Project Title: Vulnerability Assessment and Adaptation Planning for National Forest Lands in Southern California

Project Lead and Co-Lead Contact Information:

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Project Duration: 20 months

Total Requested Funding: $52,886

Partners:

Southern California Stakeholder Group led by Sarah Sawyer and Marty Dumpis (USFS), and includes participants from the following: USFS Pacific Southwest Research Station, National Park Service, U.S. Geological Survey, University of California Los Angeles, University of California Riverside, Cal Poly San Luis Obispo, Angeles National Forest, Cleveland National Forest, and the Conservation Biology Institute, among others. In addition, several members of the Stakeholder Advisory Group from the Sierra Nevada Vulnerability Assessment and Adaptation Strategy project have expressed interest in participating as member of the Southern California group (e.g., The Nature Conservancy (TNC), The Wilderness Society (TWS), Defenders of Wildlife). We will also invite representatives that participated in the Chaparral Restoration Workshop hosted by the USFS in 2013[*] (and co-organized by Sarah Sawyer), including the Bureau of Land Management (BLM), U.S. Fish & Wildlife Service (USFWS), California Department of Fish & Wildlife (CDFW), State Parks, and other interested parties to participate in the group.

Geographic Scope: South Coast, Central Coast regions of the CALCC with a specific focus on four national forests in Southern California including the Angeles, Los Padres, San Bernardino, and Cleveland. This includes over 3.8 million acres of public land. These forests are embedded in an urban landscape, but are also surrounded by other public lands. Our focus will primarily be on USFS lands, but we will not exclude immediately adjacent land ownership categories.

Partner Contributions/Leveraging: The total proposed project consists of six components: 1) Convening a stakeholder group; 2) Identifying focal habitats; 3) Conducting a vulnerability assessment; 4) Spatial analysis and mapping; 5) Developing adaptation strategies; and, 6) Translating products into on-the-ground implementation plans. The USFS has committed $120,000 to conduct Steps 1 and 3-5. We are requesting additional CALCC funding to conduct Steps 2 and 6.

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[*] http://cafiresci.org/csc-2013-chap-restoration/

Project Summary/Management Relevance

We propose to conduct a vulnerability assessment, develop climate-smart adaptation strategies and actions, and generate implementation plans for focal habitats of the South and Central Coast regions of the CALCC, with a specific focus on four Southern California National Forests (Angeles, San Bernardino, Cleveland, Los Padres). Specifically, we will: (1) Assess the regional vulnerabilities and resiliencies of focal habitats to climate change and non-climate change stressors; (2) Generate climate-informed maps to identify how vulnerabilities vary spatially to help prioritize conservation areas and activities; (3) Identify implementable climate-smart conservation strategies and actions to conserve priority habitats; and (4) Develop an implementation handbook that describes where, when, and how to implement climate-smart actions on the ground. This proposal leverages current funding from the USFS to conduct a vulnerability assessment and begin developing climate-smart adaptation strategies and actions for Southern California forests (objectives 1, 2, and part of 3 above). Funding from the CALCC will greatly enhance this climate-smart project by providing information necessary for management decision-making and implementation of on-the-ground actions in order to conserve priority habitats in the face of climate change (objective 4 and part of objective 3, above). This project *directly supports a need identified by the USFS* to assess the vulnerability of priority habitats to climate change and to identify potential adaptation strategies to help build resistance, enhance resilience, or facilitate ecological transitions. This effort will provide information and tools for USFS planning and management (e.g., NEPA analyses, Forest Plan Revisions, Climate Change Performance Scorecard – "Scorecard") and other natural resource management and conservation efforts to prepare for climate change impacts in the South and Central Coast CALCC regions.

