Appendix F: Participation Team Final Report

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Executive Summary

This Appendix is a report on the diverse activities carried out by the Participation Team to assess participation in SNAMP, improve our methods of outreach, and contribute to the integrated chapters (chapters 3, 4 and 5 of this report).

The Sierra Nevada Adaptive Management Project (SNAMP) was developed to incorporate stakeholders into an adaptive management framework where the University of California (UC) used scientific experiments to assess the impacts of Forest Service fuels reduction projects. The first pillar of the UC 2007 SNAMP workplan was that adaptive management involved "deliberate experimentation" and this dictated the way the UC Science Team structured the science conducted in SNAMP (in addition to the Participation Team, SNAMP teams studied the following subjects: fire and forest ecosystem health, Pacific fisher, California spotted owl, and water quality and quantity, and spatial analysis). The workplan's second pillar was "...that adaptive management must be a participatory process that engages scientists, stakeholders, and managers in a long term relationship grounded in shared learning about the ecosystem and society." We considered the Participation Team role to be two-fold: a demonstration of a model of participatory, or collaborative, adaptive management and an analysis of the participant experience in SNAMP. While the primary mode of stakeholder interaction with scientists and the Forest Service was necessarily consultative rather than the power-sharing of a full collaboration, the participatory adaptive management process used by SNAMP was defined for the project as "collaborative adaptive management" or CAM. For this reason the participatory process as implemented in SNAMP has the following stated definition of collaborative adaptive management (CAM):

> CAM is a science-driven, stakeholder-based process for decision-making while dealing with the scientific unknowns inherent in many physical and biological systems. In the SNAMP process, adaptive management incorporates stakeholder participation in order to improve the amount and breadth of information for decision-making, create meaningful engagement and build mutual understanding, learning, and trust.

Over the last century the Forest Service has shifted from an emphasis on management based solely on technical expertise to models using more participatory methods. Increasing litigation in the 1980s reflected continued frustrations and conflict as stakeholders demanded

more input into the decision-making process. The third party model that SNAMP used, in which an agency, the public and an outside science and outreach provider in a sense act as checks and balances to each other was derived out of the concept of shared, multi-party, or joint monitoring, and to some extent, citizen science. Both increase the participation of stakeholders in the science that drives management decisions. As true co-management, where power is shared equally, is not legally possible for the Forest Service or for scientists adhering to strict experimental protocols, projects like SNAMP can be seen to allow for more transparency in the decision-making process by opening up the science and planning processes, and providing additional pathways for input and feedback. An unforeseen benefit was the stakeholder enthusiasm for increased participation in and understanding of the science that became apparent over the course of the project. SNAMP provided some direct communication channels between scientists and the public, and this turned out to be one of the most appreciated aspects of SNAMP.

To address our focal question and engage stakeholders in the adaptive management process, the Participation Team conducted outreach based on long evolved University of California Cooperative Extension principles, and produced extensive assessments of the participant experience in SNAMP. We developed a participation process and analysis framework based on our best practices for collaboration expertise as well as an extensive review of the literature. The five core elements of our effort were inclusivity, transparency, learning, relationship building and effectiveness. We collected input from both SNAMP participants and non-participants with regard to these core elements in SNAMP via written surveys immediately at the end of meetings as well as through two online email surveys of the SNAMP listserv and three separate rounds of in-depth interviews. Our team employed the following varied outreach methods to address these elements.

The Team focused on both in-person events and presentations as well as at-a-distance methods that were web based. Each type of participation event had its advantages and limitations and each allowed certain kinds of learning to occur or relationships to be fostered (Tables F3 and F4). Face-to-face interactions with scientists and managers were a focal point of the in-person outreach program. Our large public meetings gave broad access to the project, though with little time for details, and provided a forum for interest group positions to be shared. The smaller

technical integration team meetings were focused on individual topics. These provided in-depth data sharing with advanced discussions and were incredible learning opportunities based on the presentations of the lecturers but also as participants learned from each other's less formal questions and comments. Field trips, where participants could "kick the dirt" together and actually see the forest, were touted as most valuable for learning about management context, scientific methods and findings as well as for building relationships through intimate and casual conversations. Subject matter workshops, which conveyed all the most relevant science on managing a resource including findings beyond the scope of SNAMP, were highly appreciated by managers. Taking SNAMP to targeted audiences by going to their meetings and events proved to be a powerful way to spread the scientific outcomes of SNAMP as well as increase project inclusiveness and transparency.

The project's at-a-distance methods such as the website and its document archive, science briefs, newsletters, and blogs provided the basis for all other SNAMP contacts because of their accessibility and transparency. The email list was invaluable for getting information out to interested parties, though it is not particularly interactive. Webinars were found to be useful at the end of the project (they saved time and money) but none of the online interactions could replace the importance of face-to-face connections with scientists, managers or other stakeholders. We observed that our webinars were mainly successful because they occurred at the end of the project when relationships were solidified and there was a group comfort level that could overcome the impersonal nature of the webinar.

To transfer the SNAMP collaborative lessons and to train stakeholders and the agencies to conduct or participate in future collaborative adaptive management projects, we created and implemented a multi-day workshop curriculum and companion workbook. Participants in these trainings gained a clearer understanding of adaptive management and how to include the public in the process, how and when to use an independent third party, and how participants can utilize facilitation tools to help defuse conflict. Evidence from the post-workshop surveys suggests that these trainings increased participant commitment to collaboration and it is these key stakeholders and agency participants that could help ultimately complete the SNAMP adaptive management cycle.

A review of our participation model by core element starts with the two most basic and primary elements: transparency and inclusivity. We attempted to attract and reach out to the broadest extent possible by varying our events, presenting at other groups' events and extending our contact through online and traditional media. Our goal was to include as many voices and perspectives as possible to foster the strongest buy-in for the final results as well as input during the process. Transparency was a focal point from the beginning, starting with the SNAMP website. Within its contractual constraints, SNAMP strove to be as open and transparent in its processes and decision-making as it could be. Our surveys showed that the strong effort put in by the Science Team to focus on inclusivity and transparency was recognized by participants.

Learning was the next goal of the SNAMP Participation Team and was also the overall purpose of SNAMP, as reflected in the title of the project: "Learning how to apply adaptive management…" Each of the science teams produced copious amounts of novel data with regard to their subjects and presented these findings to the public multiple times a year. We found that learning in these kinds of social settings helped SNAMP produce shared understandings about basic biological and ecological conditions as well as larger concepts about forest health and adaptive management.

The other crucial outcome of shared learning and understandings was new and improved relationships between the participants in SNAMP. Our results show that over the long life of the project, in which there were many and varied opportunities to interact or observe other participants, relationships improved even among those historically opposed to each other such as environmental and forest products groups. Unfortunately some relationships in the project were strained not because of the shared learning experience but due to limitations of the project such as funding. Though not an explicit goal of SNAMP, participants also learned about the Forest Service and the constraints faced in Sierran forest management that could help improve collaboration with the agency in the future. The shared scientific understandings and the hybrid culture they fostered, combined with the improved relationships between participants and familiarity with the Forest Service, could be the foundation for more productive and continued collaborations in the future. The Forest Service will need to continue to engage intensely with the

public in order for the positive trends to continue.

We interpreted our goal of effectiveness as encompassing the collaboration's process or structure as well as the project's ability to accomplish the goals that the literature suggested and participants felt were important for the project to be interpreted as successful. Much of the basic communication structure of the project worked well: the project invested in trained outreach and facilitation staff, meetings were set up to encourage productive discussions, events were evaluated and continually adapted to meet participant suggestions, and a large variety of outreach strategies were implemented and supported for the duration of the project. In addition, the Forest Service treatments were implemented, the academic experiments were completed and this report was drafted, reviewed by peers and the public, and published; those were milestones that were not always assured of completion during the project and now can also be considered examples of SNAMP's effectiveness.

Ultimately, participants in collaborations like SNAMP intend for the project to have far-reaching and broader impacts past the study areas, timeframes, and agencies involved. One agency participant suggested that the most important goal of SNAMP was to create a group of stakeholders prepared to collaborate with the Forest Service and reduce conflict around forest management in the Sierra. The Participation Team worked to exemplify a model process for conducting collaborative adaptive management and training that could be implemented by agencies to hopefully reduce conflict. Though there was almost complete turnover of the Forest Service participants in SNAMP, many of the public, environmental group, forest products, and other agency representatives were able to stick with the project all the way through. A group of stakeholders had formed at the end of the project who had developed long-term relationships with each other, shared common understandings about the resources, and had similar expectations about the process of adaptive management. This modeling and training, combined with the shared understandings and improved relationships between participants, bodes well for future collaboration in the Sierra.

But was SNAMP effective at reducing conflict? A large majority of our email survey participants felt that SNAMP increased trust within the three party model. Yet both email survey

respondents and interviewee participants were ambivalent as to the project's ability to reduce conflict over forest management in the Sierra. The dominant sentiment was that appeals and litigation were inevitable because they are driven by the entrenched philosophies and agendas of interest groups. The two solutions offered by email survey respondents were the cornerstones of the SNAMP three party effort: independent science and increased stakeholder participation.

SNAMP's three party model structure was effective in a most critical aspect – the university and its science were seen as independent, unbiased and responsive to stakeholder input. But with this new model came miscommunications and disappointed expectations. The two biggest issues were the separation between management and science, and financial constraints. Initially there were disagreements as to what subjects would be studied in SNAMP. Next some stakeholders and managers hoped that SNAMP would bring university experts into the Forest Service's planning processes but this was the opposite of what the Science Team imagined due to their interpretation of how to conduct a controlled experiment. A related misinterpretation was connected to definitions of monitoring. Some stakeholders expected the university to "blow the whistle" on the Forest Service if it implemented the treatments differently than planned. This also was not the role of the university as interpreted by the Science Team. A Neutrality Agreement was created by the Science Team to clarify some of these concerns.

The financial structure of the project was a serious challenge to our effectiveness though not surprising given the dollar amounts and years of commitment. For large scale adaptive management projects, sizeable and consistent funding over many years is vital yet very difficult to achieve (Gregory et al., 2006). The difficulties of carrying out long term projects with federal agencies under an annual funding regime have been well documented (Nelson 1995). In addition, the recession that started in August of 2008, just a few years into the project, caused havoc with state and federal budgets and threw the project into years of financial stress and uncertainty. Throughout the interviews there were many comments about the tensions within the MOU Partner funding agencies with regard to how much each contributed, staff turnover, as well as a perception that the university did not understand the financial constraints and had unrealistic expectations. Eventually the project was completed but with less funding and over a longer period of time than originally planned.

In 2015, UC completed its role in SNAMP. It is left to the Forest Service to work directly with stakeholders to use SNAMP's products, results and recommendations, and to adapt them to future needs. How and whether UC Science Team results and public input are used in the next and future forest treatment plans will determine how SNAMP's effectiveness is ultimately seen. Throughout this project we have considered this a crucial step that is outside of the funded and UC Science Team part of SNAMP (Figure F1). The SNAMP collaborative adaptive management workshop teachings offer tools for both the public and the agencies to improve their communication to complete the cycle of adaptive management and begin the next cycle of learning.

Participants from all three sides of the three party model concluded the project with positive aspirations for the future. The third party science provider model was well demonstrated and should be transferable in parts or in whole to other situations or places given adequate attention and funding. It is now up to the Forest Service to close the adaptive management loop and for all of us to use the lessons learned from SNAMP to improve collaboration and management of the forests of the Sierra.

> "… we are the beneficiaries of the work and I think that the investments that we made, no one has groused about them. That wasn't the motivator for us. Benefits to the landscape over the long term and over the entire Sierra landscape were our motivators." MOU Partner 2014

I. Introduction and approach

This Appendix is a report on the diverse activities carried out by the Participation Team to assess participation in SNAMP, improve our methods of outreach, and contribute to the integrated chapters (chapters 4 and 5 of this report).

Our introduction describes adaptive management and the Sierra Nevada Adaptive Management Project's (SNAMP) interpretation of that concept into a form of collaborative adaptive management. We present a short overview of the Participation Team, its approach, role and activities, describe the structure of the team, and provide a road map to the full Participation Team Appendix. The Participation Team is one of six science teams in SNAMP. In addition to

its work in public participation, SNAMP teams studied the impact of Forest Service treatments on following: fire and forest ecosystem health, Pacific fisher, California spotted owl, and water quality and quantity. Within SNAMP, the Forest Service chose and carried out management prescriptions, while the Science Team designed and conducted assessments of management effects, reporting results back to the Forest Service and the public in order to improve future treatments.

SNAMP's collaborative adaptive management (CAM)

Adaptive management was first described by Holling (1978) and Walters (1986) as a systematic approach to learning about complex ecological systems through deliberate experimentation and improving management by learning from the results. This allows managers to act without complete information about a system (Morghan et al. 2006). The premise that adaptive management involves deliberate experimentation rather than passive trial and error provided the first conceptual pillar of the UC Science Team workplan.

Since first conceived, the definition of adaptive management has evolved to commonly include an emphasis on public participation, and SNAMP adopted this emphasis (Gregory et al. 2006; Stringer et al. 2006). The second pillar of the SNAMP workplan specifically defined adaptive management as a participatory process that engages scientists, managers and interested stakeholders, thus distinguishing SNAMP from adaptive management forms that engage managers and scientists, but not stakeholders. The Science Team's workplan states "…that adaptive management must be a participatory process that engages scientists, stakeholders, and managers in a long-term relationship grounded in shared learning about the ecosystem and society… Our working premise is that we need stakeholder participation and feedback during each phase of Science Team research for this adaptive management program. To encourage this exchange, we are committed to transparent decision-making. There will be ongoing analysis of the creation, adoption, and application of stakeholder and scientist information in the Forest Service adaptive management process" (UCST 2007 and Appendix H of this report).

Stakeholder participation was fitted to the adaptive management cycle such that participation was part of each phase (Figure F1). The Science Team's understanding of the

processes that support adaptive management is perhaps most succinctly expressed by the following statement from a recent journal article, **"**Adaptive collaborative management emphasizes stakeholder engagement as a crucial component of resilient social-ecological systems. Collaboration among diverse stakeholders is expected to enhance learning, build social legitimacy for decision-making, and establish relationships that support learning and adaptation in the long term" (Arnold et al. 2012). The Participation Team was committed to modeling this kind of participatory adaptive management process. While the primary mode of interaction was consultative rather than the power-sharing of a full collaboration, the participatory adaptive management process used by SNAMP was defined for the project as "collaborative adaptive management" or CAM. The participatory process as implemented in SNAMP reflects SNAMP's stated definition of collaborative adaptive management (CAM):

> CAM is a science-driven, stakeholder-based process for decision-making while dealing with the scientific unknowns inherent in many physical and biological systems. In the SNAMP process, adaptive management incorporates stakeholder participation in order to improve the amount and breadth of information for decision-making, create meaningful engagement and build mutual understanding, learning, and trust.

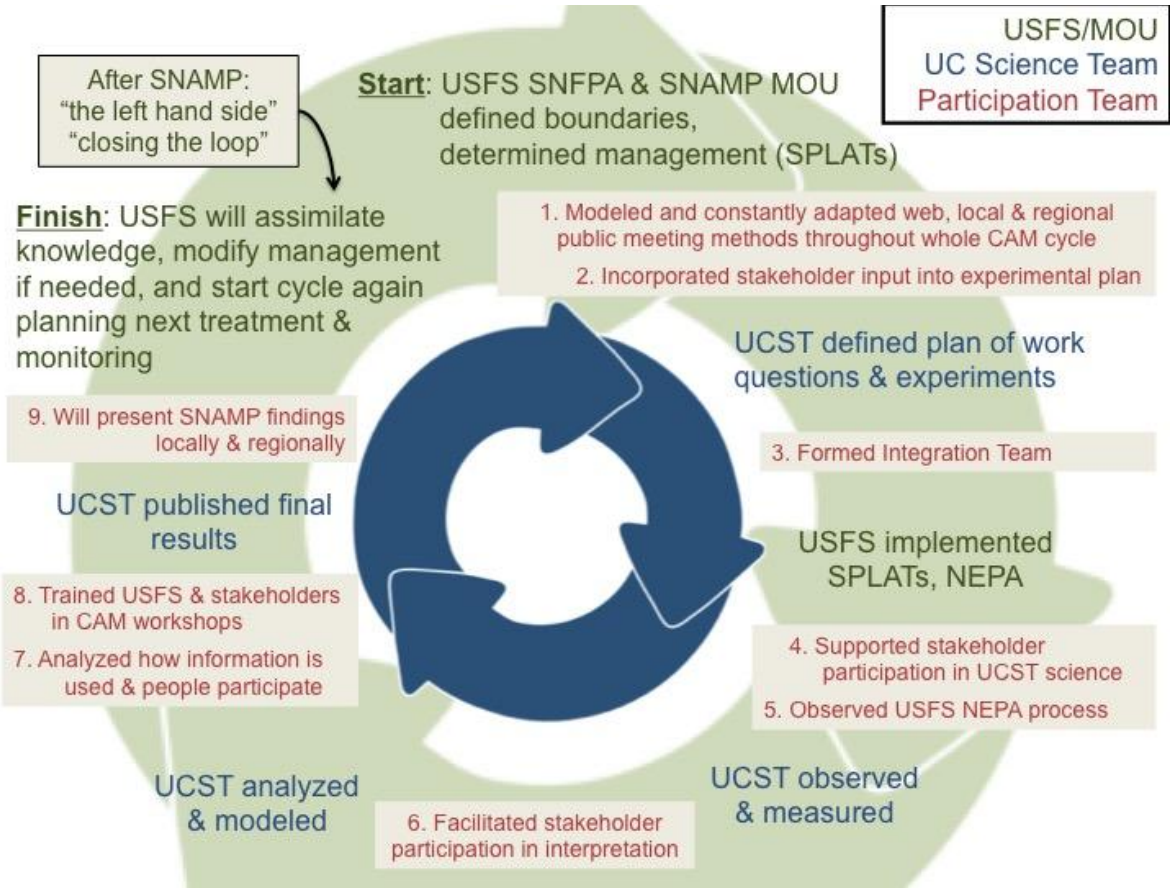


Figure F1: Depiction of SNAMP's collaborative adaptive management cycle including the roles of the United States Forest Service (USFS), the Memorandum of Understanding (MOU) Partners the UC Science Team and the Participation Team.

A complication of the collaborative adaptive management cycle that became apparent from the beginning was that completing full cycle was actually not part of the SNAMP workplan. The Forest Service planned and implemented the treatments, the UC Science Team conducted assessments and provided recommendations but the mechanism for feeding those findings back into Forest Service management was not incorporated into SNAMP. This crucial aspect of learning and utilizing that learning would occur on the "left hand side" of the collaborative adaptive management cycle and was also called "closing the loop" as it is the step just before the whole cycle would begin again (Figure F1). Participants sought assurance that SNAMP results and recommendations would be used in future management, but this could not go beyond a good faith statement by the Forest Service. Guarantees are not possible due to the legal responsibilities of the Forest Service, the difficulties in defining what "use" means in this context, and the need to continue to adapt as conditions change (described in Part II: Putting the

SNAMP Model into Context).

