history in conservation and regulation (e.g., ESA listings, ecological risk assessments). These approaches are effective in situations where there is uncertainty about current system function or future projections but where there is a reservoir of detailed knowledge and expertise. Expert elicitation also has the benefits of being relatively rapid, encouraging ownership and buy-in, and requiring low resource costs. Using the list of refined management opportunities identified in Day 1, participants will finalize a suite of focal resources (species, habitats, or ecosystems) that best meet those opportunities and assess their sensitivity and adaptive capacity. Species and habitat assessments will be based on characteristics such as the ability of the species to disperse, dependence on disturbance regimes (e.g., fire or flood regimes), physiology and ecology (e.g., sensitivity to temperature, precipitation), and the influence of non-climatic stressors[5]. Groups will be asked to evaluate their confidence (a measure of uncertainty) in their estimations of sensitivity and adaptive capacity and provide peer-reviewed references (if possible) to support any conclusions. Spatially explicit climate projections will be provided[7] for groups to assess exposure. Where possible, we will build on existing vulnerability analyses for the region.

Based on the elicitation process and the scientific literature, we will develop a digital database of climate change vulnerabilities for focal species and habitats of the Sierra Nevada. We anticipate the outputs of the vulnerability assessment will be both a numeric score and a narrative, but the final product will be modified according to user needs. Focal resource lists will be annotated with key management opportunities relevant to the representative stakeholder groups. The finalized list of focal resources and their associated vulnerabilities will be used to inform the creation of comparative maps.

Step 2 – Spatial analysis. Spatial and temporal data features (historic, current, modeled) and information from local experts will be compiled and analyzed to identify areas of conservation priority. Existing and emerging spatial climate data such as projected changes in temperature, precipitation, wildfire, dominant vegetation type, snowpack and snowmelt, and other hydrologic projections for the Sierra Nevada will be mapped[7] and used to identify areas likely to be more or less impacted by climate changes. We will overlay this information with focal species distribution data, priority habitat data, and other important data layers identified during Workshop One that are likely to impact focal resources (e.g., land cover, predicted patterns of human population development, connectivity). The resulting climate-informed maps will help identify areas of conservation priority. For example, locations of old growth and late successional forests can be compared with projected changes in dominant vegetation type to identify areas where old growth forests are more likely to remain stable as well as areas predicted to shift to new vegetation types. Similarly, current species distribution data and projected climate factors tied to species' sensitivities can be compared over time to identify areas that will likely harbor focal species in the future. From three previous projects[8,9,10], comparative mapping has proven to be an effective step in guiding practitioners toward climate change adaptation action.

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[6] Lawler, J. 2010. *Pacific Northwest Climate Change Vulnerability Assessment* http://training.fws.gov/EC/Resources/vulnerability/case_studies/cs_7.html.

[7] We will utilize information from previously funded CA LCC projects (e.g., through the California Climate Commons and Environmental Change Network) as well as Data Basin and the Conservation Biology Institute.

[8] Kershner, J. et al. 2012. *A Climate-Informed Conservation Blueprint for the Greater Puget Sound Ecoregion*. http://.ecoadapt.org/library

[9] Kershner, J. et al. 2012. *From the Mountains to the Sea: Applying the Yale Framework in Western Washington for Holistic Adaptation*. In progress. http://databasin.org/yale/pilots/ecoadapt

[10] Koopman, M. et al. 2012. *A Conservation Blueprint: Identifying Terrestrial Climate Change Refugia in the Greater Grand Canyon/Colorado Plateau Ecoregion*.

Step 3 – Workshop and adaptation strategy development. Participants from the first workshop will reconvene to explore and finalize results of the comparative maps and vulnerability assessment. Workshop Two will cover the principles of adaptation and framing management objectives, and establish ways in which managers and conservation planners can begin incorporating climate change into their conservation and resource management work. Breakout groups will use the results to develop a portfolio of adaptation options for focal resources and to prioritize where, when, and how to implement actions. Groups will also work collaboratively to identify adaptation opportunities that extend across jurisdictional boundaries with the intent of developing a suite of options that each group can implement within their area that complement those actions implemented by surrounding groups. This type of holistic adaptation planning will help ensure the persistence of focal resources across the Sierra Nevada.