Capacity

EcoAdapt staff has been actively engaged in the field of climate change adaptation for over a decade. We provide support, training, and assistance to government agencies, organizations, and individuals to help make planning and management less vulnerable and more climate-smart. Jessi Kershner, a Lead Scientist at EcoAdapt, has been engaged in climate-related work for over a decade and will serve as the primary scientist co-lead on the project. She brings expertise in designing expert elicitation vulnerability assessments, facilitating adaptation planning, and translating spatial data into useable formats to improve tangible adaptation outcomes. She led the Sierra Nevada Vulnerability Assessment and Adaptation Strategy project (funded by the CALCC), and is engaged in similar, multi-stakeholder collaborative climate adaptation efforts with several other Federal land managers throughout the western US. She will lead the: (1) organization and facilitation of the stakeholder group and expert panel, (2) development and implementation of the vulnerability assessment, (3) design and facilitation of the adaptation planning workshops, (4) compilation of findings from the vulnerability assessment and adaptation planning efforts, and (5) outreach and dissemination of findings. Jessi will also guide the climate-informed mapping component with Conservation Biology Institute.

Chrissy Howell and Sarah Sawyer will serve as the primary manager co-leads on the project. Chrissy Howell, Regional Wildlife Ecologist for the Pacific Southwest Region of the USFS, brings over 15 years of expertise in climate change, wildlife ecology, and natural resource management. She co-led the Sierra Nevada Vulnerability Assessment and Adaptation Strategy project. Sarah Sawyer, Assistant Regional Ecologist with the USFS, brings expertise in climate change, chaparral ecosystems, and wildlife management. Sarah was also involved with the Sierra Nevada Vulnerability Assessment and Adaptation Strategy project. As regional office employees, Chrissy and Sarah regularly

coordinate projects and initiatives across multiple Forest Service units in California and they are both members of the USFS Pacific Southwest Region's climate change integration team, which serves to integrate climate change considerations into Forest Service management practices. For this project, Sarah and Chrissy will coordinate involvement with the four National Forests, as well as with stakeholders and interest groups that work with those forests. They will also take the lead on integrating project findings into Forest Plan Revision efforts, documenting project results in the USFS Scorecard, and disseminating products to resource managers in the National Forests.

The three project leads all worked together in various capacities to conduct the Sierra Nevada Vulnerability Assessment and Adaptation Strategy project, and are confident in their abilities to conduct a similar project in Southern California that builds on lessons learned from implementing the Sierra Nevada project.

Approach and Scope of Work

Climate change is the most pressing societal challenge of our time, with projected changes likely to result in cascading impacts to species, habitats, and physical processes. These impacts will exacerbate current resource challenges such as conflict over water resources, residential encroachment on wildlands, and competing uses for federal lands. Resource managers and planners are meeting this challenge by revising current plans and practices with increased attention on potential climate impacts to natural resources, communities, and social/economic values to better meet long-term goals.

For example, under the USFS 2012 Planning Rule, as well as the Scorecard, all 155 National Forests and 20 Grasslands are required to consider climate change impacts, including vulnerability and adaptation, as they revise their land management plans. This presents a critical opportunity to develop an effective process to assess climate impacts on natural resources so that impacts can be incorporated into revised plans, advancing the implementation of effective and robust management and conservation strategies. Further, because collaboration and stakeholder input are a required part of the Plan Revisions and Scorecard, the process must also enable all stakeholders – managers, conservation practitioners, landowners, and others – to participate in identifying complementary conservation and management strategies. The ultimate goal is increasing the success of regional natural resource conservation, restoration, and management in the face of climate change.

We propose to support these efforts by conducting a vulnerability assessment, developing climate-smart adaptation strategies and actions, and generating implementation plans for focal habitats of the South and Central Coast regions of the CALCC. Development of an effective approach to climate-smart conservation – from vulnerability to adaptation and implementation – will benefit future planning efforts across California as well as at other National Forests. This proposal leverages current funding from the USFS and follows the successful model developed by EcoAdapt and funded by the CALCC for the Sierra Nevada.[†]