The SNAMP model can be seen as part of an evolving history of public participation in Forest Service decision-making. Efforts to include the public in decision-making for public lands can be generalized into two categories, “grass-roots,” or “top-down”, of course with the understanding that there is considerable territory between these two poles. The SNAMP project is a top-down project, initiated by public agencies to improve forest management in the Sierra and facilitate the implementation of fire hazard reduction treatments in accordance with the legally binding Sierra Nevada Adaptive Forest Plan Amendment (SNFPA) 2004. This controversial plan, also called the Framework, resulted in legal discussions between several agencies and groups, including the state of California Resources Agency and the federal Fish and Wildlife service, prompting the Forest Service to seek an alternative approach through this project and the request for UC to serve as a third party “neutral” entity within the SNFPA.

Defining the project boundaries, such as the fact that the Framework was law and that it would be implemented and tested rather than revised immediately, was critical to framing the dialogue. These set the limitations for the democratic forms of participation that could be facilitated to support mutual learning and to maximize information exchange between participants. Some stakeholders did not accept the SNFPA 2004 as a framework to begin with and could not accept the treatments associated with the project. The constraints the UC Science Team faced within the boundaries of SNAMP were many and diverse over this long term effort, including limited choices for treatment timing, maintaining neutrality despite the controversies surrounding forest management, vacillating funding levels, and a level of collaboration limited by the requirements of agency oversight and by scientific protocols. These required ongoing dialogue and resulted in key operational agreements. Maintaining open communication on all related changes over time to these boundaries, constraints and agreements became essential to maintaining stakeholder engagement and moving forward with the process.

Approach to participation

The University of California was chosen for the role of third party neutral science and outreach provider because of its perceived credibility with participants on both sides of Sierran

forest management debates. Other factors were University of California Cooperative Extension's (Cooperative Extension or UCCE) extensive network of outreach professionals, and long history of working with stakeholders on collaborative projects. Cooperative Extension coordinated and facilitated all public, scientist, and manager involvement in SNAMP. The Participation Team integrated this engagement component with an extensive assessment piece emphasizing analysis of stakeholder response to and learning from, outreach, science, and treatments, and developing methods to allow greater participation in the program. This assessment effort included conducting and analyzing a variety of surveys of participants and non-participants at different periods over the 10 years of the project, and a series of three in-depth interview projects. The two scientific approaches were designed to complement each other: while the surveys provided quantitative measures of the proportion of participants experiencing various outcomes, the interviews provided a more nuanced understanding of the responses, allowing interviewees to frame problems, observations, and perceptions in their own terms.

A literature review of adaptive management and participation in natural resources management was conducted early in the project to provide the foundation for SNAMP participation work and evaluation (Appendix FI). It included what were identified as the core elements of collaborative adaptive management: inclusiveness, transparency, relationship building, learning, and the effectiveness of the process itself. From experimental design to interpretation of results, our outreach strategy emphasized these core elements using Cooperative Extension training and experience.

The Participation Team developed, managed and studied the participatory opportunities of the project. From the start, efforts to engage the public were part of SNAMP. The original UC workplan was peer reviewed by outside scientists and the reviews were shared with the public. The SNAMP ecological and outreach teams reported directly to the public, Memorandum of Understanding partner agencies (MOU or MOUP), and the Forest Service about the design, methods, and results of the effects of treatments. Results were published in peer-reviewed journals, and nontechnical briefs of each publication and a complete listing of all publications were readily available at the project website: http://snamp.cnr.berkeley.edu/. The Forest Service, from regional representatives and district managers to field technicians, attended, and frequently

presented, at all SNAMP events, and carried out its National Environmental Policy Act (NEPA) public involvement process with UC attendance.

The Team managed the SNAMP website where all meetings were posted and documents were available, facilitated meetings among scientists and stakeholders, and led the development of a network of stakeholders that included the public, non-profit organizations, the state Resources Agency, the Forest Service, and others interested in forest management in the Sierra Nevada. Involvement included "integration team meetings" on specific scientific topics, field trips, lectures, annual meetings, presentations to local, state and regional groups including local high schools; and an interactive website for sharing meeting information, notes, reports and responding to comments and questions. Cooperative Extension also frequently represented SNAMP at Board of Supervisor's meetings, local interest group member meetings, and other venues.

Overall, SNAMP stakeholders included three broad groups: managers, scientists and the public. Managers were individuals from participating federal and state agencies (e.g. Forest Service, US Fish and Wildlife Service, CalFire, California Department of Fish and Wildlife, California Natural Resources Agency, California Department of Water Resources, and California Department of Food and Agriculture). Scientists came from UC Berkeley, UC Merced, UC Davis, UC Cooperative Extension, and the Universities of Minnesota and Wisconsin. Public stakeholders included a number of environmental advocacy groups, such as the Sierra Club, Sierra Forest Legacy, Defenders of Wildlife, and of a small group of vocal and concerned unaffiliated individual citizens from local communities, as well as of industry representation, such as Sierra Pacific Industries and the California Forestry Association (see Appendix F2: Affiliation of stakeholders contacted through SNAMP).

Participation Team structure: Outreach, facilitation, and analysis

The Participation Team was charged to facilitate public involvement and assess the response of stakeholders to the adaptive management experiment (Sulak et al. 2015). The Participation Team included three groups of UC scientists and UCCE professionals. The groups worked together and there was considerable overlap in the work and activities of each group.

Professor Lynn Huntsinger and Research Specialist Adriana Sulak led the effort to assess the kinds of learning and adaptation that took place as a result of project participation. Participation data was archived throughout the project and provided a database for digital and other assessments. In line with the "before and after" approach adopted by SNAMP overall, the use of qualitative interviews and quantitative email surveys of participants early and late in the project allowed examination of changing norms, what stakeholders learned about forest management treatments, and the response of stakeholders to different outreach and learning approaches.

Professor and Specialist Maggi Kelly of the Department of Environmental Science, Policy, and Management, and her graduate students including Shufei Lei and Shasta Ferranto, adapted the use of interactive web technology to create new means of engagement in the adaptive management process. This allowed participation from both near and far, overcoming the common barrier of distance to facilitate fuller participation. Using the long term data collection built into the project and the project archives, engagement could be explored using the latest in networking technology and assessment, and engagement levels and characteristics could be followed over the full duration of the project.

Kim Rodrigues of the Division of Agriculture and Natural Resources was one of the initiators of the project and led the outreach and facilitation effort with UC Cooperative Extension staff for most of the project. Natural Resources Advisor Susan Kocher transitioned from Team member to lead in the last 3 years of the project, after participating in SNAMP from early on. The team also included two outreach Community Education Specialists, Anne Lombardo and Kim Ingram who resided in the vicinity of the project sites in rural Foresthill and Oakhurst, California. Using the UC Cooperative Extension approach of bringing science based information to local communities with embedded local relationships, the UC Cooperative Extension outreach team facilitated local participation in science and adaptive management by conducting in-person events in the local community as well as with communities of interest. Adriana Sulak also assumed significant responsibilities in this group as the project progressed. In-person events were used to promote shared understandings of the science (both for results and how science is conducted) and emphasized direct communication with scientists. The in-person events were also important because they encouraged interactions between managers, scientists

and the public to promote mutual learning, to foster stronger relationships that support adaptive management, and to strengthen confidence in the outcome of project. As was appropriate to the project, the major project investment was in outreach.

Outreach sought to engage the community of interest in Sierran forest management, rather than geographically bounded stakeholders, because in fact as Sierran urban populations grow, many local residents have less direct knowledge of forest management. Still, the majority of public stakeholders who participated in our email surveys as a sample from this community of interest, as defined by the Cooperative Extension's contact list for persons interested in Sierran forest management, were from the counties where the study sites were located (Figure F2). However, the online presence of SNAMP through the interactive website also meant that there were participating stakeholders from distant places. Email survey participants came from many different backgrounds (Figure F3), and the SNAMP email contact list grew steadily throughout the period of the project to 825 people in 2014.

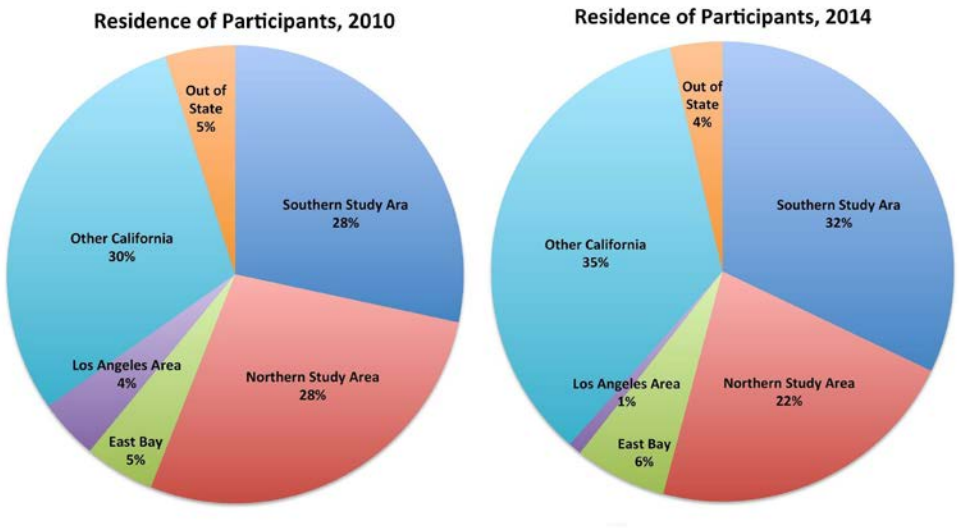


Figure F2: Residence of survey respondents in 2010 and 2014.

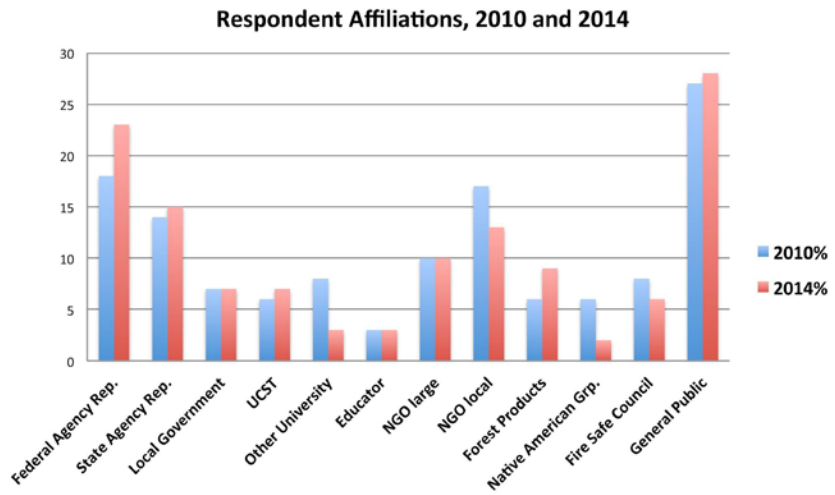


Figure F3: Respondent affiliations.

Organization of Appendix F

In Part II the collaborative adaptive management model used in SNAMP is placed within the context of the history of Forest Service efforts to create management and decision-making processes that meet the needs of the public and support sustainable forest management. It provides a brief background of the evolution of participation in forest management nationally. Over the last century the Forest Service has shifted from an emphasis on management based largely on technical expertise to models using more participatory methods.

The third party model that SNAMP used, in which an agency, the public and an outside science and outreach provider in a sense act as checks and balances to each other was derived out of the concept of shared, multi-party, or joint monitoring, and to some extent, citizen science. Both increase the participation of stakeholders in the science that drives management decisions. As true co-management, where power is shared equally, is not possible for the Forest Service because of legal doctrine, or for scientists following strict protocols, projects like SNAMP can be seen to allow for more transparency in the decision-making process by opening up monitoring and planning processes, and providing additional pathways for input and feedback. An unforeseen benefit was the stakeholder enthusiasm for increased participation in, and understanding of, the science that became apparent in the course of the project. SNAMP provided some direct communication channels between scientists and the public, and this turned

out to be one of the most appreciated aspects of SNAMP.

Part III reviews in detail the outreach goals, methods, techniques, and systems the Participation Team created for SNAMP. The Team focused on both in-person events and presentations as well as "at-a-distance" methods that were web-based. Each type of participation event had its benefits and limitations and each allowed certain kinds of learning to occur or relationships to be fostered (Tables F3 and F4). Face-to-face interactions with scientists and managers were a focal point of the in-person outreach program. Our large public meetings gave broad access to the project, though with little time for details, and provided a forum for interest group positions to be shared. The smaller technical integration team meetings were focused on individual topics. These provided in-depth data sharing with advanced discussions, scientist presentations, and opportunities for participants to learn from each other's less formal questions and comments. Field trips, where participants could "kick the dirt" together and see forest conditions and treatments, provided opportunities to learn about management context, scientific methods and findings as well as to build relationships through conversation and shared experience. Participants emphasized that field trips were valuable learning experiences. Management workshops, which conveyed relevant science on managing a resource including findings beyond the scope of SNAMP, were appreciated by managers. Taking SNAMP to targeted audiences by going to their meetings and events proved to be a powerful way to spread the scientific outcomes of SNAMP as well increase project inclusiveness and transparency.

The project's at-a-distance methods such as the website and its document archive, science briefs, newsletters, and blogs provided the basis for additional SNAMP contacts because of their accessibility and transparency. The email list was invaluable for getting information out to interested parties though it was not particularly interactive. Webinars were found to be useful at the end of the project (they saved time and money), but none of the online interactions could replace the importance of face-to-face connections with scientists, managers or other stakeholders. We observed that our webinars were mainly successful because they occurred at the end of the project when relationships were solidified and there was a group comfort level that could overcome the impersonal nature of the webinar.

To transfer the SNAMP collaborative lessons and to train stakeholders and the agencies to conduct or participate in future collaborative adaptive management projects, we created and implemented a multi-day workshop curriculum and companion workbook described in Part IV. Participants in these trainings gained a clearer understanding of adaptive management and how to include the public in the process, how and when to use an independent third party, and how participants can utilize facilitation tools to help defuse conflict. Evidence from the post-workshop surveys suggests that these trainings should increase participant commitment to collaboration and it is these key stakeholders and agency participants that could help to assure that SNAMP results and processes are applied in the future.

Our overall assessment of the SNAMP project is described in Part V. In-depth interviews and email surveys were used during the project to collect participant views of SNAMP and all its varied components. The strong effort put in by the Science Team to focus on inclusivity and transparency was recognized by participants. The comments we collected during the SNAMP project tell us that SNAMP had a definite impact on the relationships between participants and created social capital that can be relied on in future collaborations. SNAMP's focus on shared learning did foster new and improved relationships (ex: environmental groups and forest products groups) but at the same time the constraints of the project caused some strained relationships (ex: MOU partner difficulties over funding, stakeholder and manager misunderstandings about roles and relationships). Years of large and small meetings, field trips, and webinars allowed participants the time in a consistently facilitated setting to build connections between stakeholders. These data were collected and analyzed before the final SNAMP results were presented and therefore we cannot say how relationships stood at the conclusion of the project. We can say that in 2014 environmental and forest products groups were working together, attendees learned a vast amount about the Forest Service that should improve interactions going forward, and some bridges have been built between agencies and participants. We believe the Forest Service will need to continue to engage intensely with the public in order to build on what has been created in SNAMP.

In addition to the evolution of relationships between participants, Parts VI and VII describe how the time spent together and learning together also created shared understandings

about the scientific results and how science is done as well as larger more complex topics like adaptive management and forest health. These shared understandings and the hybrid culture they fostered, combined with the improved relationships between participants, could be the foundation for more productive and continued collaborations in the future.

The body of the Participation Team appendix concludes with a review of the project, its assets and limitations and presents a list of important lessons learned that should be helpful to anyone, agency or academic or public citizen, who intends to create or participate in a collaborative process.

Our Participation Team appendix also contains its own appendices that provide additional description or information about where our evaluation core elements were sourced (F1: Participation Team Evaluation Tables), the affiliations of all SNAMP participant contacts (F2: Affiliation of stakeholders contacted through SNAMP), and listings of all SNAMP newsletters (F3: SNAMP Newsletters), videos (F4: SNAMP Videos) and blog stories (F5: SNAMP UCANR Green Blog Stories). The full CAM workbook is included (F6: SNAMP Collaborative Adaptive Management Curriculum) and all our journal publications are also described (F7: Participation Team paper abstracts).

II. Putting the SNAMP model in context: Evolution of participatory management for national forests

The extent and process of public participation in US forest management transformed dramatically over the last century. Today, relationships between the land management agencies and the public are now considered key to making decisions and even conducting science for resource management. But is there a third phase on the horizon? SNAMP can be seen as part of the potential evolution of a three way model for natural resource management that includes the agency, the public, and a monitoring or scientific participant. SNAMP provided a demonstration of a neutral third party strategy and how the agency could foster a more open and transparent culture. The goals and ideologies of the Forest Service have changed over time, but the legacies of the past still cloud current options for participatory management. This section attempts to explain that historical context for SNAMP, shows how SNAMP fits into the development of

collaborative management, and lays some of the groundwork for a future, more developed, publication.

SNAMP was created to address a specific problem at a particular point in time: the 2004 US Forest Service Sierra Nevada Forest Plan Amendment (Framework) that dictated management of the Sierra national forests was controversial and implementation was likely to be hindered by this conflict. The University's role was to study the impacts of the management strategies of the Framework in an open and transparent process that would allow the conflicting parties the space to learn together and, it was hoped, move forward from the impasse. The adaptive management process used in SNAMP emphasized public participation and was considered "collaborative adaptive management" within the project.

Three historical time periods can be used to characterize the major phases in the development of the public role in Forest Service decision-making processes: the early twentieth century, the post WWII period, and the post 1980's. After reviewing these periods we follow with a discussion of the current state of the collaboration field.

The early 20th century: A culture of expert management

In 1905 Gifford Pinchot, the first chief of the Forest Service, imbued the agency with his vision of conservation: "the greatest good for the greatest number for the longest time." Pinchot strove to create a cadre of professional forest managers, inculcated with the professional norms of the agency, to decide what was best for all (Hays 1960). Unfortunately, along with the assumption that only technical experts could make the right decisions, his philosophy seems to imply that what is best for the majority is best for all--leaving those not in the majority out in the cold. One of Pinchot's forest professionalism core beliefs was that the science developed by American and European institutions of higher learning was the only legitimate basis for making decisions for managing forests. Despite the fact that the U.S. timber supply was not then, and has never been, threatened, another core value was maximizing timber production and making it more efficient (Hays 1960).