Products/Data Sharing

This project will yield four primary products:

(1) *Digital database of vulnerability assessment results* (month 8) - Analysis of climate change vulnerabilities for focal species and habitats of the Sierra Nevada; includes both numeric score and narrative. Vulnerability assessment results will be documented during Workshop One; references will be added and results peer-reviewed by a scientific expert panel before being finalized.

(2) *Comparative maps to inform conservation priority setting* (month 12) - GIS layers comparing existing distributions of focal resources with projected climate change exposure data. The finalized list of focal resources and their associated vulnerabilities will be used to guide the development of draft comparative maps (month 8). A small stakeholder group will convene to review the draft maps and provide comments during the interim between Workshop One and Two. Maps (hard copy and digital) will be revised and finalized during Workshop Two and completed by month 12. Maps will also be translated into a spatially explicit and interactive web tool (likely housed by Data Basin or CA LCC website) that helps people identify adaptation strategies (by month 12).

(3) *Climate change adaptation strategies for focal resources of the Sierra Nevada* (month 12) - Adaptation strategies will be developed during Workshop Two based on the vulnerability assessment and comparative maps. Following the workshop, strategies will be compiled, peer-reviewed and revised. Adaptation strategies will be released in a final report, which will provide specific actions for decreasing the vulnerability of focal resources to climate change. The report will also emphasize the ways in which different groups (e.g., federal agencies and NGOs) can implement actions that facilitate adaptation across management boundaries.

(4) *Workshop support page* (months 4, 10) - All workshop presentations, worksheets and handouts, speaker bios and contact information, and resources will be posted online so that attendees are able to access the information. This page will also include an online community for documenting and tracking projects and sharing new information.

All products will be posted online within 12 months through CA LCC websites, with links from other online outlets. Products will also be emailed directly to all workshop participants to publicize completion and facilitate use. The total project duration will be 12 months.

Measuring results

In the short-term, progress will be measured by the on-time posting of peer-reviewed deliverables including the vulnerability assessment results, comparative maps, and adaptation strategies. We will include a link (through one of the CA LCC websites or the workshop support page) where people can report needs or problems they would like to see addressed. We will also ask people to register for free in order to access the online tool so that we can keep track of users and potential applications of the tool. We will follow up with workshop attendees six months after the project has been completed to survey the degree to which the data products (i.e., vulnerability assessment database and comparative maps) have been used in their own planning efforts (e.g., integration into Forest Plan revisions) and the extent to which our suggested adaptation strategies have been implemented. Because a vulnerability assessment is one of the performance measures on the FS Climate Scorecard, we will also follow up with FS staff on their progress on the scorecard.

EcoAdapt 2012

California Landscape Conservation Cooperative 2012 Proposal Budgets

Budget Categories	CA LCC Request	Partner(s) Contribution(s) (monetary)	Partner(s) Contribution(s) (non-monetary value/in-kind)	**Total**
Salaries	$ 38,931.00	$ 8,511.00	$ 15,000.00	$ 62,442.00
Supplies	$ 400.00	$ -	$ -	$ 400.00
Overhead	$ 14,894.00	$ 1,489.00	$ -	$ 16,383.00
Equipment	$ -	$ -	$ -	$ -
Other (specify)	$ 45,775.00	$ -	$ -	$ 45,775.00
Total	$ 100,000.00	$ 10,000.00	$ 15,000.00	$ 125,000.00

Salaries:
$38,931 EcoAdapt staff (84.9 days)

Supplies:
$400 for workshop materials and printing

Overhead:
EcoAdapt's institutional indirects rate is 17.5%

Other:
$4,000 for workshop catering, venue
$4,150 for EcoAdapt staff travel
$4,900 travel grants for workshop participants
$32,725 consulting fees (Geos Institute, Conservation Biology Institute)

Partner Contributions (monetary):
$10,000 Western States adaptation innovation support (Wilburforce Foundation)

Partner Contributions (non-monetary value/in-kind):
$15,000 US Forest Service committed staff time involvement in working group and workshops

State of California -The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
South Coast Region
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(858) 467-4201
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***EDMUND G. BROWN, JR**, Governor*
***CHARLTON H. BONHAM,** Director*