Specifically, we will work with scientists, managers, and conservation practitioners to conduct a vulnerability assessment, generate climate-informed maps, and develop adaptation strategies and implementation actions for focal habitats in the South and Central Coast regions of the CALCC, with a specific focus on four National Forests (i.e., Angeles, Los Padres, San Bernardino, and Cleveland). This project directly addresses Objective 1 of the CALCC Science-Management Framework by *supporting the design and implementation of a place-based project that leads to climate-smart conservation actions by USFS resource managers*. Key project steps include:
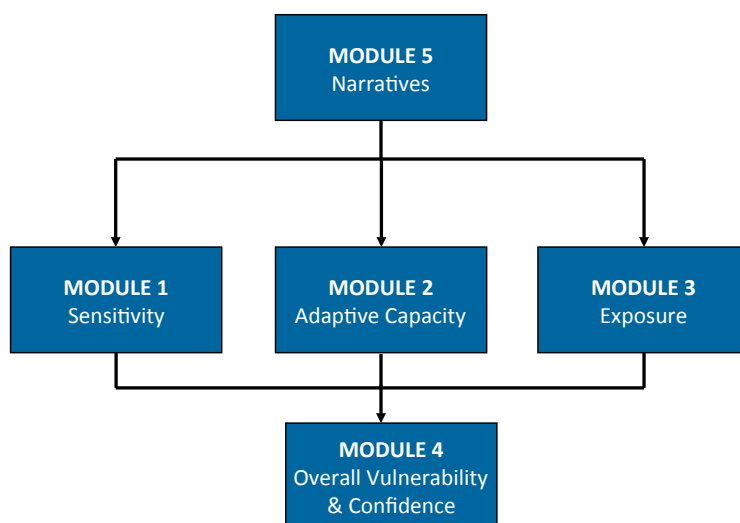

[†] From Awareness to Action: A Vulnerability Assessment and Adaptation Strategies for Focal Resources of the Sierra Nevada.

1. **Convene stakeholder group and identify draft list of focal habitats**. We will invite additional representatives from the BLM, USFWS, CDFW, State Parks, TNC, TWS, and others to participate in the existing Southern California Stakeholder Group. We will convene the group to develop a draft list of focal habitats using USFS planning documents, external research, and stakeholder input. The committee will meet throughout the duration of the project to provide input into product formats and maps, as well as review draft materials.

2. **Focal habitats workshop**. We will convene a workshop to finalize the draft list of focal habitats using a set of evaluation criteria based on multi-criteria decision analysis methods. Based on lessons learned from the Sierra Nevada project, this workshop is an important component of the climate-smart conservation approach in that a broad range of stakeholder and scientific expertise creates buy-in into the process and provides credibility to the project, and early in-person engagements foster commitment from experts and stakeholders to participate throughout the project's duration. We will build on the list of participants from the Chaparral Restoration Workshop hosted by the USFS in 2013.[‡] Current draft focal habitats under consideration include chaparral, coastal sage scrub, oak woodlands, ponderosa pine, and pinyon-juniper, among others.

3. **Vulnerability assessment**. We will use a modified expert elicitation process based on guidance from *Scanning the Conservation Horizon*[1], the Pacific Northwest Vulnerability Assessment[2], and the NEAFWA model[3]. Expert elicitation has a long history in conservation and regulation; these approaches are effective where there is uncertainty about current habitat 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.

    The vulnerability assessment model comprises five connected modules (Figure 1). Module 1 comprises 4 elements and scores the likely sensitivies of focal habitats to climate change, disturbance regimes, and non-climate stressors. Module 2 comprises 4 elements and scores the likely adaptive capacities of focal habitats by considering characteristics such as habitat extent, integrity, and continuity; topographical, component species, and functional group diversity; and management potential and use conflicts. Module 3 scores the potential future exposure of focal habitats to climate and climate-driven changes. Module 4 combines the results of Modules 1, 2, and 3 to produce an overall evaluation and score of a given habitat's future vulnerability to climate change and non-climate stressors. Modules 1-4 are also assigned one of five certainty scores (ranging from Low to High), so that the degree of confidence

Figure 1. Structure of the vulnerability assessment model.