According to the 1897 Organic Act that created the Forest Service as a federal agency, the intention of the forest reservations was "to improve and protect the forest within the reservation, ...securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States." In 1905 Gifford Pinchot sought to create a corps of educated resource professionals who would make decisions about managing the Forest Reservations for the "foresighted utilization, preservation and/or renewal of forests, waters, lands and minerals, for the greatest good of the greatest number for the longest time." The agency he created embodied Pinchot's progressive conservation ethic – professionalism, efficiency, use of science, and large-scale government management (Hays 1960). It was both a reaction against the impression that special interests were dominating and pillaging the public lands, and a commitment to the belief that science and technology could solve many societal issues including how to make public land management decisions (Culhane 1981). The Forest Service was organized to utilize "to the fullest extent the latest scientific knowledge and expert, disinterested personnel" (Hays 1960; Fortmann and Fairfax 1989). The founders felt so fervently about the conservation ethic that it was an issue of morality, of right and wrong (Wondolleck 1988). Fires set by Native Americans, herders, and farmers as part of traditional management practices were included among the many threats from which the forests needed protection. In 1895, Bernhard Fernow, a Prussian forester educated in Europe and Pinchot's mentor, opined that "the whole fire question in the United States is one of bad habits and loose morals. There is no other reason for these frequent and recurring conflagrations" (Bowers 1895).

These founding ideas created a decision-making model of expert management for the public good, where experts would decide what constituted the public good. Under the influence of Pinchot and his mentor Bernhard Fernow, the primary goal of forest management was determined to be sustainable timber production. Following a model of intensive forest management established in Germany, where the population was dense, timber was very limited, and wood was highly valued for domestic and military uses (Behan 1975), common silvicultural practices espoused by the Forest Service included clear-cutting to allow for "improved" forests and forest genetics, control of herbs, shrubs, and less desirable tree types to facilitate rapid forest re-growth, and harvest of mature, old-growth trees at least partly because they were considered

"decadent"—no longer growing and adding to timber stocks (Nelson 1995). Worth noting is the contradiction between these "maximize timber production" practices and the low population density of the United States at the time, together with its vast stock of standing timber. In fact, timber prices remain low to this day.

Forest Service faith in the superiority of "science-based" knowledge and professional ethics went so far as to create a culture where the agency did not use information from other disciplines, only forestry: "Exalting expertise, the Service believed that it alone could master the requisite knowledge… Advice offered by scientists with backgrounds in related, if not more fundamental, disciplines frequently went unheeded" (Schiff 1962). Once hired by the Forest Service, the internal training each employee received was extensive (Kaufman 1960). This training, combined with immense amounts of detailed administrative requirements and prohibitions, created an agency where employees believed in agency policy wholeheartedly and usually disparaged or distrusted information sourced outside the forestry profession (Kaufman 1960). The public, especially those most affected by resource decisions, did not have the technical expertise to make correct decisions, and was too prone to self-serving intentions that would lead to abuse of the resource. To the Forest Service, "locals are in no way peers. Lacking professional expertise, they are, in terms of forestry orthodoxy, perforce political actors, seeking some kind of advantage, some distortion of the technically correct decision which would meet their own needs and preferences. It is the forester's job to base decisions on science, hence to exclude such local influences from the process" (Fortmann and Fairfax 1989).

Concern about capture by local interest groups was the rationale behind the frequent transfer of Forest Service personnel and district rangers. The rangers were moved every few years to create a cohesive culture that trumped local needs: "By breaking rangers' interpersonal ties to the communities in which they were stationed, the Service fostered identification with other agency officers as a peer group; by leaving rangers vulnerable to detection of departures from agency policies, transfers sharpened effectiveness of the Service's formal control policies" (Kaufman, 1960). Changes in Forest Service personnel have at times frustrated long term collaborations and relationships (Kaufman 1960).

These founding qualities – professional expert management, belief in science and technology, a culture of conformity, and distrust of capture – are still with the Forest Service today. This model of decision-making for the national forests can be visualized in the top portion of Figure F-4, with the Forest Service responsible for determining the goals, activities, and outcomes of management. During this time, the "non-delegation" doctrine in U.S. legislation took shape. The doctrine forbids the delegation of federal agency decision-making or authority to private groups or other branches of the U.S. government, largely because agency authority comes from the responsibility of agencies to represent the will of Congress.

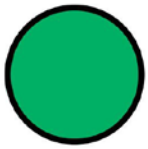
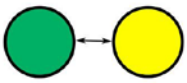
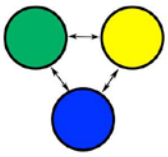
Model	Discourse	Legislation	Issues
[USFS: management+ monitoring+ representing the public interest] 	*Professional expertise.* Experts trusted and respected by the public. Experts are objective and use science. Experts decide the goals and methods, are responsible for the decisions. *Professional Management*	Organic Act, non-delegation doctrine	Experts not sensitive to local conditions, knowledge; agency "culture" takes precedence; clash with public, litigation, eventual rise of activism and "mistrust"
[USFS: management + monitoring] vs. [Groups and individuals: public interest] 	*Involving the public.* Communication, transparency Participation, USFS gets and uses feedback from diverse publics, earns trust Need for engaged stakeholders who are knowledgeable *Ecosystem Management, Community Forestry, Adaptive Management*	NEPA: public should be informed and comments taken; Clinton E.O.: Tribes must be consulted	Litigation, confusion about how comments are solicited and used, lack of trust Groups and individuals with resources/science/technology/ time/numbers get the most attention Rise in litigation Non-delegation doctrine constrains shared decision making.
[USFS manages] vs. [public interest] vs. [third party science] 	*Checks and balances.* Third party scientific monitoring separates management and research/monitoring functions, reports to public as well as USFS. Transparency critical; all-party and shared monitoring approaches, as well as other types of third party approaches *Shared science as mediator* *Third party monitoring* *Shared learning* *Participatory adaptive management*	SNAMP MOU	Assuring third party independence Maintaining transparency and public confidence in information gathering and decision-making processes Non-delegation doctrine constrains shared decision making.

Figure F4: Outline of major shifts in Forest Service (USFS) decision-making approaches and the SNAMP third party model. Figure developed for use in this discussion.

After the war: growing interest in alternative goals for the National Forests

Post World War II, recreation and wilderness gained prominence as management goals in both public consciousness and Forest Service rhetoric. "By the end of the Second World War, a growing population, combined with rising disposable income, longer paid vacations, retirement

programs, and increased mobility ushered in an era of mass recreation" (Dana and Fairfax 1980). Previously, the Forest Service tolerated recreation and encouraged it in some places to justify expenditures (Dana and Fairfax 1980) but with increased interest in recreation during the 1950s this use could no longer be treated as an afterthought. Public pressure for better recreation facilities began to grow and this squarely pitted the Forest Service as a silvicultural organization against those who thought managing places to visit and enjoy should be a primary goal. The value of a "clear-cut" as a picnic ground was questionable. In fact, Bernhard Fernow lost his position as head of the nation's first forestry school when he applied the scientific harvest method of clear-cutting in the Adirondacks in the early 20th Century (Behan 1960).

By the end of the fifties, recreation was no longer a side benefit of the national forests; it was a purposefully funded part of the agency and hence began to compete with the agency's well-entrenched interests. Recreation and preservation lobbies were able to push the Forest Service to reconsider its priorities and policies. The agency emphasized recreation's importance in their newest agency wide plan for management – what turned out to be the Multiple Use Sustained Yield Act (MUSY 1960) – by listing is as one of four major uses (Dana and Fairfax 1980). Though the law was a start toward public involvement in Forest Service management, Congress continued to expand its appropriations for timber production more than any other use (Ruth 1996).

The wilderness and recreational movements took on steam in the 1960s with the growing environmental movement that was explicitly attempting to exclude the country's wild lands from management for commodity production. The Wilderness Act (1964), the Land and Water Conservation Fund Act (1964), the National Trails System Act (1968), and the National Wild and Scenic Rivers Act (1968) all direct the management of federal lands and began to reduce the discretionary power of the Forest Service. By the late 1960s, there was a strong distaste for industrial forest management. The Forest Service was perceived to be on the side of industry, and its inability to explain itself outside of technical jargon limited its ability to appeal to the public's good opinion.

The early 1970s also brought an array of environmental quality laws that added many

layers of regulation to the Forest Service's job – the Endangered Species Act (1973) being an important example. Other laws specifically aimed at public land management and the Forest Service also added more layers to Forest Service management as well as started its public participation programs: The Forest and Range Renewable Resources Act (1974), the National Forest Management Act (1976), and to a lesser extent the Federal Land Policy and Management Act (FLPMA 1976 Pub.L. 94–579) all added Congressional expectations and subsequent rules and regulations to the Forest Service's work. These laws articulated processes and procedures for the agencies to follow but did not define priorities perpetuating multiple use conflicts. The agencies were directed to ask the public for help setting priorities.

Two laws were intended to specifically address the issue of public input in federal land management: The National Environmental Policy Act that affected all federal agencies, and the National Forest Management Act (NFMA) which was specific to the Forest Service. The National Environmental Policy Act (signed into law on January 1st 1970, NEPA) had a large impact on the public's interactions with the federal land management agencies. NEPA requires Federal agencies to analyze the short- and long-term adverse environmental consequences of a range of proposed management alternatives, including no action. Federal agencies were legally required to consult with the public, encouraging public values and goals to have greater representation in decisions about the forests. NEPA created a mechanism for participation in land management decisions but inadvertently opened the door for a dramatic increase in litigation against the Forest Service by setting up complicated and detailed procedural requirements (Kaiser 2006).

Through the National Forest Management Act of 1976, Congress reaffirmed the multiple use mandate and attempted to give the Forest Service clearer guidance on how to involve the public. Amongst other goals, "the law expanded opportunities for public involvement in the planning process, seeking to permit an unprecedented level of public participation in management decisions" (Ruth 1996). However, direction on how to incorporate public opinion was "less than definitive" at the time with the main emphasis being on attainment of input through the planning process (Ruth 1996).

Increasing litigation

The 1960s and 70s changed Forest Service management to include more mechanisms for public input. As part of NEPA and forest planning, the public can make suggestions and comment about forest management, and the agencies are required to listen and to consider them, but the agency is solely responsible for final decision-making and implementation. Public input is strictly on a "consultative" basis. There is little evidence that these approaches increased public confidence in the agencies or reduced conflict over forest management—in fact the opposite may be true in many cases, as is supported by the explosion in litigation in the following decades (Kaiser 2006; Broussard and Whittaker 2009; Henderson and Krahl 1996).

Through the 1960s, the Forest Service did not have more than one or two court cases about an administrative decision at a single time; in the 80s there were one to two dozen at a time (Wondolleck 1988). Litigation had become such a crucial tool that in the 1980s the Wilderness Society created a two volume manual explaining how to appeal national forest plans (Wondolleck 1988). Between 1970 and 2001 there were a little less than 300 cases brought against the Forest Service with regard to its NEPA compliance (Broussard and Whitaker 2009). Suits against the Forest Service for any type of transgression generally increased every year from 1989 till the year 2000 with a high of 76 cases in 1998 (Keele et al 2006). NEPA itself fed into this process, as the technical requirements of the law provided fertile ground for legal challenges.

The 1990s brought attempts at transformation for the Forest Service through many new social and ecological strategies to address this broad skepticism – conflict resolution, interest-based negotiation, alternative dispute resolution, community forestry, ecosystem management, adaptive management, and watershed councils (Leach 2006). Community forestry and other attempts at sharing decision-making have been constrained by an inability to fully share decision-making (Moote et al. 1997). Clarifying the limits of shared decision-making has been critical to participatory processes (Fernandez-Gimenez et al. 2008). Participatory management efforts that follow the two way model of an agency working with stakeholders have not proven to be the full answer to stakeholder distrust. For example, one comprehensive study of collaborative projects found that "collaboration experience was negatively associated with trust, indicating that participants with past experience in many collaborative groups were less trusting

of other participants than participants with little previous collaborative experience" (Wagner and Fernandez-Gimenez 2009).

A review of these two historical approaches to forest management helps clarify how SNAMP can be distinguished from past efforts and what the SNAMP model might offer for future participatory management efforts. In the first model (Figure F4) the Forest Service determines the goals and management strategies, and then assesses the success of their own management. In the second model, the Forest Service has less discretion in goal setting due to a proliferation of legislation, and is required to consult the public on goals and practices, but at the same time, also assesses the effectiveness of their own management. The public has responded to this scenario with divergent and conflicting assessments of management outcomes and practices, delivered through multiple venues, including litigation. Other scientists have honed in on trust as the major problem—the public often does not trust the Forest Service, and there is a need to build more trust. However, given this second scenario, a lack of trust may be a reasonable response to a situation where the same entity carries out management in the public interest, and then assesses the success of its own management. No matter how well intentioned and sincere, the basic structural flaw remains, of the agency being primarily accountable to itself for monitoring the ecological and social outcomes of management.

2005: The Sierra Nevada Adaptive Management Project

In part, SNAMP arose out of the State of California's concerns that the implementation of fire hazard reduction treatments, as stipulated in the Sierra Nevada Framework of 2004 would be so controversial that they could not be implemented. Concerns of the California Resources Agency and the US Fish and Wildlife Service, as well as potential litigation was one of the major incentives for the Forest Service and others agencies to work with UC to develop an "adaptive management and monitoring process" between 2005 and 2007. The proposal for SNAMP came as a result of that collaboration, in an effort to provide a model for implementing forest health restoration and fuel reduction programs without litigation. An MOU was signed by state and federal agencies and the Forest Service initiating a diverse agency partnership based on the signatory agency representatives, as well as the role of the UC Science Team as a "third party"

science and outreach provider in a forest management collaborative adaptive management program (MOU 2005, see also Appendix G of this document).

SNAMP continued the trajectory of increased public participation in forest management by emphasizing the participatory part of adaptive management, but perhaps even more importantly, by introducing a "third party" science provider and facilitator into the process (Figure F4), in the form of UCCE and the Science Team. Assessment was reported directly to stakeholders, as well as to the Forest Service, and stakeholders had many opportunities to interact directly with scientists and managers. The third model, with a third party participant that reports to the public as well as the agency, may be one way to address problems centering on "trust". The third party role of UC in SNAMP provides some insight into how such a scenario can work.

In SNAMP, the UC Science team carried out the science, and designed the way that ecological outcomes were assessed. For this reason the public was assured that a group outside the Forest Service was making the assessment. In addition, a principle of SNAMP was that, when not precluded by contractual arrangements, scientists reported directly to the public. Results were not filtered through the agency lens. Finally, stakeholders were given the opportunity to provide feedback throughout the scientific process, from goals, design, measurement of outcomes, and interpretation.

The last two decades have seen a trend towards opening up monitoring, particularly in collaborative projects. "Multi- party monitoring", "shared monitoring", and "joint monitoring" are all terms reflective of the desire to increase confidence in assessments of outcomes—public participants can witness and even participate in the gathering of data and ideally in its interpretation. This can contribute to collaboration within the bounds of the legal and scientific framework for participation, and help build trust, or rather "trust with verification" as some proponents have suggested. This could be seen as a form of third party monitoring, with the monitoring group as a third party. A third party approach has also begun to appear in a number of other ways. For example, the Bureau of Land Management (BLM), in the Department of Interior has called on the Natural Resources Conservation Service, an advisory agency in the

Department of Agriculture, to conduct monitoring on BLM lands, and to help devise monitoring strategies and databases. “Shared monitoring”, or “all parties” monitoring can be seen as occurring along a continuum from monitoring taking place exclusively within and by the managing agency, to having a third party independent entity monitor management outcomes (Figure F4). Part of the assessment reported in this appendix describes some aspects of participant response to this model.

Early on in SNAMP, some stakeholders expressed skepticism of the process because of SNAMP’s inability to guarantee the application of the science produced by SNAMP to future Forest Service management. There was no clear way to assure the public that the management recommendations made by the Science Team would be applied in future Forest Service management, or how they might be applied. It became clear that “co-management” in the sense of shared authority was an ideal for some participants. For this reason, this section explores the notion of co-management in forest management. The work was generated to clarify some of the boundaries of the SNAMP process.

SNAMP, consultation, and the co-management question

The literature of collaborative management programs tells us that transparency is crucial (Conley and Moote 2003, Laurian and Shaw 2009) and that it is imperative to provide opportunities for stakeholder input before agency decisions are made; that scientific information should come from sources credible to stakeholders, that studies should conducted in an open manner, ideally with stakeholder input; and that participation and management structures should be flexible and may need to change as new ideas and findings become available (Gregory et al 2006; Reed 2008; Rowe and Fewer 2000). To some extent, all of these things were possible in SNAMP. What was not possible was the kind of collaboration that relies on shared authority in decision-making.

Shared decision-making is logistically and legally problematic for the Forest Service (Moote and McClaran 1997). Sharing decision-making authority outside a federal public agency leaves Congress with no clear line of accountability or oversight (McClaran pers. comm. 2008). Legally, ultimate decision-making authority resides solely with the Forest Service and cannot be

devolved or abdicated outside of Congress's reach (Coggins 1995/1996; Coggins 1999; Moote and McClaran 1997), as stated by Moote and McClaran, the "concept of shared decision-making is in direct conflict with federal officers' responsibilities to Congress" (Moote and McClaran 1997).

The extent to which authority for the management of public lands can be delegated to non-federal agencies and private organizations ultimately refers back to the separation of powers between Congress, the Executive Branch, and the Court. It is possible for agencies to sub-delegate some aspects of management to non-federal groups. This can be done through a direct act of Congress or through agency discretion. When the delegation is done by agency discretion it is looked at much more carefully by the courts. In either situation, however, the agency must have final review and control over decisions and this agency review must be specific and demonstrable. The Forest Service could not promise to SNAMP participants that it would abide by, or implement, all the SNAMP final recommendations because in addition to the need to adapt information to changing circumstances and future conditions, by doing so it would have delegated too much of its decision-making authority to SNAMP participants and the UC Science Team.

In fact, Congress has taken specific steps to limit the role of advisory groups in federal agency decision-making through the Federal Advisory Committee Act (FACA 1972). This was originally done to combat the backroom image and secrecy of many task forces by requiring federal advisory committees to be accessible to the public. FACA enables qualifying committees to give official advice to officers and agencies in the Executive branch. FACA committees must be made up of people representing a variety of perspectives and all work of these committees must be made public. However, the sponsor agency controls meeting agendas, meeting minutes are to be submitted to, and approved by, the sponsor agency, the agency can convene or dismisses meetings at its discretion, and the entire committee can have only a limited lifespan. There must also be an official agency representative at each committee meeting held. These types of cumbersome rules make forming FACA committees unappealing to many collaborative groups.

