

**Sierra Nevada Conservancy- Progress Report**

**Sierra Nevada Conservancy Grant Program  
Safe Drinking Water, Water Quality and Supply, Flood Control  
River and Coastal Protection Act of 2008 (Proposition 84)**

**Grantee Name:** Environmental Defense Fund  
**Project title:** Sierra Nevada Watershed Ecosystem Enhancement Project  
**SNC Reference Number:** SNC 070314 **Submittal Date:** February, 29, 2012  
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**Check one:**

**6-Month Progress Report**  
 **Final Report**

**6-Month Progress Reports** should reflect the previous six months. **Final Reports** should reflect the entire grant period.

**A. Progress Report Summary:** (Please provide a general description of work completed during this reporting period.)

As a final report, this report reflects the entire grant period.

Environmental Defense Fund (EDF), working in partnership with faculty and staff at UC Berkeley and UC Merced, examined the feasibility of launching a major research study to assess the impact of forest management on snowpack retention and the resulting benefits to downstream hydropower operations. We conducted literature reviews; identified and visited potential research sites; and initiated dialogue with stakeholders in the hydropower industry, Sierra Nevada communities and the US Forest Service. We conducted field surveys of one prospective research site – the Onion Creek Experimental Forest in the Tahoe National Forest. We drafted the results of our work in a white paper.

**B. Deliverables or Outcomes completed during this Reporting Period or Milestones Achieved:** (Include specific information, such as public meetings held, agency participation, partnerships developed, or acres mapped, treated or restored.)

This partnership –the Sierra Watershed Ecosystem Enhancement Project (SWEET) – is designed to explore the following questions:

- What type of forest management provides the greatest benefits to downstream water users, in particular hydropower operators?

- What level of financial incentive would motivate forest landowners to modify their forest management to provide these benefits?
- How much might water users be willing to pay to receive these benefits?
- What are the environmental effects of these management actions?

Our goal is to ultimately develop the scientific and financial justification for a program of financial incentives paid to forest landowners to modify their forest management in ways that provide benefits to downstream water users. Our initial geographic targets are Sierra Nevada watersheds that serve as water supply, particularly those with various hydropower facilities. Our major focus in this first SWEEP phase was on the American River watershed which serves the Placer County Water Agency (PCWA), one of the collaborators in SWEEP.

Generous support from the Bella Vista Foundation, coupled with support from the Sierra Nevada Conservancy, has helped fund the initiation of this applied research project involving multiple partners including EDF, the University of California Berkeley and Merced campuses, PCWA and the US Forest Service. SNC and Bella Vista Foundation funds have supported the planning stage of what we hope will be a multi-year, multi-million dollar effort.

Specific project activities included:

1. *Conduct a literature review on the topic of improving water use efficiency in forests.*

The literature review was conducted by partners at UC Berkeley and UC Merced. Results are incorporated into a white paper which is one of the main deliverables of this planning phase. (100% Complete)

2. *Conduct a detailed assessment of potential research sites in the American River Watershed.*

AND

3. *Identify sub-watersheds for treatment and negotiate with landowners.*

Our attention is currently focused on the Onion Creek Research Forest on US Forest Service land. In the fall of 2008, SWEEP conducted a detailed forest inventory to begin the process of developing a research design and set of silvicultural prescriptions. We have begun outreach to neighboring landowners at *The Cedars* (a vacation community) to gain their input into project design.

In addition, we made initial inquiries with a private landowner in Lone Star, another candidate watershed, to determine if they might be willing to participate in the research. Initial indications are that they may be willing, but that they may have silvicultural objectives incompatible with the project.

The Onion Creek site appears to offer the greatest advantages for conducting the field research component of the SWEEP project, because:

- US Forest Service is amenable to working with SWEEP partners
- The site was established for the purpose of conducting forest hydrology and water yield research. yet little research has occurred there.
- The forest is in need of thinning to reduce fire risk, a need that coincides with likely SWEEP silvicultural treatments.