[‡] http://cafiresci.org/csc-2013-chap-restoration/

that experts had in their scoring of each variable is explicit. Documenting confidence helps to identify areas of uncertainty, data gaps, and where future studies may be directed to reduce uncertainties. Module 5 includes the narratives accompanying each habitat assessment, which summarizes information from the peer-reviewed literature and makes transparent the rationales and assumptions underlying assessment scores.

We will convene an expert panel comprised of representatives from federal and state agencies, NGOs, universities, and others to guide, review, and evaluate the vulnerability of selected focal habitats. Active participation of these representatives is essential for two reasons: (1) they are the sources of much of the knowledge about the ecology, management, and threats to the region; and (2) they are the professionals who will use the results of the project. EcoAdapt will *collect, compile, and synthesize existing relevant science information* on sensitivity, adaptive capacity, and exposure for each selected habitat to inform and facilitate evaluation of habitat vulnerabilities by experts. Experts will also be provided with spatially explicit climate projections for the South/Central Coast CALCC regions using the wealth of existing climate data for the region. This will include projections from: (1) Climate Western North America dataset and AdaptWest (hosted by Data Basin) – temperature and precipitation; (2) USGS Basin Characterization Model – hydrologic projections including soil moisture and recharge; (3) USFS Western Wildland Environmental Threat Assessment Center – MC1 dynamic vegetation and wildfire modeling; and (4) applicable results from projects funded by the CALCC[4].

Experts will be asked to provide their best judgment and confidence ranking for Modules 1-3 for a given habitat. The vulnerability assessment results will integrate the expert-opinion based scores of sensitivity, adaptive capacity, and exposure with associated information from the peer-reviewed literature, projected changes in climate, and (if possible) existing vulnerability analyses for the region. The final report will consist of expert-assigned scores, confidence rankings, and narratives for each focal habitat, as well as a description of project methodologies (including how focal resources were selected), and will be sent out for peer-review.

4. **Spatial analysis and mapping**. The results of the vulnerability assessment and stakeholder input will guide the creation of climate-informed maps for each habitat. A key activity will be to utilize and leverage the spatial analysis and mapping (climate and non-climate) that has already occurred in California and to integrate those results into this project where applicable.

   Spatial and temporal data features (historic, current, modeled) and information from local experts will be compiled and analyzed to generate new spatial data and maps of the current distribution of habitats and threats, both climate and non-climate. For example, existing and emerging spatial climate data can be combined in novel ways to identify where, when, and how habitats may experience the highest magnitude of change. Similarly, spatial climate data can be overlaid with priority habitat data, and relevant non-climatic stressors (e.g., predicted patterns of human population growth and development, land use) to identify areas of conservation priority. Several previous projects[5,6,7,8,9] have shown that maps depicting comparative and magnitude of change are effective tools to help practitioners understand where and why a resource is vulnerable or at risk, and guide climate change adaptation action. This component will be completed in partnership with Conservation Biology Institute.

5. **Adaptation planning – part I**. We will convene a two-day workshop with scientists, managers, conservation practitioners, and others *to use the findings of the vulnerability assessment to inform the development of climate-smart adaptation strategies and actions to conserve priority habitats*. Specifically, we will use the results of the vulnerability assessment to evaluate whether existing management actions may be vulnerable to climate change, and identify opportunities to

modify existing actions to reduce vulnerabilities and become more climate-smart. We will then focus on *identifying climate-smart conservation strategies and actions that are not currently being implemented, but should be considered in order to conserve priority habitats*. As part of this activity, adaptation strategies and actions will be evaluated for feasibility (likelihood of being implemented) and effectiveness (likelihood of achieving desired results), potential barriers (e.g., institutional, social), and linked with corresponding management operation levels. For example, some adaptation strategies would be most appropriately implemented at the land management plan level (e.g., instituting activity restrictions within a certain distance of riparian areas) whereas others are best implemented at the project or site-specific level (e.g., removing culverts). Adaptation strategies and actions developed during the workshop will be compiled into an Adaptation Plan, sent out for expert review, and revised based on feedback and comments.