Before it could implement treatments at the two study sites the Forest Service conducted its NEPA process. NEPA encourages federal agencies to collect public input on the environmental consequences of proposed public activities. However, decision-making still resides with the agency: "Collaboration does not turn the NEPA process into a process where an agency's responsibility to make sound decisions is replaced by how many votes are cast for a particular option or alternative" (CEQ 2007). But, "Collaboration does enable decision makers to consider any consensus that may have been reached among the interested and affected stakeholders, furthering the lead agency's ability to make informed and timely decisions" (CEQ 2007). The Council on Environmental Quality (2007) considers the primary goal of the NEPA process is "to arrive at an alternative that can be implemented" (CEQ 2007); something that was crucial to SNAMP given the litigious nature of cutting trees.

At the request of the Forest Service, interviews were conducted with stakeholders in the SNAMP community of interest in 2008-2010 to explore their responses to the NEPA process, and results were discussed at a manager workshop. In general interviewees appreciated some opportunity to make their views known and also found it useful to meet other like-minded individuals at public hearings. However, as is typically revealed in studies of NEPA, stakeholders found the NEPA process frustrating, as it is purely consultative and there is no assurance that their input will be used.

Co-management, shared-management, and joint management are all phrases used to mean more or less the same thing: the sharing of power and responsibility between government and local resource users, affected communities or nongovernmental organizations (NGOs) (Treves et al 2006). None of these methods were used in SNAMP, and in fact as stated earlier their feasibility is arguably limited by the non-delegation doctrine in U.S. law: the Forest Service cannot delegate its responsibility for decisions. Figure F5 depicts increasing levels of shared decision-making in participatory programs. Full co-management, where all parties share decision-making power equitably, is located in the upper right corner. The SNAMP approach was closer to the middle, a more "consultative" approach. The Science Team was straightforward about this from the inception of the project, acknowledging that they could commit solely to a scientific and participatory process where the scientific results, and the

processes of making experimental decisions, were shared as openly as possible. However, the Science Team believed that decisions needed to be bounded by the need to maintain the standards of the experimental methods and approach, and to fit topics to the realm of publishable interest and scientific peer review approval. The Science Team, and likely other scientific participants in future projects, therefore also have constraints that limit their ability to share power or decisions with other stakeholders, particularly when it comes to methods and the subjects of assessment. The Science Team did agree that if participant input was not used in a particular Science Team decision, the Science Team would provide a full explanation.

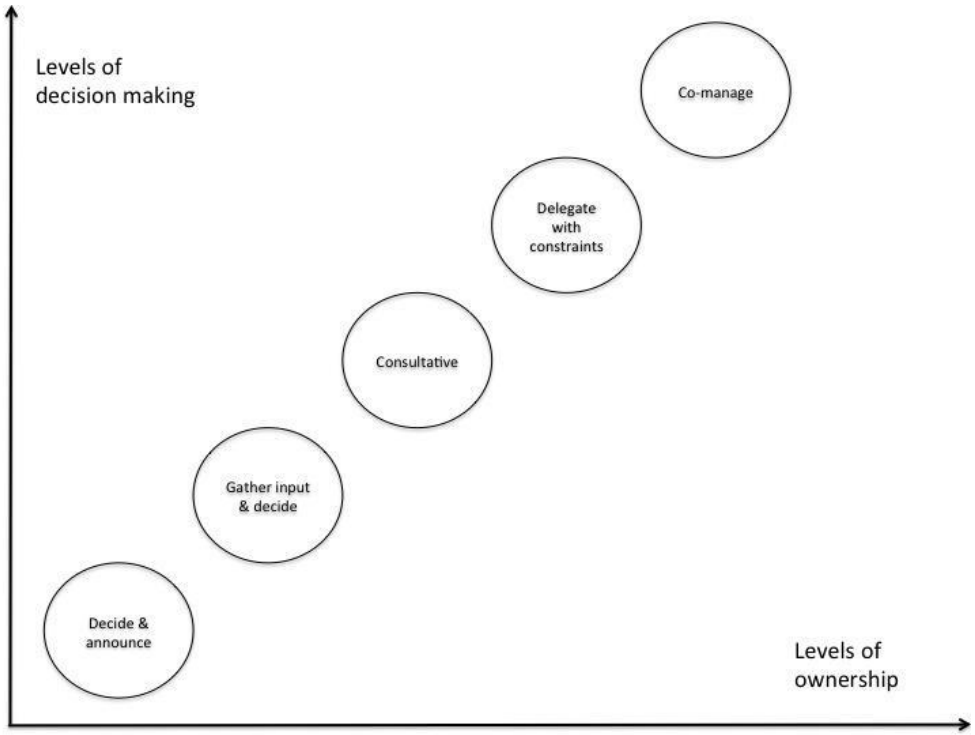


Figure F5: Levels of decision-making as related to levels of participant ownership of the process (originally from Interaction Associates 1997 and modified by Adriana Sulak).

Conclusions: A trajectory for participatory programs?

There are diverse ways of opening monitoring and science up to the public, and there is a growing trend to do so. These include all-parties monitoring, third party monitoring, sharing of monitoring data, and even citizen science, where research is conducted by unaffiliated citizens. One way to look at these kinds of models might be seeing them as similar to bringing in an external auditor. Another way to look at model three (Figure F4) is as a "checks and balances"

approach. Shared monitoring and third party monitoring are the checks that may help to increase public confidence in agency management, especially if the process is transparent. A major innovation of the SNAMP project was the use of a form of a third party model, grounding it in principles of transparency and participation. A question for the future is how and if forms of third party monitoring can play a role in the future of adaptive and other participatory management programs, especially given the limitations on co-management and lessons learned from SNAMP. The Participation Team assessed some aspects of how a third party model might function, but it largely remains a hypothesis that we believe should be further tested.

III. SNAMP outreach: Goals, processes, and outcomes

To facilitate the engagement portion of the SNAMP project, the Participation Team's work was based around five core elements attributed to successful collaboration projects in the literature: inclusiveness, transparency and information exchange, learning, relationships, and effectiveness (Appendix F1). In this section we introduce these core elements and then describe in detail the outreach methods used, both in-person and distance strategies, as well as what we and our attendees thought of the methods' abilities to address our core engagement elements. Here the opinions of the meeting attendees were collected via written or online evaluation forms immediately after the event. This is different than our overall assessment of the SNAMP process, discussed in section V, where the results reported were from interviews and email surveys conducted at different times during the project, not connected to specific events. Evaluations were used to develop and improve SNAMP outreach strategies.

For SNAMP's results to be long lasting and widely known, the project needed buy-in from as large a group as possible. Our goal was to be inclusive with a broad and diverse group of participants. The Participation Team worked to engage participants from all sides of the forest management debate and also to create a project that was accessible at many levels of understanding of the topics discussed. Participation by people local to the project areas as well as national or regional groups was important. We valued consistency in participation but also encouraged new participants at any stage of the project.

Building positive relationships can be considered an outcome while also being the foundation of successful collaboration projects. Consistency in participation can influence the ability of a project to foster these kinds of productive relationships. Transparency and effectiveness, as well as going through the mutual learning process together, also sets the stage for building relationships.

Transparency is crucial to building trust and fostering collaboration around a contentious issue. The Participation Team tried to plan meetings that were located in the local study areas as well as in the regional center where many agency and other participants worked. Meetings always had a UC Cooperative Extension facilitator and we eventually developed trainings aimed at teaching participants how to engage in collaborations. The project was designed to share information, both scientific and administrative, as quickly as possible via email, phone calls or the SNAMP website, and also through in person meetings when time was less pressing. An extensive repository of documents was maintained on the project website including all meeting notes and questions and answers from scientists.

Learning together is a crucial part of collaboration and was a main focus of the SNAMP effort. The Participation Team tried to increase awareness of the variety of viewpoints active in the project and worked to help all participants feel "heard." The individual resource focused meetings and the annual meetings were intended to facilitate shared learning among the participants: meetings presented SNAMP findings and collected participant input. A data sharing server was created to promote information transfer. Ultimately it was hoped that shared understandings would develop regarding the results of the project forming a group of stakeholders with common collaboration skills and ecological knowledge who could continue to work together in the future.

Measures of effectiveness were: 1) participant response to the outreach and communication structure of the project, and 2) the project's ability to complete the basic project milestones and goals as described in the workplan and as compared to the collaborative and adaptive management literature. The Participation Team embodied SNAMP's communication people and processes and conducted all SNAMP sponsored events. The UC Science Team

needed to effectively produce results and complete its assigned tasks in a way that was viewed as unbiased. Simply getting the treatments implemented and allowing the science to move forward with post project data collection was not always assured. Continuing the project until results could be determined was also not something all participants believed was likely. More audacious hopes for SNAMP were to reduce conflict and to create a group of stakeholders with shared understandings of the science of forest management. With this final report, the UC Science Team portion is complete. It was then left to the Forest Service to continue with the lessons learned and apply the Science Team's recommendations, and so to close the adaptive management loop where findings will be incorporated into future management.

SNAMP participation goals and methods

A first focus of SNAMP outreach was to promote and facilitate involvement by managers and the public in forest science development and use. In order to develop an active participatory project, substantial resource and time commitments had to be made at the very beginning of the project. Collaboration requires input of "labor" – time (of all stakeholders), money, and expertise – and should not be taken lightly. SNAMP was innovative in that the commitment to collaboration was made at the beginning of the project and continued for the project's duration.

The first and primary commitment was that SNAMP partners had to agree to a participatory approach. Project scientists made a commitment to work with the public, including allocating the time to develop at least one in-depth public science meeting or field trip per year. Forest Service managers made the commitment to host field trips, attend meetings, and integrate UC Science Team experimental activities into their management projects. Stakeholders from local communities and interest groups invested their time into on-going involvement (through meetings, field trips and workshops) with a long-term project.

Funding was planned to initiate and maintain a locally based outreach program through the whole project. At the beginning of the project this amounted to the equivalent of two full time staff. Funding consistently declined through the project years affecting the outreach effort. Staff that began as full-time saw their positions reduced to half time, leaving the equivalent of just one full time staff allocated to outreach by the end of the project.

Other studies have demonstrated the multiple benefits of having the local community involved in collaboration so outreach personnel were "embedded" in the local community (Conley and Moote 2003). To reach the participation team goals of transparency, inclusiveness, accessibility, and learning, staff were needed in the local study site as well as regionally. Outreach staff were hired in 2007 and 2008 by Cooperative Extension in each of the two study area communities, Oakhurst and Foresthill, California, as well as a central coordinator for outreach. Together with the rest of the Science Team, they organized, hosted or developed over 287 participation and outreach events during the life of the project, from 2005 to 2014. There were more than 8,455 attendees at these events, with duplications. Attendance numbers reported here sum up the total number attending each event, and so count many people more than once. They do not represent the number of individual people involved.

Public participation in SNAMP was fostered through both in-person and at-a-distance methods. With staff time and participant commitments as inputs, activities were developed to reach our core collaborative goals (inclusiveness, transparency, relationship building, and learning) as well as less quantifiable long term goals and indicators of effectiveness such as reduced conflict and increased equity. In general, in-person participation methods were focused on increasing learning and building relationships while distance methods were used to create awareness of the project, convey information and keep people updated. Both were used to increase inclusion and transparency within the project.

Overview of SNAMP in-person participation methods

In-person events and face-to-face interactions within a local community as well as with communities of interest were at the foundation of SNAMP participation. Our participation events were successful at drawing a broad and inclusive set of managers and stakeholders. Organizations with staff attending SNAMP meetings included a wide variety of federal, state, and local government agencies as well as local water and fire safe councils, districts and conservation organizations. Participants also represented local, regional and national conservation and industry organizations (Appendix F2, Figure F3).

SNAMP participation events were a significant investment in time and effort for all. Some agency and stakeholder participants came and went over the duration of the ten year project due to normal staff turnover. One study site had three different District Rangers during the project period. However, a number of participants were able to maintain involvement throughout the project. The UC Science Team showed very little turnover.

SNAMP's most dedicated non-Science Team participants were an environmental NGO participant and a Forest Service representative. We estimate that they each put in a minimum 170 and 150 hours respectively in meetings (again not including travel or preparation time). Of the ten most frequent non-UC Science Team attendees there were three environmental NGO participants, three Forest Service representatives, one forest industry group representative, one local water district representative and two unaffiliated public citizens. To us this shows that SNAMP was successful at attracting and obtaining serious commitment from a few people from the key stakeholder categories. This also exemplifies the challenge to obtaining more actively engaged participants because time requirements limit who is able to participate at that level.

The time invested in attending these events by all attendees combined was almost 8,300 hours by the end of the project (Table F1). This does not include the time of the UC Science and the Participation Team who facilitated all the events.

Table F1: Hours spent at SNAMP organized participation events. Hours spent is a calculation of the number of hours the event lasted multiplied by the number of people present at each event. Preparation and travel time was not known and so not calculated.

Event Type (2005 to 2014)	**Total Events**	**Total attendance**	**Hours spent by non-Science Team participants**
UCST Public / Quarterly / Annual meetings	14	745	1,874
Integration Team (science) meetings	23	811	3,077
Field Trips / Scientist talks	29	920	1,938
Workshops	29	472	1,407
TOTAL	**95**	**2,678**	**8,296**

In-person participation events included public/annual meetings, integration team (science) meetings, field trips and workshops. Each type of event was designed with somewhat different goals, formats and content. To investigate progress toward the goals of relationship building, learning, and transparency, participants completed evaluation forms at most of our meetings. Each type of participation event and how participants rated it is described below.

Public/annual meetings

At the beginning of the project (2005-2007), large public meetings were held quarterly to design the workplan and develop the experimental efforts. These were reduced to one annual meeting after public feedback indicated preference for more intensive modes of interaction. In 2008, the first of seven annual project wide annual meetings was held. These typically involved about 70 scientists, managers, regulators and stakeholders. The goal of these meetings was to update all participants on the status of the project. Typically the agenda included short science updates from each of the six science teams, updates from the Forest Service on the implementation of the treatments, time for discussion about next steps, and time for small group interactions with each science team so that participants could ask their specific questions of the scientists. All meetings were facilitated by the Participation Team. Fourteen of these meetings were held between 2005 and 2014 with a cumulative (not individual) attendance of 745. All

participants (excluding science team members) logged over 1,800 total hours in these types of meetings (Table F1).

Participants completed at least 238 written evaluation questionnaires at the six annual meetings between 2008 and 2013. Evaluation forms asked for input and also quantitative ratings of the event, with participants agreeing with or disagreeing with statements about it (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). Scores reported for responses are averages.

Annual meeting participants strongly agreed that the Science Team had clearly articulated study findings and issues (4.7), that collaborative discussion was encouraged (4.6), and that there was encouragement of public participation (4.6). The latter two findings were particularly rewarding to us given that these types of meetings were more difficult to facilitate due to the large venues and popularity. Participants' lowest ratings were for having adequate time for questions and answers (4.1) and for clearly articulating next steps (3.8).

Since they summarized the state of a very large and complex project, these meetings necessarily covered a lot of information in a small amount of time. Initial meetings included extensive technical information from each team. A variety of meeting formats and strategies were explored to allow for increased dialog. The solution was to reduce the amount of science content of these meetings so that each science team had only eight to ten minutes to summarize their findings for the year. This allowed for more time to ask questions using a small group breakout format so participants could converse with the scientists. Even though the settings were large, we wanted to promote relationship building so we also emphasized networking during breaks and lunches.

Annual meetings were designed to allow a less frequent participant to catch up on the project's accomplishments and challenges over the year in one meeting. Some stakeholders, especially those affiliated with Sacramento based agencies or organizations, attended only these SNAMP meetings. In order to have time for in-depth conversations about each of the scientific

topics being pursued with those that were interested, we developed an additional format for participation, the integration meeting.

Lesson learned: Design participation events for participants with varying levels of interest and time, including those who only want an occasional briefing on the status of the project. Hold these events in the regional capital to draw agency and regional stakeholder representatives.

Integration meetings

To focus more on the specific information being developed by each science team, the Participation Team instituted science "integration meetings" in the third year of the project. Each of the six teams typically held one of these meetings each year attended by agency, Science Team, and interested public participants. The goal was to collaboratively address the interpretation of results and the potential applications of what had been learned to forest management. We hoped this would foster shared understandings about the project from start to finish, so that participants would have some common knowledge base at the end of the project on which to base individual conclusions and recommendations. The agenda typically involved an overview of the study plan, an in-depth presentation of data and findings at that stage of the project, and time for input into design, analysis, and the interpretation of results.

Meetings were a form of shared science learning. The long term goal was to enable participants to be able to evaluate impacts on forest resources from Forest Service fuels reduction treatments and to develop a knowledge base to facilitate participation in future natural resource management. Depending on the topic, attendance ranged from 10 to 100 persons.

Each integration meeting provided time for discussion and interaction between the Science Team and other participants so that learning could be mutual. In other words, learning by the Science Team from stakeholder and agency insights, knowledge, preferences, and constraints was also desired. The intention was to encourage detailed two-way conversations with the Science Team, to develop a committed core membership and allow for development of long-term, constructive, ways of working together.

The mission statement for this process was:

> "...to engage the public, the University of California, and natural resource agencies in a process of mutual learning as we proceed through the adaptive management cycle. Part of the work is to learn about UC research and data, as well as Forest Service treatments, so that the Integration Team can evaluate and understand the tradeoffs as research information is integrated within the adaptive management project and into Forest Service management. Ultimately, the goal is to address the part of the adaptive management cycle where scientific information and public input is integrated into future management decisions."

Stakeholders most interested in the resource being studied attended integration meetings. For example, Water Team meetings drew stakeholders that represented water purveyors, irrigation districts, agency hydrologists and conservation groups most interested in aquatic habitat. Many of these participants did not attend other integration team meetings with other science teams because understanding the science behind managing for forest health or the California spotted owl were not necessarily part of their job description or interest. Relationships between scientists and professionals in their disciplines within the agencies and stakeholder groups were fostered.

In the last year of the project, half of the integration meetings were held as webinars rather than in-person meetings. The final integration meetings were planned to occur in a short amount of time which would have burdened many stakeholders with extensive travel. In addition, we felt that SNAMP relationships were strong enough to overcome the detractions of webinars (disjointed discussion, reduced ability for feedback and engagement, lack of face-to-face interactions) after so many hours together in an assortment of settings.

A total of 23 integration meetings were held between 2005 and 2014 with a cumulative attendance of 811. Participants (excluding Science Team members) spent almost 3,100 total hours in these meetings. Participants completed at least 351 evaluations of the 17 meetings held between 2008 and 2014, showing agreement or disagreement with statements about the meeting (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree). They strongly agreed that collaborative discussion was encouraged (4.6), the events were well organized (4.5) and that they learned something new (4.6). Participants agreed there was encouragement of public participation (4.5) and their comments were heard by UC scientists (4.4). Participants still

agreed though less strongly that there was adequate time for questions and answers (4.1) and that the meetings met their goals (4.1). Evaluation results for the webinars were consistently positive and not substantially different from ratings of the in-person meetings.

These meetings required a significant amount of investment by the Science Team as well as agencies and stakeholders in that they amounted to a 'yearly review' of their project. Principal investigators and staff spent significant amounts of time preparing for and presenting at these meetings. The benefit for the Science Team was the ability to get input and prioritization on study topics from stakeholders and to better understand the context in which the science would be used, with the goal of creating a more useful product.