Conducting forest management on public land, however, involves considerable cost and up front permitting including endangered species surveys and NEPA analysis. We have begun conversations with US Forest Service staff on the Tahoe National Forest about the process required for gaining all necessary approvals. (100% complete)

4. Collect baseline hydrology information for predictive modeling- Basic snowcover, precipitation, temperature, radiation and streamflow data for the area will be complied and evaluated.

AND

5. Develop hydrology modeling framework and run initial simulations. We will use the hydrologic model DSHVM1 in this project to model water flows and responses to forest treatment. During the planning phase, we will calibrate the model to the specific conditions present in the American River watershed using baseline information collected in action item #4 above.

We have compiled relevant snowpack, discharge, temperature, precipitation and other meteorological data for the American River basin. In addition, we have satellite snowcover data for the period 1999-present. We have also compiled elevation, soils, geology and vegetation spatial data layers for use in modeling. We have selected the REHSSys model, which represents hydrology in the same way as does DHSVM, but includes additional water-ecosystem interaction options not included in DHSVM. The model has been tested on the nearby Sierra Nevada Adaptive Management Project (SNAMP) catchments, with parameterizations that are relevant for the proposed SWEEP catchments. The next step is to set up the model on the specific SWEEP catchment proposed for treatment, as part of the detailed planning phase. (100% complete)

6. Initiate economic analysis.

Project economists have conducted interviews with Placer County Water Agency personnel to begin the process of economic analysis. Initial discussions illustrated the complexity of an economic analysis of projected future benefits that will have high levels of variation and beneficiaries, with varying levels of interest in strategy that resembles what venture capitalists do (i.e., investing across a wide array of potentially high risk/high return) rather than the strategies used by public agencies that historically manage forest or water resources.

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<sup>1</sup> DSHVM - Distributed Soil-Hydrology-Vegetation Model, a state of the art computer model for predicting hydrological response from vegetation manipulation.

For a full analysis, it will be necessary to complete data collection and modeling of the institutional entities that represent buyers, sellers and investors, as well as the physical resource production system. Evaluation of the full range of purchased and “free” ecosystem services would begin with data collection on the actual costs and revenues from the forest management project activities, and an extrapolation of the potential costs and revenues for treatments applied at a commercial scale of operation. The economic value of the estimated increased late-season flow would be calculated from the marginal value of the water as it runs through sequential hydroelectric turbines and is then available for diversion to agricultural or urban water districts. The value of the increased late season in-stream flow would be estimated by the implicit price of contractual obligations, as well as through sets of structured interviews with water managers and environmental consultants engaged in monitoring in-stream flows. The project data would then be used to parameterize a more generic model to estimate the benefits and costs on systems with different-sized treatment areas, number of turbines and lengths of streams with improved conditions. (100% complete)

*7. Prepare a full project proposal. The main output of this planning phase will be a full and detailed project proposal.*

A full proposal that addresses the next stage of the SWEEP research agenda was submitted in response to a call for proposals from the University of California’s competitive grants program in Agriculture and Natural Resources. The proposal, “Effect of Forest Management on Water Yields and other Ecosystem Services in Sierra Nevada Forests,” was submitted in May 2011 by the SWEEP team. The lead-PI was Professor O’Hara. We outlined a three-year research program supported by \$600K in funding. Note that this proposal can be expanded during the second phase of SWEEP, involving detailed planning, permitting and baseline measurements. (100% complete)

**C. Challenges or Opportunities Encountered:** (Please describe what has worked and what hasn’t; include any solutions you initiated to resolve problems. If your project is not on schedule, please explain why here.)

The primary challenge was the delay in the project due to the bond funding freeze. This project enjoyed great momentum during the summer and fall of 2008, but that momentum was difficult to regain due to new commitments and staffing constraints at EDF and at UC.

**D. Unanticipated Successes Achieved:** (Please describe any additional successes beyond completing scheduled tasks or meeting scheduled milestones.)

Project partners R. Bales and J. Battles, at UC Merced and UC Berkeley respectively, have included the SWEEP forest management and water concepts in talks they have given, thus raising the profile for consideration of water as a key ecosystem service that is influenced by forest management.