6. **Adaptation planning – part II**. Participants from the first workshop will reconvene to explore the results of the climate-informed mapping and Adaptation Plan in order to generate *implementation plans that clearly lead to on-the-ground action*. We will revisit the earlier developed adaptation strategies and actions and, using the climate-informed maps, identify where on the landscape managers could implement specific actions. As part of this workshop, we will discuss model assumptions and uncertainties, as well as data and mapping limitations in the context of creating realistic, on-the-ground action recommendations. Workshop findings will be used to generate an implementation handbook that describes where, when, and how to implement actions, as well as emphasizes adaptation across management boundaries. The handbook will also provide guidance on the application and integration of the vulnerability assessment and adaptation strategies in management decision-making.

Project Timeline

Step	Task and Timeline
1	**Convene stakeholder group and identify draft list of focal habitats (Jun-Aug 2014)** • Invite additional representatives to participate in Southern California Stakeholder Group • Convene stakeholder group meeting to identify draft list of focal habitats • Work with group to identify important regional stakeholders and scientific experts to invite to participate in the focal habitats workshop, and begin contacting potential participants
2	**Focal habitats workshop (Sept-Nov 2014)** • Create focal habitat evaluation criteria • Host one-day workshop (Oct/Nov 2014) to finalize draft list of focal habitats
3	**Vulnerability assessment (Oct 2014-May 2015)** • Form scientific expert panel • Collect, compile, and synthesize existing sensitivity, exposure, and adaptive capacity information on focal habitats • Assemble spatially explicit downscaled climate information for the region • Scientific expert panel application of vulnerability assessment model (scoring and confidence evaluation) for focal habitats • Assemble draft vulnerability assessment summaries comprised of expert scores and confidence rankings, and information from the peer-reviewed literature • Write vulnerability assessment report, including methodologies, vulnerability assessment model and its application, and vulnerability findings for focal habitats • Send out for peer-review, integrate comments and revisions, finalize, and post online

Step	Task and Timeline
	• Host webinars for regional stakeholders to present findings and encourage participation in upcoming adaptation workshops
4	**Spatial analysis and mapping (Jan-Aug 2015)** • Compile spatial and temporal data features for each habitat • Create custom spatial datasets and climate-informed maps for habitats • Convene stakeholder group to review draft maps, integrate comments and revisions, finalize, and post online (Data Basin)
5	**Adaptation planning – part I (Apr-Aug 2015)** • Convene first adaptation planning two-day workshop (May 2015) • Assemble draft adaptation strategies and actions for focal habitats into Adaptation Plan • Send out for peer-review, integrate comments and revisions, finalize, and post online
6	**Adaptation planning – part II (Sept 2015-Feb 2016)** • Convene second adaptation planning two-day workshop (Oct/Nov 2015) • Use climate-informed maps and Adaptation Plan to generate implementation plans for specific, on-the-ground actions • Assemble draft findings into an implementation handbook, which links climate-informed maps with adaptation strategies and actions. Handbook provides recommendations on what actions to implement where, as well as guidance on the application and integration of the vulnerability assessment and adaptation strategies in management decision-making. • Send out for peer-review, integrate comments and revisions, finalize, and post online • Host webinars to present and disseminate findings

Measuring Results

Primary users of project results and products include staff from USFS focal National Forests, as well as managers and conservation practitioners from state and federal agencies, private lands, and NGOs. All deliverables including the vulnerability assessment results, spatial analysis and climate-informed maps, adaptation strategies, and workshop support pages will be posted online through EcoAdapt, California Climate Commons, and Data Basin websites as they are completed. We will also track the extent to which documents such as the vulnerability assessment and adaptation strategy reports are downloaded from the EcoAdapt website. We utilized the same approach for the Sierra Nevada products, which have been visited over 19,000 times since their release in February 2014. We will also host, record, and archive webinars through EcoAdapt, Climate Adaptation Knowledge Exchange (CAKE, www.cakex.org), and CALCC websites, among others, to disseminate data and products.