Lesson Learned: Participants possess a wide variety of expertise in science methods and topics. It's important to design participation events for those from diverse backgrounds and to facilitate involvement of those who want to be immersed in the details of the science.

Field trips

Field trips were popular events with project participants including a wide variety of stakeholders, community members, and students. Each Science Team held at least one day-long field trip, while most teams held three or four over the course of the project. Pre and post treatment implementation field trips were held at each study site as well. At the northern site, additional field trips were held to view treatment in action and then later to see the results of a wildfire that burned through the treated area. Several Science Teams also made short presentations about their work to local community groups most interested in the topic such as local conservation and school groups. These types of talks were substituted for field trips by the Fisher Team due to concerns about confidentiality and location of individuals of this rare species. A total of 29 field trips or Science Team talks were held over the life of the project with over 920 (duplicated) in attendance. Participants (excluding Science Team members) spent at least 1,938 total hours in these events.

Field trips typically started at the local Forest Service office with a short safety briefing, a description of SNAMP and the agenda for the day. Participants then carpooled out to the

treatment area in mixed groups. The distance to the northern study site from the Forest Service office was 45 minutes, while at the southern site it was only about 15 minutes. Scientists and Forest Service staff usually made presentations at 3 to 4 different stops on the field trip to give a broad overview of forest conditions, treatment and findings. Several field trips were attended by three UC Science subject teams so the broad effects of the treatments could be discussed. Several field trips were held at affiliated sites including the Forest Service's Kings River Experimental Watershed with the Water Team and UC Berkeley's Blodgett Research Forest with the Owl Team.

The Science teams gave demonstrations of their data collection techniques. These involved hands-on demonstrations of the equipment used and viewing of experimental plots and stations in the field. Participants were able to core trees, examine fire scars, measure vegetation on transects, hold fisher tracking sensors, watch spotted owls respond to calls and take the offered bait of live mice, see a carbon dioxide flux tower and wireless sensor network, and examine stream monitoring equipment. On the treatment oriented field trips they were able to look at the results of prescribed burning, see a cable yarder, feller bunchers, skidders, log loaders and trucks in action, and examine treatment units before and after thinning and before and after wildfire.

Field trips were a substantial time commitment on the part of the Science Team and the Forest Service. All these field trips were on national forest land and so collaboration with Forest Service staff was critical to holding the field trips. The District Ranger and other staff attended nearly all field trips. Implementation field trips were hosted primarily by the Forest Service themselves. Most field trips were 6 to 7 hours long.

Field trip goals were to increase inclusiveness and provide for relationship building and mutual learning. Seeing the forest, treatments and resources of concern made for a very productive mutual learning environment in which scientists could learn about management challenges while managers could learn about the most current science methods and results. Being together in the field and carpooling with new people was also extremely conducive to relationship building.

Participant (including the Science Team) evaluation of 12 of the 13 field trips held between 2009 and 2014 showed the trips were good for learning and for opportunities to give input. Participants filled out 262 evaluation surveys which showed that field trips allowed adequate time for questions and answers (4.9), encouraged public participation (4.8), were well organized (4.7) and encouraged collaborative discussion (4.7). Participants also agreed that goals of the meetings were met (4.6) and they learned something new at the event (4.6). As at other events, the lowest rated aspect of the field trip was that there was a clear plan of action for the future, though participants still agreed (4.0).

Lesson Learned: Field trips are excellent venues for learning about how science is done and how the forest is managed including constraints on management and science institutions. Field discussions allow scientists and managers to better understand each other's points of view. They also allow participants to visualize and discuss conceptual terms such as "resiliency" and "forest health" in tangible ways that cannot readily be done in other meetings – they are ideal settings for shared understandings to develop. Field trips draw the broadest audience of participants including unaffiliated citizens such as local community members, teachers and students. They are a critical part of a third party monitoring effort.

Subject matter workshops

These events featured the Science Teams' management advice about their resource of concern, often at the request of forest managers. Some workshops were not open to the public, while some were advertised broadly and brought in new participants who had not been involved in SNAMP. Typically these workshops provided a synthesis of information on the team's topic, beyond the information being produced for SNAMP. Science Team members compiled and drew on their experiences and practice in their field of expertise to summarize the state of knowledge on the topic and recommend management actions (which was explicitly not part of the Science Team's role in SNAMP). The California Spotted Owl Team was asked to give two full day workshops on management of owl habitat by the Forest Service (which was not open to the public as other SNAMP events were). The Spatial Team organized four workshops on use of lidar in forest management that involved some regular SNAMP participants but also diverse participants from many agencies and organizations who wanted to learn the latest science on this

evolving technology. These lidar workshops included hands-on sessions where participants could manipulate lidar data and explore applications. The Participation Team held a workshop with the Forest Service that presented feedback on their NEPA processes in a private setting. In addition, the Participation Team initiated a series of public workshops on their own initiative (not in response to managers' requests) on how to facilitate collaboration in forest management which involved developing facilitation and meeting planning skills as well as role playing conflict resolution. A total of 17 collaboration workshops were held.

Participation Team goals were to increase mutual learning, build positive relationships, and increase effectiveness of the project. These workshops were excellent venues for scientists to learn about the everyday context that managers face and how their studies could address these problems. A total of 29 subject matter workshops were held between 2005 and 2014. Cumulative attendance was 472 people. Participants (excluding Science Team members) spent over 1,400 hours in workshops.

Participants at the four Spatial Team workshops on Lidar in 2009 and 2012 filled out 65 evaluations and strongly agreed (5- strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree) that workshops were a great place to have comments heard by UC scientists (4.9), learn something new (4.9), and hear a clear articulation of study issues (4.9) and participate in the project (4.9). Participants filled out 178 evaluation forms for the Participation Team's 17 collaboration workshops and rated them as excellent (64%) or very good (35%). They said their expectations for the workshop were met (53%) or exceeded (46%) and agreed strongly that workshops were timely and relevant (4.4), provided practical and useful knowledge and skills that are applicable to their jobs (4.5), and provided new information, ideas, methods and techniques (4.5). They agreed even more strongly that they were satisfied with the instructors (4.9) who were knowledgeable about the subject (4.9), and generated active discussion and involvement (4.8). Evaluation of the collaboration workshops is done in a separate section below.

Lesson Learned: Subject matter workshops that covered the latest science on a topic and allowed for hands-on practice and or role playing with new concepts allowed for an excellent learning environment. Topic focused workshops that went beyond the confines of SNAMP data

and methods and focused on participants' own management contexts were highly appreciated by participants.

Special projects

Six different special SNAMP-related outreach projects were done to include people in SNAMP science. These projects focused on developing ways for participants to be included in investigation of SNAMP topics without directly participating in the SNAMP experiments. One project was to site wildlife cameras around the fisher study site to help the team identify occupancy of fishers on surrounding private lands where willing landowners wanted to be involved. Several other projects were carried out with students around the Oakhurst area to help them participate in appropriate levels of related study including conducting acorn counts (an important food to rodents, the prey base for fisher) and macro-invertebrate sampling in nearby streams (an example of an alternative way to monitor water quality). Over 160 people (duplicated) participated in these special projects. The format was not conducive to evaluation forms so evaluative data was not collected.

Reaching out from SNAMP (in-person)

Although SNAMP developed a core of committed and involved stakeholders, the Participation Team felt they also needed a strategy to involve people who were not attending in-person SNAMP events. Outreach goals were focused on increasing transparency, accessibility, and inclusiveness by keeping community members and interested groups up to date on study progress. Outreach to groups about SNAMP was also intended to encourage attendance at SNAMP meetings and events. This greatly broadened the amount and diversity of participants knowledgeable about the project and helped keep the local community in the loop. We conducted two main types of outreach: presentations at other groups' regularly scheduled meetings and attendance at other events to promote SNAMP through casual conversations, presentations and posters.

Outreach presentations

Local outreach staff made presentations about SNAMP to local groups at their meetings to keep members of the public informed that were less likely to participate in more technical science meetings or field trips. These presentations were typically a 20 to 30 minute overview about the project at the group's own regularly scheduled meeting. Presentations to groups with more of a special interest (such as the California Native Plant Society) focused on the aspect of the study most relevant to them. Presentations were made to members of:

- local civic clubs such as Rotary, Lions, and Elks;
- local conservation groups such as Audubon, Sierra Club and local conservancies;
- local governments such as county supervisors, resource conservation districts and chambers of commerce;
- local interest groups such as fire safe councils, Society of American Forester chapters, and watershed councils; and
- local schools, colleges, and universities.

Participation Team staff made a total of 167 of these presentations during the project period leading to over 4,100 contacts in total. For a list of all organizations reached through outreach presentations, see Appendix F2.

Representing SNAMP at other events

Participation Team members gave talks, brought SNAMP posters and displays to a total of 19 events held by others including conferences, professional society meetings and local Earth Day celebrations making over 1,200 contacts. This was a good way to keep the project visible and make new contacts from groups and stakeholders that were not already participating in SNAMP. This type of outreach led to personal contacts that then led to invitations to outreach staff to make SNAMP presentations to new groups not previously contacted. Therefore this outreach method primarily helped us meet inclusiveness goals.

Summary of SNAMP in-person outreach program

Inclusiveness

To achieve inclusiveness, we worked toward broad and diverse participation in terms of affiliations, locations and focal interests, as well as location and accessibility. SNAMP outreach staff hosted or attended a total of 287 participation events using the different in-person participation methods from the start of the project until December 2014. The types and frequency of outreach events and attendance increased greatly once outreach staff were hired in 2007 (Figure F6). This type of outreach is time consuming and could not have been accomplished without the commitment to staffing and outreach made at the outset of the project. It is also a product of the incorporation of place-based relationships developed by UC Cooperative Extension staff who lived and worked in the local communities and then used their connections and relationships to bridge to the Science Team who were generally located on campuses at least three to four hours away.

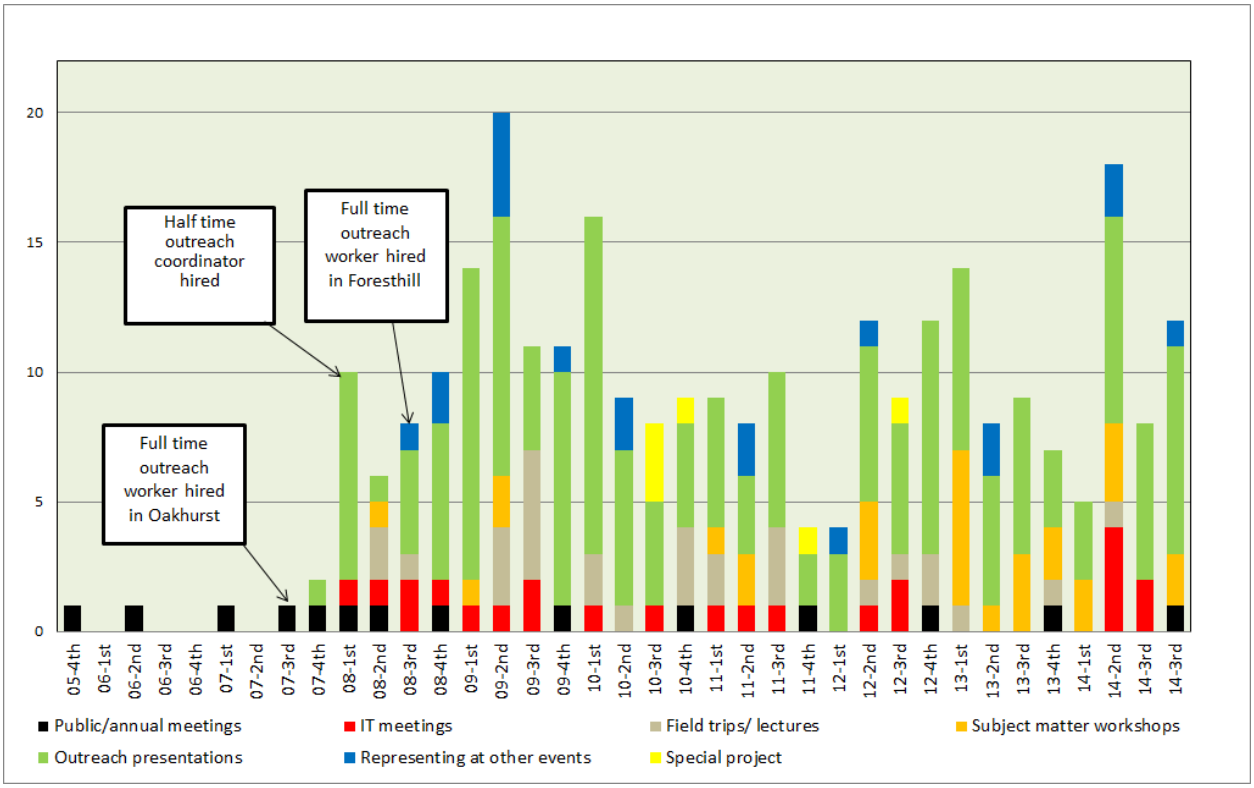


Figure F6: Number of public involvement events organized by SNAMP (public/annual meetings, field trips/lectures, subject matter workshops, integration meetings and special projects) and organized by others but attended by outreach staff (outreach presentations and representing SNAMP at other events) per quarter between 2005 and 2014 (287 total).

Almost two-thirds of the public involvement events were as a result of members of the Participation Team presenting SNAMP to people at meetings held by others, including outreach presentations (58%) and representing SNAMP at other events (7%) (Figures F7 and F8). More than half the total contacts made by the Participation and Science Teams were also made at these events [outreach presentations (49%) and representing SNAMP at other events (15%)].

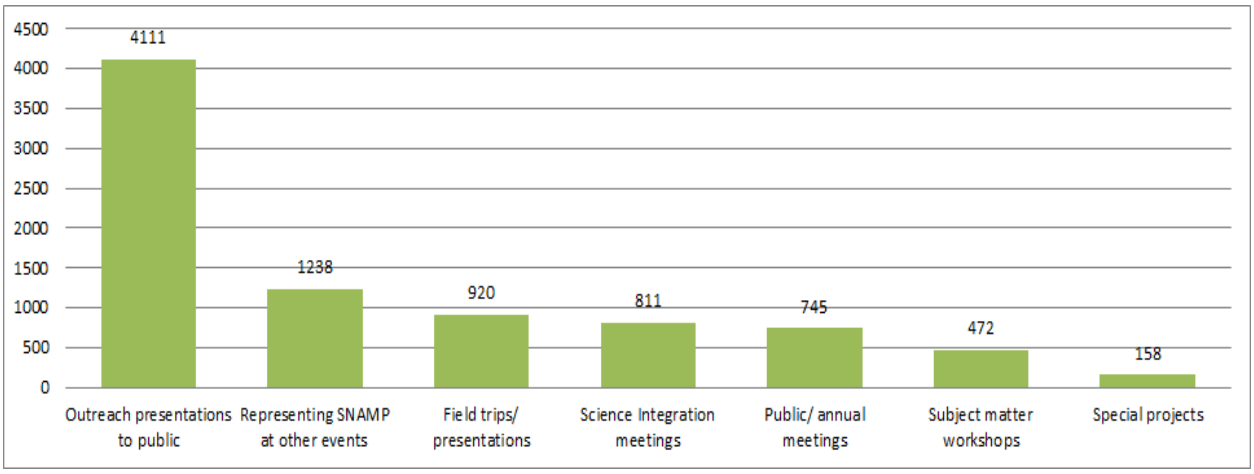


Figure F7: Total contacts made at all in-person SNAMP participation events. Contacts are the total attendance at events, including participants that attended multiple events and so not the total number of people involved. 8,455 contacts were made at 287 events.

These figures highlight the importance SNAMP put on inclusiveness by showing the commitment and effort expended to bring out information about SNAMP to interested groups and people rather than relying on those people coming to us to find out about the project.

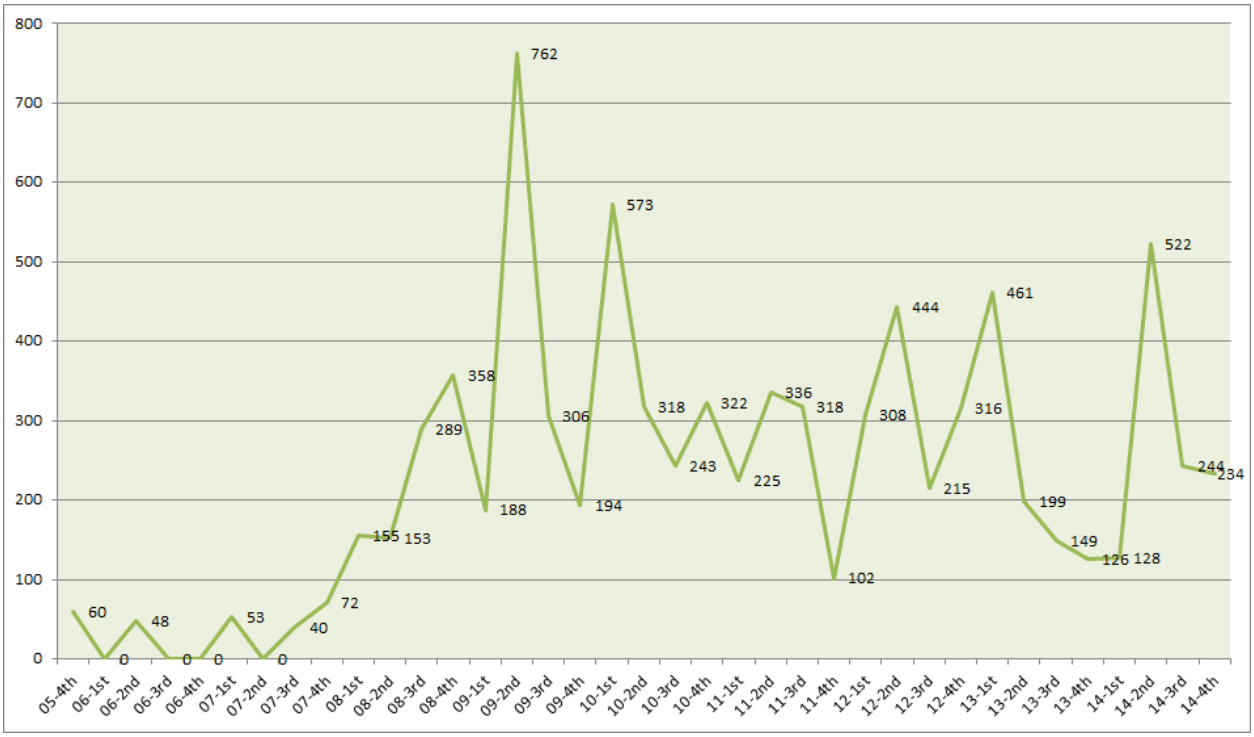


Figure F8: Personal contacts per month by SNAMP Participation Team from 2005 to 2014 by quarter (8,455 contacts).