**E. Compare Actual Costs to Budgeted Costs:** (Please refer to your grant agreement to list your deliverables/budget categories and budgeted costs compared to actual costs incurred during this reporting period in the table below.)

**F.**

<b>PROJECT BUDGET CATEGORIES</b>	<b>Budgeted SNC Dollars</b>	<b>Actual Dollars</b>
Salaries	45,174.02	52,798.55
Fringe	12,196.98	9,126.85
Travel	4,572.00	2,495.01
Meetings	762.00	0.00
Misc Expenses	1,524.00	1,871.75
Overheads	10,438.00	8,107.33
Hydrology Monitoring Equipment	5,333.00	5,600.51
Total	80,000	80,000

Because of the extensions of time given for this grant, EDF spent additional staff time on the project. The savings we had in lines such as travel and meetings were used to cover the extra personnel.

**F. Do you have information to report on the project-specific Performance Measures for your project?** (If so, please list the Performance Measures below and describe your progress.)

None to report.

**G. Were there any other relevant materials produced under the terms of this Agreement that are not a part of the budgeted deliverables? If so, please attach copies.**(Include digital photos, maps, media coverage of project, or other work products.)

No.

**H. Next Steps:**(Work anticipated in the next 6 months, including location and timing of any scheduled events related to the project.)  
This is a final report. No next steps anticipated.

**Description of Project Accomplishments**

1. **Most Significant Accomplishment** (Describe in one concise, well-written paragraph, the most significant accomplishment that resulted from this grant.)

SWEEP’s most significant accomplishment is to develop an optimized strategy for Sierra Nevada forest management utilizing California’s most important resource: snowpack. The proposed management strategy increases the availability of water and optimizes the timing of its delivery which protects the ecological integrity of the upland forests, mitigates the risks associated with catastrophic disturbances, and increases resilience to climate change. This grant also produced a robust synthesis of the literature that will help

tease out a research agenda for the next steps of the project, i.e., the development of a metric for quantifying benefits of good forest management for downstream water users.

2. **WOW Factor** (If applicable, please describe anything that happened as a result of the project or during the project that is particularly impressive.)

This project set the stage for a future WOW factor. If the research proves out, the ideas for forest management proposed in SWEEP have the potential to be transformative in helping California and the Sierra Nevada adapt to climate change.

3. **Design and Implementation** (When considering the design and implementation of this project, what lessons did you learn that might help other grantees implement similar work?)

We began our project with an assumption that direct field testing of hypotheses was the optimal way to create the new knowledge that would guide a new ecosystem market. This assumption was challenged by the high cost of conducting field testing. Had we anticipated this, we would have adjusted our project timeline to begin evaluating the option of using existing field studies and models to accomplish our objectives earlier. Direct field testing is still the optimal way to develop new knowledge, but the economic reality and time constraints pushed us toward a more flexible study design, an approach that others should consider early on.

4. **Indirect Impact** (Please describe any indirect benefits of the project such as information that has been developed as a result of the project is being used by several other organizations to improve decision-making, or a conservation easement funded by this grant that encouraged other landowners in the area to have conservation easements on their property.)

Since this was primarily the planning stage of this project, it is premature for SWEEP to have indirect impacts. Through this grant, we began to lay the groundwork with utilities and other interested stakeholders for a new way of doing business – the concept of paying for better forest management for improved snowpack and water supply. It is critical that we started these conversations early on in our research development, but the concept needs further scientific substantiation before it can be incorporated into a business plan.

5. **Collaboration and Conflict Resolution** (If you worked in collaboration or cooperation with other organizations or institutions, describe those arrangements and their importance to the project. Also, describe if you encountered conflict in the project and how you dealt with it, or if there was conflict avoided as a result of the project.)

SWEEP was managed by strong teams of both academic researchers and environmental NGO's. We were challenged by a delay in funding for over a year, and it was hard to rebuild momentum after this interruption. It is also always difficult to bridge the divide between science and policy as we come from different perspectives and use very different

ways of presenting information. But ultimately, we were able to come up with a better end product as a result of the diversity of the project team.