This project directly supports the need of the USFS to incorporate climate change considerations in project level NEPA analysis, land management plan revisions, and best practices guidance for land management (e.g., monitoring strategies, resource guidance documents). Both the overall project process and deliverables will contribute to these efforts, especially as they incorporate broad stakeholder involvement. In addition, the USFS uses the Climate Change Performance Scorecard to track its progress on incorporating climate change considerations into USFS work at forest, regional, and national levels. The proposed project will enable forest units to meet requirements of the Scorecard, including elements 6 – Vulnerability assessment and 7 – Adaptation activities, as well as elements 4 – Integrate science and management partnerships and 5 – Develop external climate change partnerships. Further, on last year's Scorecard report, the Southern California National

Forests noted that they would benefit from having a vulnerability assessment and adaptation strategy project conducted in their geography similar to the recently completed Sierra Nevada effort.

Value-added and Transferability

Funding from the CALCC will greatly enhance this planned climate-smart project by supporting two essential components: (1) the focal habitats workshop, and (2) the second adaptation planning workshop and associated implementation handbook. While the project's implementation is not contingent upon this funding, we would be able to incorporate leading-edge climate-smart adaptation methods, particularly through the second adaptation workshop. Specifically, we will use climate-informed maps to identify on-the-ground implementation actions for resource managers and planners. Climate-related spatial information is often intended to inform the development of climate-smart strategies and actions, however in practice this is rarely the case. This was a component we tried to incorporate in the Sierra Nevada project, but learned that a second workshop was needed to have sufficient time to tackle this challenging activity. Hence our new planned project reflects an adaptive approach to improve outcomes for the four Southern California National Forests, and provides a unique opportunity to showcase the utility of spatial information in climate-smart planning and implementation. Further, creating an associated implementation handbook clearly documents the approach so that it can be replicated in other locations. The CALCC will add significant value to this planned effort by supporting a place-based project that moves through all the climate-smart conservation steps – from partnership to vulnerability assessment, to adaptation strategies and implementation plans – with a direct management application of products through the USFS.

This project is based on a successful model developed by EcoAdapt and funded by the CALCC for focal resources of the Sierra Nevada region of California, and has since been applied in other regions and ecosystems in California, Alaska, Idaho, and Montana. Using lessons learned from the Sierra Nevada project, we are refining and adding to this model to improve project outcomes for forests in Southern California. For example, Sierra Nevada participants suggested we begin reaching out to scientific experts earlier in the process to ensure appropriate representation for focal habitats. Participants also provided important feedback on the development of adaptation strategies – namely, the need to identify adaptation strategies and actions currently being implemented as well as to identify possible future adaptation actions that are not being implemented but should be considered. These recommendations will be incorporated into the planned climate-smart project, and will provide participants with a scientifically sound, well-rounded portfolio of climate-smart adaptation strategies and actions to improve conservation of priority habitats.

Previous funding from the CALCC allowed us to advance climate-smart conservation in ten National Forests; funding through this proposal would allow us to advance climate-smart conservation in an additional four National Forests in California. In the future we hope to expand this methodology to the remaining four National Forests in northwest California. However, this project and associated implementation guide will have applicability beyond its current geographic scope. By demonstrating how assessment information and adaptation options can be used in management operations, as well as how to move from a large landscape-scale assessment to on-the-ground action, this project will provide *a highly transportable, cross-scale model that will benefit future planning efforts at other National Forests and LCCs nationally*. The potential beneficiaries of this product will therefore include all USFS regions and other land managers and conservation practitioners across the U.S.