Lesson Learned: To achieve inclusiveness it is important to keep local communities and communities of interest updated on the project by reaching out to them, rather than expecting them to come to you.

In-person events were spread over a wide area of the Sierra Nevada and Central Valley (Figure F9). Events were concentrated around the two study sites in Foresthill and Oakhurst (where outreach staff were stationed) and the state capitol area of Sacramento where many land management and regulatory agencies as well as regional and national conservation and advocacy groups are headquartered.

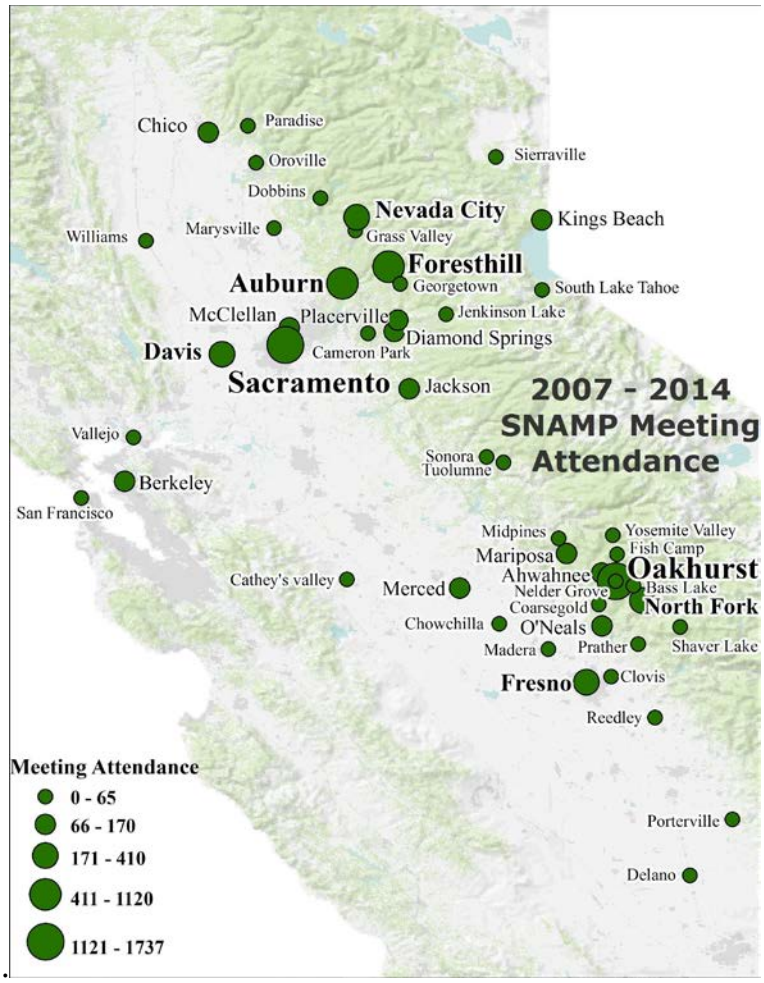


Figure F9: Attendance at SNAMP events by meeting location from 2007-2014. Map created by Kelly Easterday.

Overall SNAMP's outreach program attracted a broad and diverse set of participants, some of whom only wanted to be kept informed about the project, while also maintaining a core of dedicated participants who wanted to be involved in the details throughout the life of the project. The geographic dispersal of outreach staff embedded in the local communities was key to implementing this strategy. The evolution of different outreach methods tailored to different stakeholders was also crucial. However, we were less successful at reaching some specific targeted audiences we had specifically sought out, such as recreation groups and Native Americans. There were also several environmental groups that choose not to participate despite repeated invitations though participation by many other conservation groups was substantial.

We hoped that the broad and inclusive participation in SNAMP would provide a foundation for collaboration in developing the adaptive management strategies to be put in place by the Forest Service as a result of the recommendations made by the UC Science Team in this report. However, whether or not this inclusive process has led to reduced conflict in national forest management is not known at the time of this writing.

Transparency and information exchange

Topics covered at SNAMP meetings varied over time according to the focus of the meeting and the progression of the project. In addition to science content, annual and integration meetings covered contentious and critical issues to the welfare of the project including funding curtailment and occasional lapses in agreed-upon project protocol such as the neutrality agreement.

We used an additional method to inquire about the ways in which our public meetings succeeded in advancing dialogues and transparency for the project. We analyzed the meeting notes from the public meetings using self-organizing maps (SOM), which is a machine-learning textual analysis tool (Lei and Kelly 2015).

The self-organizing maps project textual data (in our case, this was all the questions and answers from public meetings through 2012) onto a two-dimensional space based on word frequencies and connections between words. The resulting textual map can be visualized in a variety of ways, such as word clustering, mapping through time, and histogram/frequencies (Figure F10).

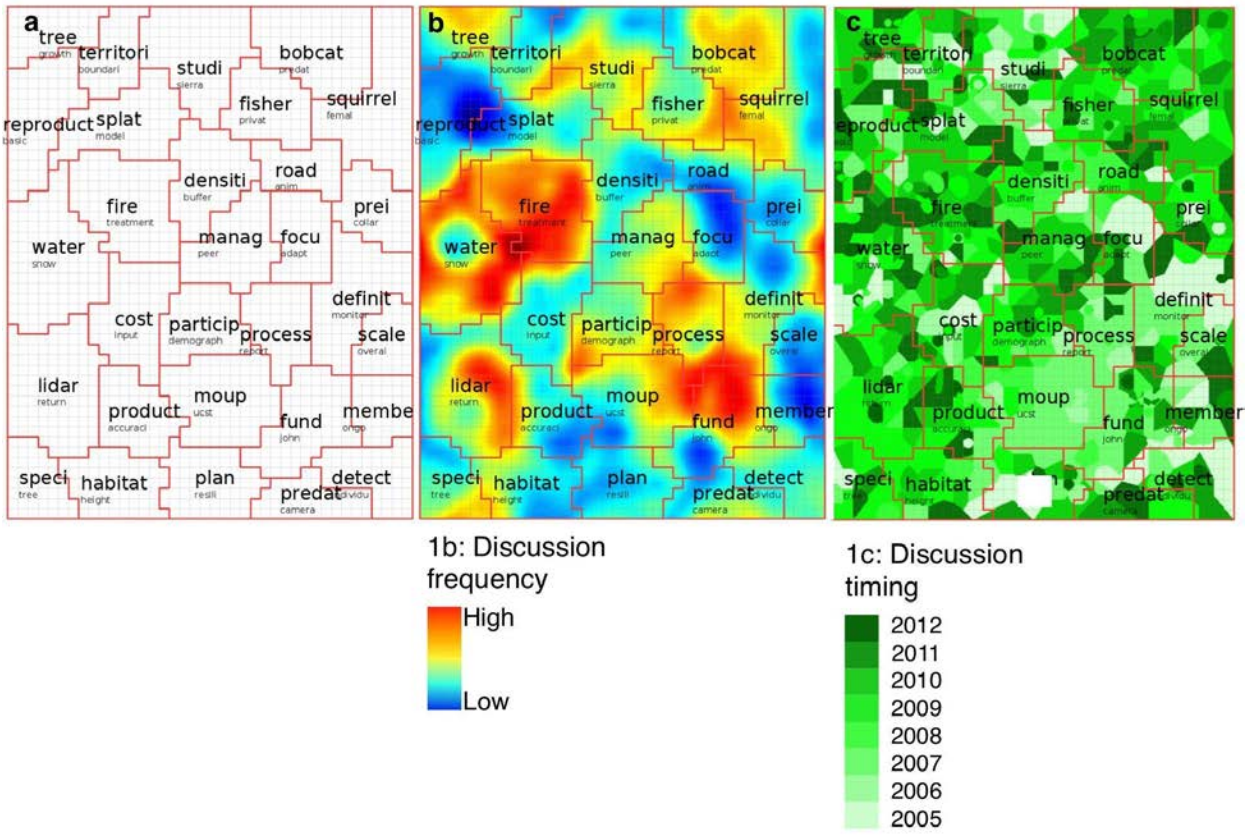


Figure F10: These three self-organizing maps visualize SNAMP public meeting discussions based on extensive annual meeting notes recorded and archived by the Participation Team. Sections are labeled by the 2 most prominent words in the discussions that occurred. The maps are as follows:
a) The basic, mapped clustering of discussion topics;
b) A smoothed data histogram map showing the frequency of the most consistently discussed topics. High discussion frequency topics are those items that were discussed often: the MOUP, funding, and process make one red cluster; and Lidar and fire make two other clusters that were discussed frequently; and
c) A thematic class map showing timing of topic discussion. The year is the year that those discussion points were emphasized through the discussion in a meeting. The color of each cell indicates when the subject was discussed. For example, MOUP was largely discussed earlier in the process, whereas fire was discussed throughout the process. The topics are determined by the discussion that occurred.

As you can see in Figure F10-1b, funding, the process and the role of the MOU Partners were high frequency topics of discussion at SNAMP event, as were lidar, fire, and water. Figure F10-1c shows that the emphasis of topics changed over time, though a number of high frequency topics such as funding, lidar, fire and management were consistently discussed over time.

By interpreting the various visualizations, we found that public discussion remained focused on the project content, yet the more contentious and critical issues dominated the discussions through time. Self-organizing maps were an effective and efficient unsupervised machine-learning tool for organizing, distilling and tracking content of meeting notes through time, and can be explored more often for this kind of analysis.

Lesson learned: Regular project meetings are important in order to facilitate discussion of critical project issues and increase transparency.

Lesson learned: The self-organizing map method helped us to see what topics were discussed more frequently, and when they were discussed over the course of the project.

Relationship building

We examined 7 years of attendance data at all public meetings associated with SNAMP and constructed an “affiliation social network” which is a diagram showing collections of individuals and how they are affiliated with collections of events. This network allowed us to ask questions about SNAMP project cohesiveness, relationships among participants, and patterns of participation. The affiliation network reveals patterns of geographic preference among meetings, the importance of particular individuals and particular public meetings, and the dynamics of social network (Figure F11).

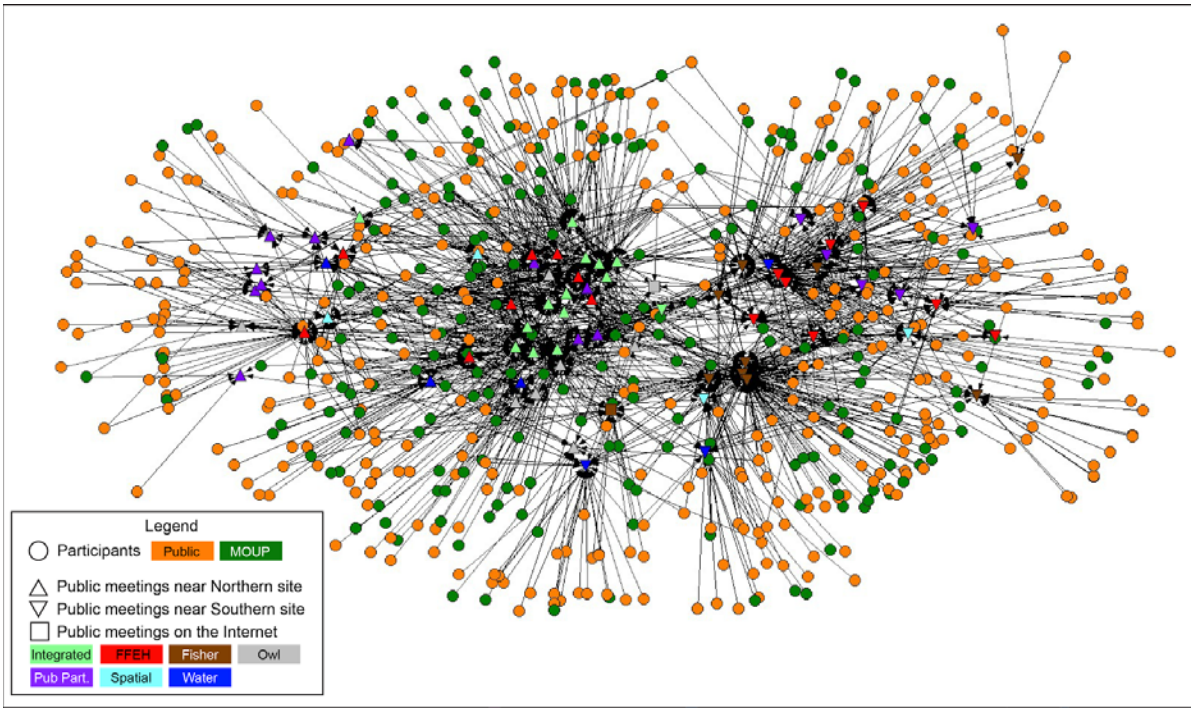


Figure F11: Affiliation network based on public meeting attendance data: participants are symbolized as orange (public) or green circles (MOU partners); meetings are symbolized as squares (webinars), or triangles of various colors (see legend) for in-person meetings. Science Team members were excluded from this analysis.

The social network analysis diagram shows clear clustering around the northern and southern meetings locations. Meetings focusing on fire and forest ecosystem health (red triangles), fisher science (brown triangles) and integration meetings (green triangles) were key elements of the SNAMP social network, bringing participants together. Meetings of the Participation Team reached the most stakeholders. There are several key stakeholders, both from the public and the MOU Partners that provide cohesion to the network. These are people who are connected well in the network by virtue of their consistent attendance at all types of meetings.

Lesson learned: Affiliation network analysis is a useful tool to characterize the social dynamics of the SNAMP network.

Comprehensive evaluation of SNAMP in-person outreach methods

There is ample evidence that SNAMP participation events allowed for learning and transparency about the project. Overall, participants rated in-person SNAMP sponsored participation events highly for the opportunity they provided for learning and interaction. Here we present the comparative evaluation results from the events described above (Table F2). Data are, again, from the evaluation forms filled out at the end of each event which involved agreeing or disagreeing with a series of statements about the event: 5- strongly agree, 4-agree, 3-neutral, 2-disagree, 1-strongly disagree. Overall, workshops and field trips were rated the most highly. Participants strongly agreed that these encouraged public participation, collaborative discussion, and left plenty of time for questions and answers. Therefore they were excellent venues for mutual learning.

Table F2: Summary of evaluation ratings for all SNAMP in-person participant events (Strongest agreement = 5, on a scale of 1 to 5).

Event type **Number of evaluations analyzed**	**Workshops** **(243)**	**Field trips** **(262)**	**Annual meeting** **(238)**	**Integ-ration** **(351)**	**All events** **(1094)**
There was encouragement and acceptance of public participation	4.9	4.7	4.6	4.5	4.6
I learned something new at this event	4.9	4.6	4.5	4.6	4.6
There was clear articulation by presenters of study findings.	4.9	4.6	4.7	4	4.6
Collaborative discussion was encouraged/ I felt my comments were heard.	4.8	4.7	4.6	4.6	4.6
I felt my comments were heard by the UC scientists.	4.9	4.5	4.4	4.4	4.5
I felt my comments were heard by USFS attendees.	4.2	4.5	4.3	4.3	4.4
The goals and objectives of the meeting were met.	--	4.6	4.5	4.1	4.3
There was adequate time for questions and answers.	--	4.9	4.1	4.1	4.2
There is a clear plan of action for the future.	4.2	4.0	3.8	3.8	3.9
This workshop provided practical and useful knowledge immediately applicable to my job.	4.5	--	--	--	4.5
This workshop provided me new information, ideas, methods and techniques.	4.5	--	--	--	4.5
This workshop was timely and relevant-it dealt with issues with which I am currently dealing.	4.4	--	--	--	4.4

Least highly ranked at all the events was the statement that there was a clear plan of action for the future of the project or individual team. In general, most participation events

summarized what had transpired so far in the project and asked for input about next steps. This is no doubt why this item did not show strong agreement from participants, as many events were actively seeking ideas from stakeholders about how to move forward. As a response to these ratings, the Participation Team made an effort to summarize next steps at the end of every event although some next steps were not well known or fleshed out at the end of the event.

Each of the participation event types described above had its specific focus, targeted audience, and strengths and weaknesses. These are summarized in Table F3.

Table F3: Comparison of different in-person participation methods used by SNAMP.

Event Type	Focus	Participants	Strengths	Weaknesses
Annual meeting	Overall status of project; Brief science summary; Done in regional center near agency headquarters	Management and agency leaders, committed and occasional participants	Conveyed a lot of information; Allowed participants to check in on the project annually	No time for in depth science information; Little time for relationship building
Integration meeting	In depth status report of science by each team	Committed participants, disciplinary professionals in agencies and organizations	Allowed for in depth learning about topic and input into experimental questions and design; Allowed for relationship building between scientists and disciplinary colleagues in agencies and organizations	Very technical, effort needed to include participants less current in topic
Field trips	Viewing treatment and scientific methods at study and affiliated sites	Committed participants, local community members, students	Allowed for in depth learning, relationship building and inclusiveness	Significant time commitment for forest managers and science teams
Subject matter workshops	Overall state of science on individual topics, beyond SNAMP work	Committed participants, local agency /organization staff, non-SNAMP participants	Excellent for mutual learning and relationship building; Some were very inclusive with many non-SNAMP participants some were private	SNAMP not the major focus so was additional work for the science teams
Special projects	Affiliated data collection with students, camera sitting on private lands	Students and teachers interested in SNAMP science, local landowners	Extended SNAMP science without time investment by Science Team; Produced some information for Science Team	Small numbers reached for extensive time expended
Outreach presentations	Short overall presentations to community and interest groups	Local civic, conservation, and interest groups, local government, students and teachers	Drastically increased inclusiveness and transparency about the project in local and professional communities	Built relationships with Participation Team, but not rest of Science Team
Representing SNAMP	Posters and displays about SNAMP at conferences and events	Non-participants, communities, professional and academic communities	Increased transparency, encouraged inclusiveness by making contacts for outreach presentations or other events	Most removed from targeted participants

It is important to note that these methods were designed to work together to increase project inclusiveness, transparency and information exchange, learning, and relationship building. In other words, the methods were additive with participants contacted through outreach presentations sometimes becoming committed participants and attending science meetings. Conversely, participants who typically attended only an annual meeting could drop in on an in-depth management workshop if they needed additional background and information on a topic.

Despite the multiple methods used for in-person participation, the time and resources of the Participation Team were necessarily limited to engaging local and regional participants who had more than a casual interest in their communities, national forest management and natural resource science. However, because public forest management takes place within a regional, state and national context, the Participation Team felt it was also important to convey the essence of SNAMP to a larger audience than could be reached through in-person events. To meet this need, we developed a number of distance outreach methods described below.