May 2, 2012

Rebecca Fris, Science Coordinator
California Landscape Conservation Cooperative (CA LCC)
3020 State University Drive East
Modoc Hall Suite 2007
Sacramento, CA 95819

Re: Letter of support on behalf of proposal by EcoAdapt to the CA LCC

Dear Ms. Fris:

The California Department of Fish and Game (DFG) supports EcoAdapt's proposal to the California Landscape Conservation Cooperative (CA LCC) to facilitate a collaborative, multi-stakeholder effort to develop a large-scale vulnerability assessment and associated adaptation strategies for the Sierra Nevada. This project will provide analyses needed for on-the-ground management of cross-boundary resources and through a series of workshops will help translate new and existing data for natural resource managers in ways that directly support implementation of actions and management goals.

DFG is responsible for maintaining native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection and maintenance in a sufficient amount and quality to ensure the survival of all species and natural communities The DFG recognizes that climate change is a major challenge to the conservation of California's natural resources and over the past several years has taken an active role in planning for and responding to the challenges posed by a changing climate. This research proposal being submitted by EcoAdapt will support and add value to existing collaborative efforts in the Sierra and should also benefit state wide conservation planning efforts related to state wide climate adaptation planning and the revision of the state wildlife action plan.

DFG is pleased to support this proposal and I strongly encourage the CA LCC to consider funding this effort.

Sincerely yours,

Amber Pairis, Ph.D.
Climate Change Advisor
California Department of Fish and Game

USDA United States Department of Agriculture | Forest Service | Pacific Southwest Region

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File Code: 2020/2600
Date: MAY 11 2012

Rebecca Fris, Science Coordinator
California Landscape Conservation Cooperative
3020 State University Drive East
Modoc Hall Suite 2007
Sacramento, CA 95819

Re: Letter of support on behalf of proposal by EcoAdapt to the CA LCC

Dear Ms. Fris,

On behalf of the Pacific Southwest Region of the USDA Forest Service, I'm writing to express our strong support for the request by EcoAdapt to the California Landscape Conservation Cooperative for funding to facilitate the development of an initial vulnerability assessment for high priority focal resources and identify potential adaptation strategies for the Sierra Nevada.

The Pacific Southwest Region has initiated an effort to develop a large-scale vulnerability assessment and associated adaptation strategy for the Sierra Nevada. EcoAdapt's proposed project would directly support this effort by facilitating the vulnerability assessment and adaptation planning processes, developing a spatial tool which we can use to identify areas of conservation priority, and providing the capacity, resources, and guidance to help us move from awareness about climate impacts to on-the-ground action. We will be able to use this information in forest plan revisions, the climate change performance scorecard, and project-level NEPA analyses.

The collaborative effort between federal and state resource agencies, environmental interests, and non-governmental organizations proposed by this project is critical to success, as our high priority resources extend beyond Forest Service boundaries. By hosting a series of workshops where all of these interests are represented and actively engaged, this project allows products to be developed in an open collaborative manner and facilitates stakeholder buy-in early on.

Should funds be awarded for this project, Forest Service staff will assist EcoAdapt in accomplishing some of the specific tasks outlined in their proposal, including outreaching to stakeholders to participate in the workshop series, as well as co-hosting a Sierra Cascades Dialog Session with stakeholders around climate change and Sierra Nevada resources.

Sincerely,

RANDY MOORE
Regional Forester

cc: Bruce Goines, Diana Craig, Lara Polansky

Sierra Forest Legacy ▪ Defenders of Wildlife ▪ Sierra Club ▪ Earthjustice
The Nature Conservancy ▪ The Wilderness Society

May 11, 2012

Rebecca Fris, Science Coordinator
California Landscape Conservation Cooperative (CA LCC)
3020 State University Drive East
Modoc Hall Suite 2007
Sacramento, CA 95819

Re: Letter of support on behalf of proposal by EcoAdapt to the CA LCC

Dear Ms. Fris:

As strong advocates for maintaining healthy and sustainable ecosystems, particularly in the face of mounting climate and land-use stressors, members of the undersigned organizations are writing to express our support for EcoAdapt's proposal to the California Landscape Conservation Cooperative. This proposal directly supports an existing multi-stakeholder effort initiated by the U.S. Forest Service to develop a large-scale vulnerability assessment and associated adaptation strategy for high priority resources of the Sierra Nevada.