6. **Capacity-Building** (SNC is interested in both the capacity of your organization, as well as local and regional capacity. Please describe the overall health of your organization including areas in need of assistance. SNC is interested in the strength and involvement of your board, significant changes to your staff, size and involvement of membership. In addition, describe how your project improved capabilities of partners, or the larger community.)

While the UCs and EDF are robust institutions with good local and regional capacity, there is always a need for research funds to continue to pursue cutting edge ideas like SWEEP. As the science behind SWEEP progresses, it will need to take on a more localized approach, with effective outreach to local stakeholders to understand how to best translate theory into practice.

7. **Challenges** (Did the project face internal or external challenges? How were they addressed? Describe each challenge and any actions that you took to address it. Was there something that SNC did or could have done to assist you? Did you have to change any of your key objectives in response to conditions “on the ground”?)

The project faced both internal and external challenges, many of which were described above. The delay in funding from the state significantly slowed the development of the white paper. When we geared back up, EDF corralled the group and convened phone calls to guide the group to the completion of the white paper. Each team brought additional resources to the table to complete the report; EDF brought on a technical editor to help bring the different pieces of the paper together and UC staff brought in research assistants to proof and format the report.

Our objectives did change in response to conditions on the ground. We discovered the barriers to direct field testing for forest treatments were difficult to overcome, but we found a good alternative by utilizing a combination of models and existing treatments.

8. **Photographs** (Grantees are strongly encouraged to submit photos, slides or digital images whenever possible. These images will be used for SNC publications such as annual reports or on the website. Please make sure you clearly identify location, activity, and your project with each submitted image. Images will be credited to the submitting organization, unless specified otherwise.)
9. See attached. **Post Grant Plans** (What are the post-grant plans for the project if it does not conclude with the grant? Include a description of the following (if applicable): (1) Changes in operations or scope; (2) Replication or use of findings; (3) Names of other organizations you expect to involve; (4) Plans to support the project financially, and; (5) Communication plans?)

The SWEEP team has received a second grant from UC Agriculture and Natural Resources (ANR) to further focus on developing the science piece of the project. (See attached grant proposal). EDF will change its role from coordinator to policy advisor.

**10. Post Grant Contact** (Who can be contacted a few years from now to follow up on the project? Please provide name and contact information.)

Eric Holst 916.492.7080

**SNC-approved Performance Measures:** (Please list each Performance Measure for your Project, as identified in your Grant Agreement, and the results/outcomes.)

1. Resources leveraged:

a. Resources leveraged to complete this Project (matching funds, in kind contributions, etc.).

In order to complete this project, EDF received matching funds from the Bella Vista Foundation and provided in-kind contributions through staff time.

b. Resources leveraged as a result of this Project.

As a result of this project the SWEEP team is a recipient University of California's Agriculture and Natural Resources grant in the amount of \$600K.

2. Impact on collaboration and cooperation among stakeholders:

a. Number of people/entities involved in Project.

Three main entities partnered on this project: UC Berkeley, UC Merced and Environmental Defense Fund. The project goals also necessitated collaboration with the US Forest Service and the Placer County Water Agency.

**b.** Increased cooperation/decreased conflict among stakeholders.

We initiated dialogue with stakeholders in the hydropower industry, Sierra Nevada communities and the US Forest Service. And we conducted field surveys of one prospective research site – the Onion Creek Experimental Forest in the Tahoe National Forest.

3. Capacity building within region:

a. Description of how completion of this Project improved capabilities of grant recipients, partners, or larger community.

Importantly, we engaged the Placer County Water Agency as well as the US Forest Service in this project. In addition, project partners R. Bales and J. Battles,

at UC Merced and UC Berkeley respectively, have included the SWEEP forest management and water concepts in talks they have given, thus raising the profile for consideration of water as a key ecosystem service that is influenced by forest management.

4. One-page description of Project accomplishments:

- a. Description of how the project succeeded in accomplishing its intent and the direct benefits that resulted from the Project.