Distance outreach

The five factors that we have focused on that can contribute to the success of adaptive management – learning, transparency, inclusiveness, building relationships, and effectiveness - require open exchange of information about science and management among all participants. To facilitate this, the Participation Team developed a SNAMP website, science briefs for published journal articles, newsletters, web digests, and webinars. These methods specifically addressed three of our four goals by focusing on inclusiveness, transparency, and learning, with less emphasis on relationship building. This effort involved spreading information through both traditional and social media. Most of these efforts were created and maintained by the Participation Team and hosted by the SNAMP website.

Using these methods, we hoped to disseminate the highest quality science and make it accessible to all, increase awareness beyond the more traditional or accessible participant, transmit information to current participants, allow for some limited interaction and to develop a repository of SNAMP information.

Peer reviewed publications

Peer reviewed journal articles published in journals of good standing are those that have successfully passed review by other respected scientists working in a similar area. They are an important source of credibility for scientists, and help those seeking information to have confidence in the results. The Science Team remains committed to putting the results of SNAMP science through this review process. As of August 1, 2015, the Science Team has published a total of 39 journal articles on studies funded by SNAMP. These were posted on the website as allowed (some journals do not allow this to protect copyright).

We used citation analysis to track how fast and how far the SNAMP science publications were cited in other publications, including journal publications, dissertations, and resource management reports. We found that the average time it takes for a SNAMP publication to be cited in another peer-reviewed journal is about 7 months. And they have been cited all over the world, but they primarily travel within academia (Figure F12).

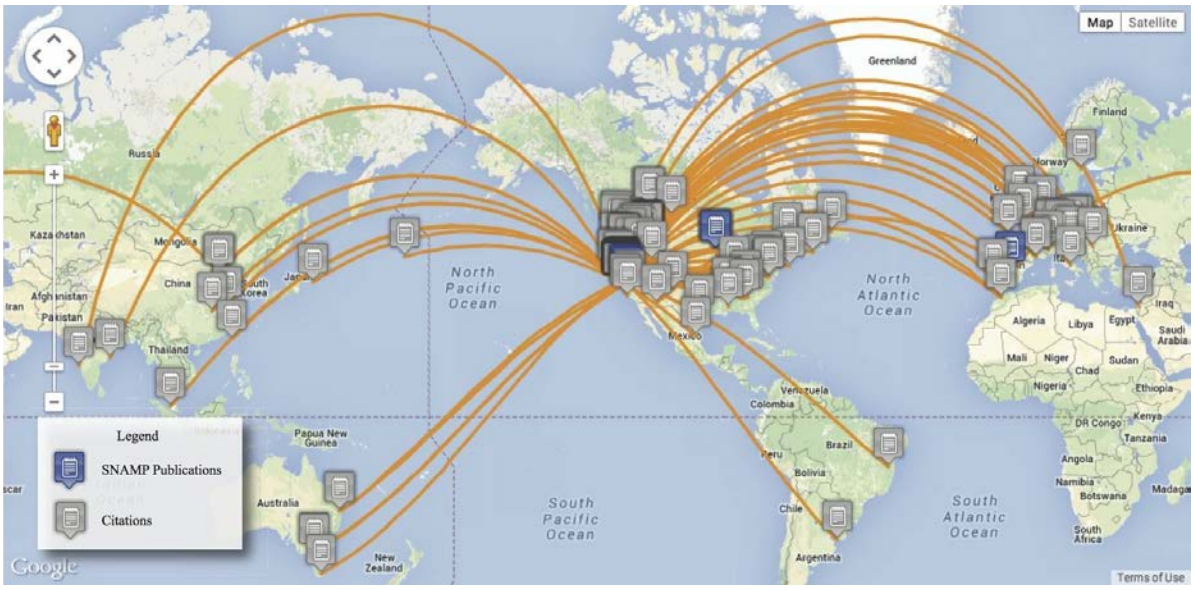


Figure F12: Map showing locations of citations of SNAMP science publications, as of December 2013.

Science briefs

Science briefs were developed to 'translate' all technical peer reviewed articles developed by the UC Science Team to a non-technical audience. These increased inclusiveness,

learning and effectiveness by reaching a broader audience that might not have the expertise, time or access to read the journal articles produced by scientists for the project. Also, peer review articles are sometimes copyrighted by journals and so are not easily distributed to in-person or online audiences. Science briefs could instead be disseminated to any audience without concern for copyright infringement.

Usually briefs were developed by the Participation Team and reviewed by the author, or paper authors took the lead on developing the brief. These were posted on the SNAMP website. There were 1,518 pageviews of the science brief webpage as of December 31, 2014.

Newsletters

Newsletters were developed to introduce and explain the progress of the whole SNAMP project and newsletters specific to each Science Team were written to give overviews of the methods and findings. Newsletters were distributed as widely as possible. They were posted on the SNAMP website, handed out at project meetings, and distributed at outreach presentations to a variety of audiences. Ideally these were developed close in time to each team's annual integration meeting in order to capture the most interesting results. The goal was to increase inclusiveness and transparency about the status of the project and learning about the efforts of the individual science teams.

A total of 16 newsletters were developed through December 2014. The website listing the newsletters was viewed 3,464 times as of December 31, 2014, and the newsletters were also printed and handed out at meetings and outreach events. For a list of all newsletters, see Appendix F3.

SNAMP website

The SNAMP website (Figure F13) was built in 2007 using open source web technologies and database, which allowed us to utilize the latest, community- supported technologies and reduce development cost. The SNAMP website was a tool used by the Science Team to directly address our goals of inclusiveness, transparency, and learning. Use of the SNAMP website was strong - nearly 80% of our 2014 email survey respondents reported having accessed the site.

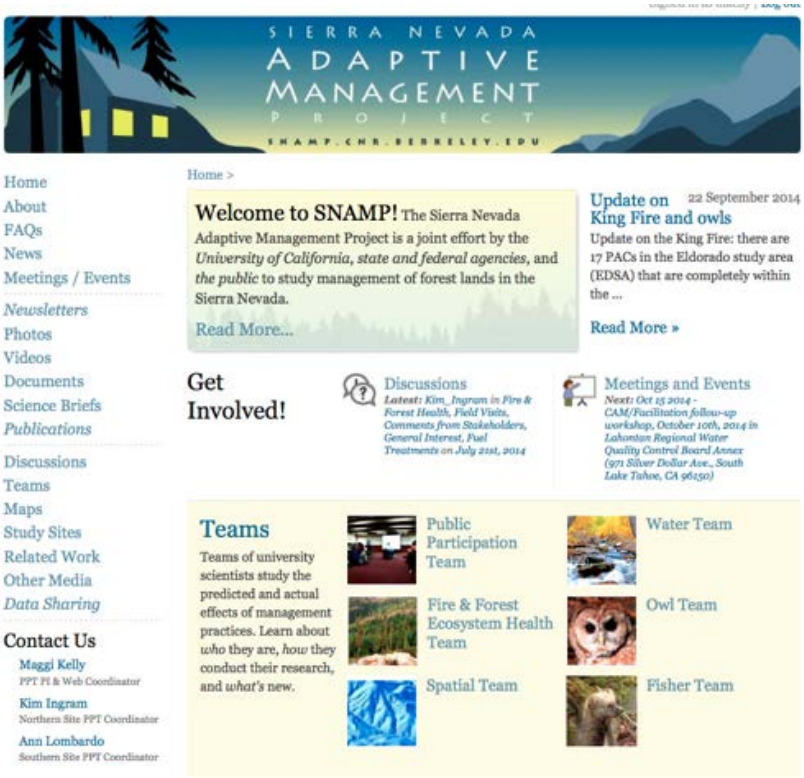


Figure F13: Screenshot of the SNAMP website home page from September 2014.

The aesthetic design of the SNAMP website was carefully considered with regard to appeal and ease of access to SNAMP information was paramount. The distinctive SNAMP logo and feel of the site were created to increase recognition of the project and were carried throughout all SNAMP products - all presentations, posters, newsletters, anything printed or web published. This continuity was important for recognition of the project as well as for projecting a professional image. The site had a news section where project status updates were posted. It hosted information generated by the Participation Team such as newsletters, science briefs, photos and videos along with a calendar of information and materials from all participation events (agendas, minutes, presentations). By the end of the project, the website had become a repository of all SNAMP generated documents, including foundational documents like the Neutrality Agreement, workplan, and project and team descriptions, as well as all papers published by the Science Teams.

Over the lifetime of the website, we had nearly 200,000 views, 83% of these were from within the US. Peaks in website activity tended to coincide with public events such as meetings (Figure F14). Our audience was concentrated in California, but we also had strong viewing from other parts of the US (Figure F15). The website was therefore key to increasing inclusiveness in the project to distant audiences.

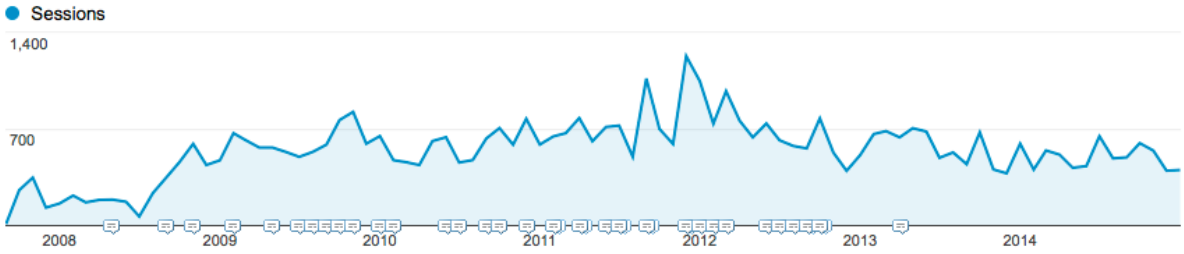


Figure F14: Monthly summary of page views of the SNAMP website over the duration of the project, as of December 31, 2014.

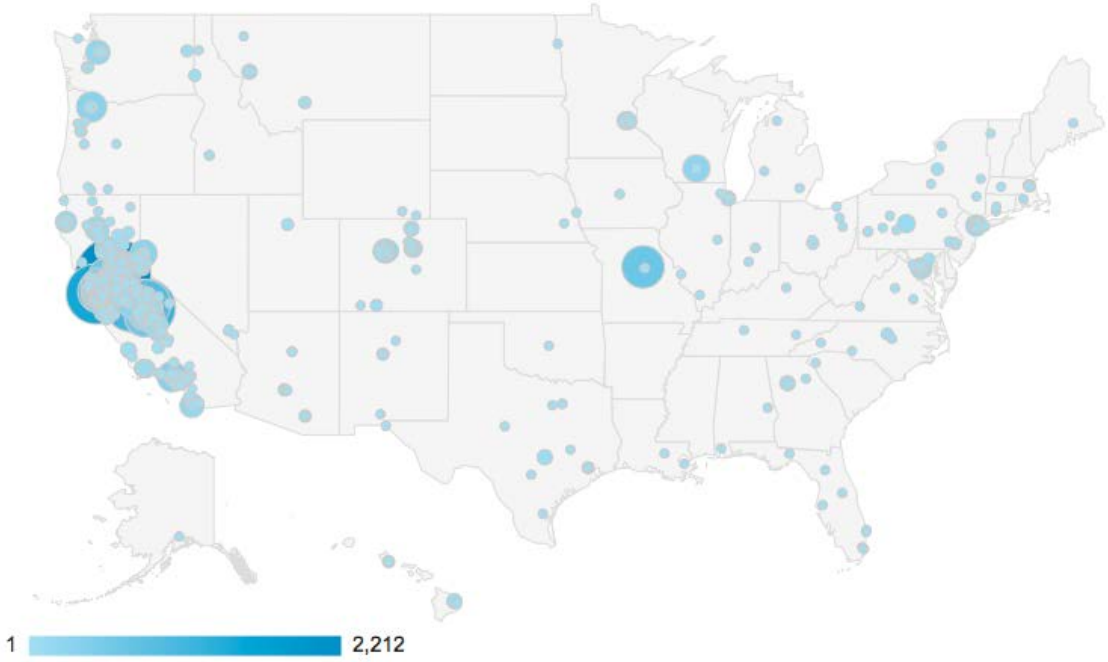


Figure F15: Spatial distribution of visitors to the SNAMP website for the duration of the project, as of December 31, 2014.

In email surveys in 2010 and 2014, more than 80% of respondents agreed that the SNAMP website helped them keep up with events, was a good place to get answers to questions about SNAMP, was easy to use, made SNAMP more transparent to the public, was the first place

they looked for documents or information related to SNAMP, and offered online meetings by webinar that help them attend meetings they could not otherwise attend. It has often been pointed out that members of the general public have a harder time attending participatory management events than professionals or organization representatives paid to be there. It seems that the webinar approach may help more of the public participate. This shows that the website was effective at increasing project inclusiveness, learning, and transparency.

The recent proliferation of Internet communities and web-based participation tools raises the question of how the Internet might help facilitate information exchange in adaptive management. SNAMP provides a useful case study for the role of Internet technologies in facilitating the flow of transparent and useful information. The dataset used for this analysis was the content of the entire SNAMP website. Three evaluation methods were used: analysis of web usage and content, a survey of active participants, and a review of comments posted to the project website.

Results suggest that the web played an important role throughout the adaptive management cycle by supporting communication through disseminating information to the public and increasing the transparency of the scientific process. The Internet played a small, but important role in public consultation, by providing a forum for targeted questions and feedback from the public. We found however, that Internet technology did not actively support the two-way flow of information necessary for mutual learning. Internet technology complements face-to-face interactions and public meetings, rather than replacing them (Kelly et al. 2012).

Lesson Learned: Internet technology complements face-to-face interactions and public meetings, rather than replacing them.

In addition to the main SNAMP website (http://snamp.cnr.berkeley.edu), UC Cooperative Extension developed several websites to collect and maintain information that was not part of SNAMP for the Pacific fisher (http://ucanr.edu/sites/pacificfisher/) and California spotted owl (http://ucanr.edu/sites/spottedowl/). These sites contain collections of owl and Pacific fisher photos, news, scientific papers and information about Science Teams. These sites were

developed separately from the SNAMP website to reduce any confusion that might arise regarding what was SNAMP information versus other science and news on these important species. The goal was to spread learning about these species to a wider audience than those involved in the project. The Pacific Fisher Information Repository and the California Spotted Owl Information Repository were visited by 3,651 and 1,183 unique visitors respectively between development in 2009 and the end of December 2014.

Email list

An email list with the email addresses of all participants and interested parties was maintained for routine communications. Over 825 people were on the email list by the end of 2014. A total of 184 email messages were sent between 2007 and December 2014. The list was used primarily to keep participants notified of upcoming events or important project news. In the second half of the project, we developed a web digest sent out quarterly that listed all new additions to the website such as papers, newsletters, photos, event notes, etc., with a link for the participant to visit the website and retrieve the information. After this innovation, we sent out many fewer emails.

Social media

The Participation Team maintained a Facebook page with 184 likes by the end of the project and contributed to 11 short videos about the project which have been viewed over 5,800 times (for a list of videos see Appendix F4). Almost 2/3rds of those views were on YouTube, which directed about 30% of the traffic to the videos. 740 photos were posted on Flickr, which were viewed 37,768 times as of November 20, 2014. These methods were used to increase inclusiveness and learning and the viewership of online videos increased dramatically during the lifetime of the project.

Blogs

The Participation Team also worked to broaden inclusiveness of the SNAMP audience by writing blogs and news articles on the project and information it was producing. This increased access, transparency, and learning about the specific blog topics. We wrote 19 blog stories on the

project for the UCANR Green Blog http://ucanr.edu/blogs/Green by December 2014. Of these, seven were about the Pacific fisher, two were about Lidar, two were on the spotted owl, six on forest and wildfire mitigation, and one each was on public participation and water (for a list of all blogs see Appendix F5). Blog stories were also tweeted by UC public information staff (not affiliated with SNAMP). This outreach method was wildly successful. Hits on the SNAMP Green Blog stories totaled over 137,000 during the life of the project, including 46,000 direct and mobile hits. Almost half the hits were for fisher blogs and another quarter were views of the Lidar blogs.

The appeal of one particular blog entry about the Pacific fisher is particularly instructive (Kocher et al. 2012). The UC public information staff posted the blog *UC wildlife research team looking for single socks* on December 14, 2011 http://ucanr.org/sockdrive (as well as being tweeted and posted on the UCANR news page and Facebook page). The goal of the post was to increase inclusiveness in the project to more distant audiences. Another goal was to solicit donations of materials to help support fisher work. Socks are used by scientists to hold bait that is attached to trees. Then motion activated sensors take photos of animals taking the bait. This is part of the protocol used to determine fisher occupancy in an area.

The social media campaign was extremely successful. The blog received over 10,000 hits in the first six weeks, the most of any story posted on the Green Blog at the time. UC scientists were interviewed for statewide radio stations and newspapers. We received over 300 packages of socks in the mail in the first few months, more than the fisher team could use over the duration of the project (Figure F16). Excess socks were provided to other scientists and philanthropic organizations.

Figure F16: Anne Lombardo – University of California Cooperative Extension and Rick Sweitzer - University of California Berkeley processing donated socks.

Most packages were received from California and from urban areas, however, people in 20 other states and Canada also sent socks (Figure F17).

Figure F17: Location of donors sending in packages of socks with legible return addresses within first 6 weeks of blog story. Map by Sarah Lewis.

The success of this campaign shows that social media can increase inclusiveness through participation by new audiences and from distant locations. The campaign asked for items most people have readily at hand and used humor to capture people's attention. Online comments on the blog and associated articles made a lot of jokes about used socks.

SNAMP distance outreach summary

Each of the distance methods used to spread SNAMP findings, information and outcomes to a broader audience had its own content, targeted audience, advantages and disadvantages (Table F4).

As with the in-person participation methods, the distance methods used to spread SNAMP information each had its own audience but can be considered additive. The website was a place where all materials developed by the project could be posted and accessed over time. This included written products like news posts, newsletters and journal articles and science briefs that were targeted at participants and land managers. To keep up with the information age we also developed more 'social' type media including blogs, videos, and social networking. These were extremely effective at reaching broad audiences and increasing awareness of the project and its findings. Blogs developed by SNAMP were promoted through the UCANR Green Blog and so increased the reach of the effort.

Lesson Learned: Using multiple forms of electronic media including websites, emails, blogs and social media can extend awareness of projects beyond the local and regional scale.

Lesson learned: Information technologies greatly facilitate the flow and use of digital information. Especially for scientific publications, science knowledge was transferred quickly and widely from SNAMP to other environmental scientists.

Lesson Learned: Powerful new information monitoring tools can be used to characterize the flow of information products through their production, transport, use, and monitoring. There are a variety of metrics and measuring mechanisms available to track the usage of information products.

Table F4: Overview of SNAMP distance outreach methods.