By assessing the vulnerabilities of high priority resources in the Sierra Nevada, developing comparative maps to identify areas of conservation priority, and creating a portfolio of adaptation options, the project will meet a critical need for practical information and tools specific to the Sierra Nevada region. For example, this project will provide the tools necessary to help the Forest Service address the specific requirements in the newly updated National Forest System Land Management Planning Rule as well as inform other conservation efforts. Furthermore, because this project involves scientists and managers throughout in order to create user-generated information and tools, it will build buy-in and capacity across a range of stakeholders.

In addition to the specific products of this work (vulnerability assessment, adaptation strategies, maps), there is a critical need to strengthen the ability of Sierra Nevada stakeholders working on the ground to respond to climate change. EcoAdapt's proposed project would go a long way toward helping meet this need by providing stakeholders with new knowledge of climate change, types of available data and how to conduct a vulnerability assessment, adaptation options, and their own empowerment by developing an initial concept of how to deal with this imposing issue.

Thank you for your consideration.

Sincerely,

Susan Britting, Ph. D.
Science and Policy
Sierra Forest Legacy

Emily Brown
Research & Policy Analyst
Earthjustice

Pam Flick
California Program Coordinator
Defenders of Wildlife

Dick Cameron
Senior Conservation Planner
The Nature Conservancy

Sarah Matsumoto
Senior Representative
Sierra Club

Stan VanVelsor
California Nevada Region
The Wilderness Society

LARA J. HANSEN, Chief Scientist and Executive Director
EcoAdapt
lara@ecoadapt.org ~ (206) 201-3834

EDUCATION

Ph.D., Ecology, University of California, Davis	December 1998
B.A., Biology (marine emphasis), University of California, Santa Cruz	June 1992

PROFESSIONAL EXPERIENCE

Chief Scientist, Executive Director and Co-Founder, EcoAdapt	2008- present
Visiting Scholar, Scripps Institute of Oceanography, University of California, San Diego	2005-present
Chief Scientist, Climate Change Program, World Wildlife Fund	2001- 2008
Lecturer, Johns Hopkins University, Baltimore, MD	2001- 2008
Post-doctoral Researcher Ecologist, Gulf Ecology Division, USEPA	1998- 2001
Aquatic Toxicologist, S.R. Hansen and Associates, Concord, CA	1986-1992
Policy Intern, Office of Environmental Affairs, State of California, Sacramento, CA	1990

RESEARCH GRANTS AND FELLOWSHIPS (Selected from past 5 years)

Mott Foundation "The State of Adaptation in the Great Lakes"	2011-2012
Kresge Foundation "Innovate and Foster Climate Change Adaptation"	2010-2012
Harder Foundation "Building Climate Change into Washington's Marine Spatial Planning Process"	2010-2011
Wilburforce Foundation "Advancing Climate Change Adaptation in Western North America"	2010-2011
Wilburforce Foundation "Building Adaptation into Western North American Conservation"	2009-2010
Kresge Foundation "Building the Community of Climate Adaptation"	2009-2010
Moore Foundation "The State of Marine Adaptation to Climate Change in North America"	2008-2010
Switzer Foundation Leadership Grant	2008-2009
MacArthur Foundation "Integrating Climate Change into Coastal and Marine Conservation"	2007-2009
Batchelor Foundation "Climate Change LEADS: Linking Environ. Analysis to Decision Support"	2007-2009
Hewlett-Packard "Assessing Climate Change Vulnerability in the Bering Sea"	2007-2008
NOAA Grant "Climate Change LEADS: Linking Environmental Analysis to Decision Support"	2006-2008
UNEP/GEF MSP "Developing Generalizable Method for Adaptive Management and Protection"	2006-2009

AWARDS AND HONORS (highlights)

EPA Scientific and Technological Achievement Award, Level III	2003 & 2004
EPA Bronze Medal	2002
Two EPA Superior Accomplishment Awards	2000
Switzer Environmental Fellow	1995-1996

PUBLICATIONS (Select from past 5 years)

Score, A., **L. Hansen** and R. Gregg. 2012. Monitoring Climate Effects on Temperate Marine Ecosystems: A Test Case using California's MPAs. MPA Monitoring Enterprise, California Ocean Science Trust, Oakland, CA. 46 pp.