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EDUCATION

M.S., University of Washington, Seattle, WA	2008
B.Sc., California Polytechnic State University, San Luis Obispo, CA	2004

RECENT PROFESSIONAL EXPERIENCE

Lead Scientist, EcoAdapt	2010-present
Research Analyst, Southern Oregon University	2010
Research Analyst, University of Washington	2006-'08, 2009-'10
Research Assistant, Oregon State University	2008-2009

RECENT GRANTS AND FELLOWSHIPS

Northwest Climate Science Center "Moving from Awareness to Action: Advancing Climate Change Vulnerability Assessments and Adaptation Planning for Idaho and Montana National Forests" – 2014-2016

California Landscape Conservation Cooperative "Science Delivery for Vulnerability Assessment and Adaptation Strategies for Focal Resources of the Sierra Nevada" – 2013-2014

Wilburforce Foundation "Nez Perce-Clearwater National Forests Vulnerability Assessment & Adaptation Planning" – 2013

Yale University School of Forestry and Environmental Studies "Applying the Yale Framework in the Nez Perce-Clearwater National Forest Plan Revisions" – 2013

RECENT PRESENTATIONS

Invited Presenter, Intermountain West Funders Network strategic planning meeting	April 2014
Invited Talk, U.S. Environmental Protection Agency webinar	April 2014
Invited Presenter, California Landscape Conservation Cooperative webinar	February 2014
Invited Presenter, U.S. Forest Service Climate Change Integration Team webinars	2012-2014
Invited Talk, Western Division of the American Fisheries Society Conference	April 2013
Symposium Organizer and Presenter, National Adaptation Forum	April 2013

SELECT PUBLICATIONS

Kershner, J.M., editor. 2014. Climate Change Adaptation Strategies for Focal Resources of the Sierra Nevada. EcoAdapt, Bainbridge Island, WA. 91 pgs.

Kershner, J.M., editor. 2014. A Climate Change Vulnerability Assessment for Focal Resources of the Sierra Nevada. EcoAdapt, Bainbridge Island, WA. 315 pgs.

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EDUCATION
University of Missouri - Columbia (Sept. 1993- Dec. 1999)
  Ph.D. Avian Ecology, (Dr. John Faaborg advisor).
  "Life History Evolution in *Melospiza melodia*, an Experimental Approach"

University of California, Berkeley (Aug. 1987- May 1991)
  B.A. Integrative Biology, awarded with Distinction in Scholarship.
  Departmental Honors for Undergraduate Honor's thesis

POSITIONS HELD
Aug 2013-present   Regional Wildlife Ecologist, Pacific Southwest Region,
                      USDA Forest Service, Vallejo, CA
Sept 2011-Aug 2013   Wildlife Program Leader, Pacific Southwest Region
                      USDA Forest Service, Vallejo, CA
Nov. 2004-Sept 2011 Sr. Conservation Scientist, PRBO Conservation Science
2000- 2004   NSF Post-Doctoral Fellow in Biological Informatics, International
                      Center for Tropical Ecology, University of Missouri – Saint Louis
                      and Adjunct Assistant Professor, Lecturer in Ecology & Evolutionary
                      Biology, University of Missouri – Saint Louis

PUBLICATIONS
Siegel, R. B., P. Pyle, J. H. Thorne, A. J. Holguin, **C. A. Howell**, S. Stock, and
  M. W. Tingley. 2014. Vulnerability of birds to climate change in California's
  Sierra Nevada. Avian Conservation and Ecology 9 (1): 7.

Latta, S. C., **C. A. Howell**, Dettling, M. D. and Cormier, R. L. 2012. Use of Data on Avian
  Demographics and Site Persistence during Overwintering to Assess Quality of Restored
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S. K. Heath, L. Culp, and **C.A. Howell**. 2010. Brood Parasitism and Nest Survival of Brown-
  Headed Cowbird Hosts at High-Elevation Riparian Sites in the Eastern Sierra Nevada,
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  extirpation. *Western North American Naturalist* 70:105-113.

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  birds? *PLoS ONE* 4: e6825–e6825.

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  Viers, J. F. Weigand. 2009. Why climate change makes riparian restoration more
  important than ever. *Ecological Restoration* 27:330-338.