SWEEP's most significant accomplishment is to develop an optimized strategy for Sierra Nevada forest management utilizing California's most important resource: snowpack. The proposed management strategy increases the availability of water and optimizes the timing of its delivery which protects the ecological integrity of the upland forests, mitigates the risks associated with catastrophic disturbances, and increases resilience to climate change. This grant also produced a robust synthesis of the literature that will help tease out a research agenda for the next steps of the project, i.e., the development of a metric for quantifying benefits of good forest management for downstream water users.

- b. Description of the follow-on or indirect benefits of the Project.

Next steps: A full proposal that addresses the next stage of the SWEEP research agenda was submitted in response to a call for proposals from the University of California's competitive grants program in Agriculture and Natural Resources. The proposal, "Effect of Forest Management on Water Yields and other Ecosystem Services in Sierra Nevada Forests," was submitted in May 2011 by the SWEEP team. The lead-PI was Professor O'Hara. We outlined a three-year research program supported by \$600K in funding. Note that this proposal can be expanded during the second phase of SWEEP, involving detailed planning, permitting and baseline measurements.

Indirect benefits: Since this was primarily the planning stage of this project, it is premature for SWEEP to have indirect impacts. Through this grant, we began to lay the groundwork with utilities and other interested stakeholders for a new way of doing business – the concept of paying for better forest management for improved snowpack and water supply. It is critical that we started these conversations early on in our research development, but the concept needs further scientific substantiation before it can be incorporated into a business plan.

- c. Description of any significant positive experiences and unanticipated occurrences, or other noteworthy events that happened during the Project and anything about the project that gives you "goose bumps."

If the research proves out, the ideas for forest management proposed in SWEEP have the potential to be transformative in helping California and the Sierra Nevada adapt to climate change.

d. Description of lessons learned during the course of completing the Project.

We began our project with an assumption that direct field testing of hypotheses was the optimal way to create the new knowledge that would guide a new ecosystem market. This assumption was challenged by the high cost of conducting field testing. Had we anticipated this, we would have adjusted our project timeline to begin evaluating the option of using existing field studies and models to accomplish our objectives earlier. Direct field testing is still the optimal way to develop new knowledge, but the economic reality and time constraints pushed us toward a more flexible study design, an approach that others should consider early on.

5. Number of individuals/organizations provided with copies of study results.  
The SWEEP white paper was posted on UC Merced's website and had its own press release which created some press. Beyond that, it has been shared informally with several organizations and agencies.
6. Number of projects/areas/entities using study results for improved decision-making.  
This study was primarily a planning report, therefore, to date this hasn't influenced decision-making processes—but it set the stage for transformations in forest management.

SNC did not provide performance measures. All project deliverables have been met as discussed in this final report.

## Sierra Nevada Conservancy Grant Program Project Reporting Guidelines

Progress Reports are required periodically throughout the term of the Grant Agreement (Refer to Exhibit B of the Grant Agreement). These reports will allow you and the Sierra Nevada Conservancy (SNC) to see the degree to which the project is on track and achieving your projected outcomes. Your Progress Reports will further provide the SNC with information that will help us to explain your work to the Board Members and various other audiences. Timing of Progress Reports is specified in the Project Schedule included in Exhibit A of the Grant Agreement, but generally every 6 months until completion of the project.

A Progress Reporting Form is provided to Grantees on the SNC Website. **Six-month Progress Reports** should reflect the previous 6-month period; **Final Reports** should address each question for the entire grant period – looking at the project as a whole.

The form specifies the items you will need to report on. For the Six-Month Interim Report these include, but are not limited to: *A Progress Report Summary of work completed, Deliverables or Outcomes Completed, Challenges or Opportunities Encountered, Unanticipated Successes Achieved, Actual Costs compared to Budgeted Costs, Any Additional Relevant Materials Produced, and Next Steps.*

The Final Report will include additional information, such as: *Resources Leveraged, Capacity-Building Results and Collaboration and Cooperation with Stakeholders, a Description of Project Accomplishments, and SNC Approved Performance Measures.*

Please make sure that you submit complete reports by the dates requested in your Grant Agreement.