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

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

Lawler, J.J., T.H. Tear, C. Pyke, M.R. Shaw, P. Gonzalez, P. Kareiva, **L. Hansen**, L. Hannah, K. Klausmeyer, A. Aldous, C. Bienz, and S. Pearsall. 2009. Resource management in a changing and uncertain climate. Frontiers in Ecology and the Environment 7, DOI 10.1890/070146.

Janetos, A., **L. Hansen**, et al. 2008. Biodiversity. *In*: The effects of climate change on agriculture, land resources, water resources and biodiversity. Synthesis and Assessment Product 4.3: A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Washington DC USA, 362 pp**.**

Ficke, A.D., C.A. Myrick and **L.J. Hansen**. 2007. Effects of global climate change freshwater fish and fisheries. Reviews in Fish Biology and Fisheries. 17:581-612.

Hansen, L.J. and C.R. Pyke. 2007. Climate Change and Federal Environmental Law. Sustainable Development Law & Policy Journal 7(2):26-29.

M A R N I E . K O O P M A N
Geos Institute, 84 Fourth Street, Ashland OR 97520

EDUCATION

University of Wyoming, Laramie WY — Ph.D. 2003
Dept. Zoology and Physiology

University of California at Berkeley, Berkeley CA — M.S. 1995
Dept. Wildland Resource Science (now ESPM)

University of California at Santa Barbara, Goleta CA — B.A. 1993
Dept. Environmental Studies

WORK HISTORY – PROFESSIONAL

Geos Institute – Climate Change Scientist — May. 2008-present

- Conservation Blueprints – Project lead on development of conservation blueprint for the Colorado Plateau. Participated in similar effort for Western Washington, Klamath-Siskiyou, and PNW temperate rainforest. Developed methodology for mapping current and future areas of conservation priority, including linkages and buffers.
- Adaptation Planning – Climate change adaptation planning for Missoula County, Montana. Partnered with Clark Fork Coalition, Headwaters Economics, and other local groups to hold workshops and develop adaptation strategies that are cohesive across the different sectors of the community. http://www.geosinstitute.org/completed-climatewise-projects/climate-change-adaptation-planning-in-missoula-county.html
- Climate Change Communication – Presented climate change science and adaptation information for groups of elected leaders, scientists, farmers, public health officials, emergency response officials, city and county planners, and others, in a series of workshops in San Luis Obispo County and Fresno, Tulare, Madera, and Kings Counties.
- Wrote reports on climate change in the Klamath Basin, San Luis Obispo County, and Fresno County and surrounding counties, projecting temperature, precipitation, vegetation, wildfire, stream flow, and carbon sequestration. Also included scientific review of the likely impacts of climate change on natural resources.

U.S.D.A. Forest Service – Rocky Mountain Research Station — Mar. 2007-Apr 2008

- Research Wildlife Biologist (Postdoctoral researcher)
- Created and maintained database on current and projected future effects of climate change on natural resources.
- Mapped the spatial distribution of the effects of climate change on wildlife in the U.S.
- Presented information on climate change impacts to wildlife and adaptation strategies for state and federal land and wildlife managers in Colorado and Wyoming. Participated in workshops with managers to develop .

SELECT PUBLICATIONS

DellaSala, D. A., P. Brandt, M. E. Koopman, J. Leonard, C. Meisch, and P. Herzog, and H. von Wehrden. Testing a climate change adaptation framework for the North America Pacific Coastal Rainforest: A report to Yale Science Committee. Geos Institute.

Cross, M. S., E. S. Zavaleta, D. Bachelet, M. L. Brooks, C. A. F. Enquist, E. Fleishman, L. Graumlich, C. R. Groves, L. Hannah, L. Hansen, G. Hayward, M. Koopman, J. J. Lawler, J. Malcolm, J. Nordgren, B. Petersen, D. Scott, S. L. Shafer, M. R. Shaw, and G. M. Tabor. The Adaptation for Conservation Targets (ACT) framework: A tool for incorporating climate change into natural resource management Accepted to Env. Management.