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EDUCATION

- **University of California, Berkeley** (2007 –2012)
  - PhD in Environmental Science, Policy, & Management
  - Concentrations: Wildlife Ecology, Conservation Science and Policy
- **Stanford University** (1999-2004)
  - Master's degree in Anthropological Sciences

• EMPLOYMENT AND PROFESSIONAL DEVELOPMENT

Jun 2012 – Current	**Assistant Regional Ecologist**: *US Forest Service Pacific Southwest Region, Vallejo, CA* Duties: Assist the Regional Ecologist in applying ecological principles to regional forest management; develop Fisher conservation strategy, assess climate and resource trends in CA national forests, aid planning staff in bioregional assessment of Sierra Nevada bioregion, international environmental consultation
Fall 2007 –Fall 2012	**Graduate Student:** *University of California, Berkeley, Dept Envir. Science, Policy, & Mgmt.* Duties: Develop and implement research program in Cameroon, including: field data collection of ecological and anthropogenic variables, habitat surveys/monitoring, establishment of relationships with village members and field assistants, train assistants in navigation and data collection methods, complete GIS and statistical analysis, develop reports and scientific papers
Jan - May 2012	**Lecturer**, "*Wildlife Ecology*" Duties: Design and carry out syllabus, lecture, and administrative duties for 200 student course, manage 4 graduate student instructors
Aug 2010- Aug 2012	**Summer Program and Network Coordinator**: *UC Berkeley Beahrs Environmental Leadership Program (ELP)* Duties: Organize, plan, facilitate, and implement intensive summer training course for 40 international environmental leaders. Provide logistical, fundraising, communication, and travel support to participants, instructors, & program staff. Maintain contact with and updated information for over 400 alumni, write feature pieces for ELP website, solicit, edit, and publish ELP newsletters.
Jan-Dec 2011	**Graduate Student Instructor**, "*Wildlife Ecology*" and "*Principles in Conservation Biology*" Duties: Teach six lab/discussion sections, including 280 students, plan and implement lessons, homework, and laboratory exercises; give 2 guest lectures

PUBLICATIONS

- **Sawyer, S.** (In Press). *Failing to give enough: when researcher ideas about giving back fall short.* Journal of Research Practice.
- Linder, J.M, **Sawyer, S.**, and Brashares J. 2013. *Primates in Trade*. In: 'Primate Ecology and Conservation'. Pp 323 – 345.
- **Sawyer, S.** and Brashares, J. 2013. *Applying resource selection functions at multiple scales to prioritize habitat use by the endangered Cross River gorilla*, Diversity & Distributions.
- **Sawyer, S.** 2012. *The Ecology and Conservation of the critically endangered Cross River gorilla in Cameroon.* University of California, Berkeley (PhD dissertation)
- **Sawyer, S.** 2012. *Subpopulation Range Estimation for Conservation Planning: A case study of the critically endangered Cross River gorilla.* Biodiversity and Conservation. DOI: 10.1007/s10531-012-0266-6
- Sawyer, J. and **Sawyer, S.** 2011. *Lessons from the Mist: What can international environmental law learn from gorilla conservation efforts?* Georgetown International Environmental Law Review, Vol. XXIII, Issue 3.
- **Sawyer, S.,** Epps, C., and Brashares. J. 2011. *Placing linkages among fragmented habitats: Do least-cost path models reflect how animals use landscapes?* Journal of Applied Ecology 48: 668-678.
- **Sawyer, S.** and Robbins, M. M. 2009. *A Novel Food Processing Technique by a Wild Mountain Gorilla (Gorilla beringei beringei).* Folia Primatologica 80: 83-88.
- Robbins, M. M. and **Sawyer, S.** 2007. *Intergroup encounters in mountain gorillas of Bwindi Impenetrable National Park, Uganda.* Behaviour 144: 1497-1519.
- **Sawyer, S.** 2004. *The Interwoven Lives of Humans and Primates: How the Political and Economic Crises in the Democratic Republic of Congo Have Affected Bonobo Populations.* Stanford University (MA Thesis).