Olson, D., D. A. DellaSala, R. F. Noss, J. Kass, M. E. Koopman, and T. F. Allnutt. 2011. Climate change refugia for biodiversity in the Klamath-Siskiyou Ecoregion. Natural Areas Journal. 32:65-74.

Koopman, M. E., J. Alban, B. Randall, M. Haggerty, and R. Rasker. 2011. Missoula County Climate Action: Creating a Resilient and Sustainable Community. Geos Institute.

Koopman, M. E., K. Meis, and J. Corbett. 2010. Integrated Climate Change Adaptation Planning in San Luis Obispo County. Geos Institute.

Joyce, L. A., C. H. Flather, and M. E. Koopman. 2008. Analysis of Potential Impacts of Climate Change on Wildlife Habitats in the U.S. Final Report to WHPRP.

Curriculum Vitae – Dominique Bachelet

Conservation Biology Institute, Olympia, WA
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Education

1980-1983	Ph. D.; Colorado State University, Botany and Plant Pathology,
1978-1979	DEA; Université de Paris XI (France), Plant Ecology.
1977-1978	MS; Université de Lille I (France), Plant Biology.

Professional experience

2009-current	Senior Climate Scientist; Conservation Biology Institute.
2007-2008	Director of Climate Change Science, The Nature Conservancy.
1999-current	Associate professor Senior Research, Dept of Bioengineering, Oregon State University
1989-1999	Assistant professor Senior Research, Dept of Bioengineering, Oregon State University

Selected peer-reviewed journal articles

Shaw, M.R., L. Pendleton, D.R. Cameron, B. Morris, D. Bachelet, K. Klausmeyer, J. MacKenzie, D.R. Conklin, G.N. Bratman, J. Lenihan, E. Haunreiter, C. Daly, P.R. Roehrdanz. 2011. The impact of climate change on California's ecosystem services. Climatic Change DOI 10.1007/s10584-011-0313-4.

Rogers, B. M., R. P. Neilson, R. Drapek, J. M. Lenihan, J. R. Wells, D. Bachelet, and B. E. Law. 2011. Impacts of climate change on fire regimes and carbon stocks of the U.S. Pacific Northwest. J. Geophys. Res. 116, G03037, doi:10.1029/2011JG001695.

Wiens, J. and D. Bachelet. 2010. Matching the Multiple Scales of Conservation with the Multiple Scales of Climate Change. Conservation Biology 24(1):51-62.

Allen, C.D., A.K. Macalady, H. Chenchouni, D. Bachelet, Nate McDowell, M. Vennetier, T. Kitzberger, A. Rigling, D.D. Breshears, E.H. Hogg, P. Gonzalez, R. Fensham, Z. Zhang, J. Castro, N. Demidova, J-H Lim, G. Allard, S.W. Running, A. Semerci, N. Cobb. 2010. A Global Overview of Drought and Heat-Induced Tree Mortality Reveals Emerging Climate Change Risks for Forests. Forest Ecology and Management 259:660–684.

Bachelet D., J. Lenihan, R. Drapek, R. Neilson. 2008. VEMAP vs VINCERA: A DGVM sensitivity to differences in climate scenarios. Global and Planetary Change 64:38-48.

Bachelet D., J.M. Lenihan, R. P. Neilson, R.J. Drapek, and T. Kittel. 2005. Simulating the response of natural ecosystems and their fire regimes to climatic variability in Alaska. Canadian Journal of Forest Research 35:2224-2257.

Synergistic activities

Contributor to 2000 National Assessment: Chapter 17. Potential consequences of climate variability and change for the forests of the United States. In: National Assessment Synthesis Document. 2000. http://www.cgrio.org.NationalAssessment/

Contributor to Intergovernmental Panel on Climate Change (IPCC) Assessment Reports: Chapter 13. Agriculture in a changing climate: impacts and adaptation. In: Watson et al., Climate Change 1995: Impacts, adaptations and mitigation of climate change: scientific-technical analyses. Published for IPCC 1996, Cambridge University Press.

Expert reviewer for 2007 Intergovernmental Panel on Climate Change (IPCC) Working Group II Fourth Assessment Report. http://www.ipcc-wg2.org/