Outreach Type	Content	Users	Strengths	Challenges
Journal articles	Peer reviewed findings produced by Science Team	Academics, committed participants, land managers	Highest quality of information needed for environmental planning and management	Often not read by managers and lay people
Science briefs	'Translation' of peer reviewed articles for non-scientist audience	Committed participants, land managers	Makes findings more accessible	Requires editing expertise and scientist review
Newsletters	Status updates on project, individual team study design and findings	Committed and casual participants, general audience, used at outreach events	Highlighted project and findings for a general audience	Not much room for details about the science
Websites	Repository of SNAMP information, news posts, calendar, discussion	Committed and casual participants, regional and national audience	Unified location for all materials; Archive for long term project; Easy to use	Discussion board under-utilized
Email list	Notifications about project status and events	All participants that have attended a SNAMP sponsored event or asked to be on list	Makes communication to large groups feasible and easy	Communication is only one way from the project out to participants
Social media	Notification about project status and events	All, local, regional and national audience	Increases reach of other materials to wide audience for minimal effort	Time consuming; Some participants do not engage with social media
Videos	Overviews of SNAMP and findings	All, local, regional and national audience	Reaches audiences not likely to read scientific materials	Time consuming and requires specialized skills; Easy to look unprofessional
Blogs	Overviews of SNAMP findings	All, local, regional and national audience	Can be focused around outcomes of SNAMP events; Reaches media and a very broad audience; Does not require editing skills as videos do	Benefits from an on-going dedicated effort

IV. Transferring collaboration skills: Review, summary, and evaluation

SNAMP participation goals were to increase inclusiveness and transparency about agency actions and the science being done, to build relationships, and to promote learning about forest management science and issues. These goals were developed to serve the larger project purpose of learning how to effectively implement collaborative adaptive management in Sierra Nevada national forests. However, achievement of adaptive management necessarily came after delivery of this final SNAMP report by the UC Science Team that reported on the effects of fuels reduction treatments and made recommendations about the next round of management actions by the Forest Service. The application of SNAMP findings and recommendations in the next series of Forest Service plans would be the final step in the adaptive management process but occurred after the UC Science Team and the Participation Team were no longer funded to be part of the dialog process.

The need to continue a productive dialog after UC involvement in SNAMP ended spurred the Participation Team to hold management workshops to pass along the skills needed to maintain inclusion, transparency, relationships and learning. Training staff to develop the skills needed to establish and maintain this kind of participation has not necessarily been a priority within land management agencies or organizations participating in SNAMP. This lack of training in collaboration skills has been noted nationwide in an assessment of the Forest Service (Burns and Cheng 2005). Scientists assessing the readiness of the Forest Service to collaborate identified the need for training staff on many national forests: *"The work of collaboration requires specific skills in and a commitment to relationship building, communication, and facilitated dialogue. Some staff has evolved these skills through previous experiences or training, while others may need some additional amount of orientation and preparation"* (Burns and Cheng 2005). In this section we report on a series of workshops conducted by the Participation Team that attempted to address this gap by training stakeholders in the adaptive management process so that the Forest Service and the public might partner to complete the SNAMP adaptive management cycle and go on to foster more productive future collaborations.

Development of facilitation and collaboration curriculum

To share collaboration lessons with our SNAMP partners, UCCE developed curriculum that became a free downloadable workbook entitled: *Facilitation Skills for a Collaborative Adaptive Management Process: A workbook to train natural resource managers and stakeholders in facilitation of collaborative projects* (UCCE 2014, http://snamp.cnr.berkeley.edu/documents/574/, Appendix F6). It includes 17 modules written in a 'train-the-trainer' style. Lessons focused on framing a collaborative process by identifying project boundaries and constraints, analyzing stakeholders and developing specific desired outcomes. Modules on methods to hold effective meetings included content on developing effective agendas, process rules, decision-making, note taking, evaluation and follow through. Group dynamics were addressed through identifying stages of discussion, thinking and learning styles and group development. Managing conflict was described through development of key agreements, dealing with difficult behaviors, and prevention and intervention methods.

Collaborative adaptive management workshops

In 2013 and 2014, UCCE staff held five separate 12 hour training series, each followed by a 6 hour long follow up workshop about 6 months after the initial workshops totaling 18 hours of instruction. Workshops were held in 2013 in Auburn (Placer County), Oakhurst (Madera County), and Jackson (Amador County). 2014 workshops were held in South Lake Tahoe (El Dorado County) and Marysville (Yuba County). Workshops were structured around participant input but also covered the standard curriculum, including the 17 modules. Initial workshops included lecture, group discussion, group exercises, and role playing. Follow up workshops reviewed previous content, included a guest speaker and focused on role playing.

A total of 115 staff from federal and state forestry, fire, wildlife and research agencies, local agencies and conservation and non-profit organizations attended the trainings. About 15% of those beginning the training were from federal agencies, 35% were from state agencies and 25% were from local agencies. 80% completing the training were female. About 90% of participants had facilitated some sort of meeting before the training although 64% had never had formal training before the workshop to do so.

Of those 115 participants, 72% attended only these workshops and no other event organized by SNAMP. Another 7% attended only one other SNAMP events while 21% also attended two or more other SNAMP type events. For comparison, the email survey results showed that of all SNAMP participants, 56% attended only one SNAMP event, 18% attended only two events, while 26% attended 3 or more events.

Participant hopes for collaboration

Participants were asked at registration to define successful collaboration. They gave a variety of answers that were then used in workshop discussions. Overall these comments show that participants had high hopes about collaboration and what it can achieve if done well. However, they also had many valid concerns about the potential pitfalls of collaborative processes.

Participant definitions of successful collaborations are described below as a set of composite opinions about their effects on relationships, process and results.

· *Relationships* - Participants described the relationship aspects of a successful collaboration in terms of how stakeholders feel about the process. They said stakeholders should leave the meeting (and the process) feeling heard, respected, and that their interests have been adequately considered. Stakeholders should feel they have been empowered with decision-making and that the process was a valuable use of their time. Participants should feel a sense of accomplishment, buy-in and forward movement.

· *Process* – Participants described a successful process as involving broad stakeholder participation and engagement allowing stakeholders to take ownership of the problem being addressed. It should be open, inclusive and have a commitment to dialogue with genuine give and take where all viewpoints are considered in making decisions and participants are willing to make compromises to meet the common goal. It should be structured to meet the goals of the group not one person or organization.

· *Results* – The results of a successful collaboration should be a win-win for all stakeholders leading to decisions that are transparent and built on participant and collective interests. It should move a project forward through a sustainable agreement/decision supported by enthusiasm and commitment from all participants. The task should be completed on schedule leading to a usable end product that is used to influence management decisions. Participants should learn about the problem and walk away with a common understanding of the problem while appreciating various perspectives.

Participant concerns about collaboration

Participant concerns were substantial. Attendees were worried about the time it takes to collaborate effectively, how to run an efficient process and ensure that there is follow through, having appropriate participation and expertise, dealing with conflict and producing a useful product. Here are quotes from participants about each of these concerns that they provided at registration:

· *Participation - I am concerned about…*

- "…working with people with different goals and values and staying positive while enduring our slow and expensive governing process so commonly stalled by special interests."
- "…how to strike the balance between including the right people and keeping the group to a productive and manageable size, without upsetting stakeholders who might feel excluded."
- "…about not having as much technical knowledge as your collaborators/stakeholders; and feeling that the void between groups is insurmountable."

· *Process - I am concerned…*

- "…about having the process of defining a project, or the project itself, disrupted by a small group who isn't interested in collaboration but instead just getting their way and they make meetings and progress difficult, not having enough time to dedicate to getting all stakeholders in agreement to the collaborative process and completing the project within the financial constraints and construction timelines."
- "…that [collaboration] is used as window dressing with limited follow through on considering opposing opinions."

· *Dealing with conflict - I am concerned about…*

- "…getting a stakeholder who does not believe in compromise. And that his solution is the only solution to the problem or issue we are attempting to collaborate on."

· *Emotion and conflict - I am concerned about…*

- "…not knowing what to say when a tense situation arises, or personal dogma interrupts the flow."

· *Results - I am concerned…*

- "…about getting a watered down product that does not achieve the original goal."

Eliciting these concerns during registration allowed the workshops to be structured to address them when applicable. Curriculum that dealt with the stated concerns was stressed during the workshops as were exercises and role playing.

Participant learning outcomes

In addition to commenting on their hopes and concerns about collaboration at registration, participants were asked to complete a written pre-test at the beginning of their first workshop to assess their knowledge and attitudes about facilitation of collaboration. They then took the same assessment at the end of the first 12 hours of instruction (Table F5). Scores were compared to evaluate changes in knowledge and attitudes. Of the 115 total participants, 42% attended only one of the collaboration workshops, 38% attended two workshops, and 20% attended three or more. A total of 82 participants took the pre-test, while 47 took the post-test. Paired data are described below.

Both before and after the workshops, participants were asked to agree or disagree with a series of outcome statements, choosing whether they strongly agreed, agreed, somewhat agreed or did not agree (scored 4, 3, 2, or 1). The biggest increases in agreement after the workshops were in participants agreeing that they had a clear idea of what adaptive management is (+0.8 from 2.4 to 3.2) and that stakeholder participation is critical to it (up +0.5 from 3.1 to 3.6).

Strong agreement became nearly unanimous that participants would be able to use what they learned in the workshops (agreement grew +0.5 from 3.3 to 3.8).

Table F5: Results of pre- and post- surveys of collaborative adaptive management workshop participants.

Do not agree = 1, Agree somewhat = 2, Agree = 3, Strongly agree = 4	**All**			**Pairs**		
	Pre N=82	**Post N=47**	**Diff**	**Pre N=47**	**Post N=47**	**Diff**
I have a clear idea of what adaptive management is	2.5	3.2	+.7	2.4	3.2	+.8
I will use what I learn here in my profession	3.4	3.8	+.4	3.3	3.8	+.5
Stakeholder participation is critical to the adaptive management process	3.2	3.6	+.4	3.1	3.6	+.5
In controversial management processes, it is useful to have an independent third party to do facilitation	3.3	3.7	+.4	3.3	3.7	+.4
The Forest Service is ultimately responsible for forest management decisions on Forest Service lands	2.6	2.9	+.3	2.5	2.9	+.4
I am comfortable managing conflict	2.1	2.4	+.3	2.0	2.4	+.4
Facilitation is not usually needed in meetings between stakeholders and agencies about forest management	1.1	1.4	+.3	1.1	1.4	+.3
I think that better facilitation can improve forest management	3.4	3.6	+.2	3.3	3.6	+.3

Increases of +0.4 were seen in understanding how to manage and frame collaborative processes. After the workshop, participants more strongly agreed that it is useful to have an independent third party to do facilitation in controversial management processes (from 3.3 to 3.7) though the Forest Service is ultimately responsible for forest management decisions on Forest Service lands (from 2.5 to 2.9). Participants' comfort level with managing conflict grew

(from 2.0 to 2.4). There was also growth in agreement (+.3) that better facilitation, when needed, can improve forest management (from 3.3 to 3.6) though facilitation is not usually needed in all meetings between stakeholders and agencies about forest management (from 1.1 to 1.4).

Discussion

Participant hopes about collaboration collected at registration were quite high, though they listed many concerns that could jeopardize effective collaboration. They defined success as project participants feeling heard, respected, and empowered. The processes used should be open, inclusive and with a commitment to dialogue and learning where all issues and viewpoints are understood and considered in making decisions. Decisions should be transparent, built on participant and collective interests and supported by all participants. The project should be completed on schedule leading to a usable end product used for management.

Participant concerns about collaboration highlight some of the anxieties provoked by the prospect of conducting natural resource management in a different way, especially when almost half had had no training in collaboration or facilitation. Participants have valid concerns about *"having enough time to dedicate to getting all stakeholders in agreement to the collaborative process and completing the project within the financial constraints and construction timelines."* They also articulated concerns about dealing with difficult stakeholders that may not have enough expertise or open mindedness to participate fully, leading to a *"watered-down product."*

SNAMP collaboration workshops did seem to both increase the commitment to collaboration and also help ease concerns of participants. Participant learning outcomes were highest in areas that seemed to increase their comfort with the collaborative process, with strongest growth in understanding what adaptive management is and that stakeholder participation is critical to it. There was also growth in understanding how to manage a collaborative process including the importance of having an independent third party to do facilitation in controversial management processes though the Forest Service is ultimately responsible for forest management decisions on Forest Service lands. Participants' comfort level with managing conflict grew along with the belief that better facilitation can improve forest management though it is not needed in many situations.

Results also show that participants are glad to be receiving training in collaboration techniques. Participants said they would be able to use what they learned in the workshops and rated the collaboration and facilitation content as providing new information, ideas, methods and techniques practical and useful knowledge and skills that are applicable to their jobs.

Recommendations for collaboration skills training

Information collected as part of this workshop series shows that natural resource managers, scientists and stakeholders share many hopes and concerns about collaborative adaptive management. Most have not been trained in collaboration and facilitation techniques and so have concerns that increased collaboration will lead to time consuming and confusing interactions with potentially difficult participants that will lead to less effective outcomes.

Whether or not the management workshops held will assist participants in the post-UC phase of collaboration around UC Science Team forest management recommendations remains to be seen. However, available evidence suggests that the trainings held both increased commitment to collaboration and allayed some collaboration concerns for SNAMP participants. Workshops did this by giving specific instruction on how to frame and conduct collaborative processes, sharing collaboration success stories and developing skills to manage collaborative processes. These skills should increase participants' ability to be inclusive and transparent about agency actions, build relationships, and promote learning about forest management science and issues.

Lesson learned: Skills training can increase commitment to, and skill in, conducting collaboration when it focuses on how to frame collaborative processes including defining success, setting up the project's boundaries and constraints and, clarifying the roles and responsibilities of agency staff, scientists and participants. Trainings should also teach how to encourage positive interactions through a better understanding of group discussion, dynamics, learning styles, and tools to deal with difficult behaviors, including identifying when facilitation is needed.

Lesson learned: The SNAMP Collaborative Adaptive Management workshops allowed the community to build the capacity to continue this effort without the presence of the Science Team or active facilitative leadership from UCCE. A rigorous environmental decision-making framework, clearly outlining the roles for the public and the accountability of the agency(s) would also assist future efforts.

V. Assessment of the SNAMP process: Pre-and post-program results

Interviews and email surveys were used to assess the impact of the project on participants and their assessment of the adaptive management process. In this section we look at SNAMP's progress toward our core elements of inclusivity, transparency, learning, building relationships and effectiveness but from different vantage points: we report on views at three points in time over the course of the project and from participant and non-participant views unconnected to a particular event or meeting as was reported in section III and IV. This data helped us understand some of the larger and more elusive concepts such as how effective UC was in its third party role of facilitating public participation and assessing impacts of management practices; who was able to participate in the adaptive management program and why or why not, whether participants felt decision-making was adequately transparent, and what and how participants learned over the course of the project. An ultimate goal of the SNAMP process was reducing conflict, and survey and interview results give us some insight into this and prospects for the future.

Learning is critical to the adaptation needed to manage complex adaptive systems. Sierra Nevada forest management and the adaptive management process of SNAMP are parts of a social ecological system that has both social and ecological dynamics. As ecosystems change, management must learn and use what is learned to adapt--the studies conducted by the wildlife, water, and forest health teams were aimed at learning new things about ecological response to changes brought about by management within the context of the many other ecological changes affecting forests today. The Participation Team focused on understanding the social processes of adaptation and change: how people learn about a system, how they work together to use the knowledge they have gained to improve current management, and how to build a process to transmit what has been learned into the future for future management.

Methods

To gather thoughts, opinions and reflections directly from participants in the SNAMP process about learning and working together in SNAMP we used a variety of quantitative and qualitative social science methods. There are five sources of survey data, and two types of surveys, all separately conducted between 2008 and 2014, that informed our analysis of the collaborative adaptive management process in SNAMP (Table F6). In addition, meeting notes, matrices of attendee characteristics, and all written products were archived in a database that facilitated the network analyses reported in the previous section and remains a rich source of data for future use in understanding the adaptive management process. This "mixed methods" approach allowed us to take advantage of the benefits of qualitative and qualitative methods by using the two types of data to complement each other. Quantitative data allow us to understand the proportion of a population that responds in certain ways, while qualitative data take us out of the realm of pre-formed and limited questions and into an analysis where the respondent can frame ideas and responses in accordance with their own worldview. The qualitative data add nuance and depth to the quantitative information, and strives to assess the full spectrum of opinion, rather than the proportion of respondents agreeing with one prompt or another. For this reason, the two types of information are often presented together, while in some cases, one type of data is the only kind gathered. SNAMP results from both types have been published (Sulak and Huntsinger 2012; Sulak et al. 2015). All in all, we believe a robust and multifaceted presentation of respondent interactions with SNAMP is achieved.

Lengthy qualitative interviews, with protocols contextualized to the phase of the project, were conducted three times during the course of the project, toward the beginning, the middle and the end. Results were analyzed using NVivo software for qualitative data. The interviewees were purposely selected from an extensive interested parties list created from attendance at SNAMP meetings or Forest Service NEPA lists, contacts from SNAMP outreach team outside presentations, and key informant referrals from interviewees or team members. Selection from this group of around one thousand possibilities was based on participation level and affiliation category. Frequent, light and non-participants who were connected to the SNAMP forest sites or activities in some way, were chosen as well as Forest Service, representatives of agencies and local government, the UC Science Team, Native American Tribes, environmental organizations,

forest industry, recreation groups, fire safe councils, ranchers, unaffiliated citizens and news reporters were all included in interviews.

Table F6: Program assessment methods.

Survey Data Source Name	Type of Data	Dates Collected	Number of Participants	Response Rate	Type of Participant
First interviews	Qualitative	2008-2010	42	NA	Both SNAMP participants (34) and non-participants
2010 Email survey	Web based, quantitative	Summer 2010	166	26%	Both SNAMP participants and non-participants
Midpoint interviews	Qualitative	2012	27	NA	SNAMP participants only
Final interviews	Qualitative	2013-2014	31	NA	Both SNAMP participants (26) and non-participants
2014 Email survey	Web based, quantitative	Summer 2014	258	32%	Both SNAMP participants and non-participants

In total, 100 interviews were conducted, lasting 45 minutes to 2 hours, and all but one was conducted by phone. For each round of interviews ("first", "second" or "midpoint", and "third" or "final"), interviewees were added or replaced "lost" or "declined" participants until we were confident that the majority of the relevant perspectives had been sampled (Auerbach and Silverstein 2003). The first and final interviews included non-SNAMP participants but the second round of interviews did not as we were focused on what participants were experiencing in, and learning from, SNAMP. A "response rate" is not included for interviews as all but one

contacted potential interviewee agreed to be interviewed, and the qualitative data are in any case not appropriate for inferential statistics.

Interview questions ranged widely. The first and final interview questions focused on assessing the SNAMP program and its inclusivity, relationship building, transparency, learning, and efficacy. In the first interviews we also looked for preconceived sentiments toward the issues and participants in SNAMP: opinions on forest health, public land management, the Forest Service, the National Environmental Policy Act, the University of California, non-governmental organization (NGO) work in the Sierra and SNAMP. The second round of interviews was conducted mid-way through the project to collect participant experiences with learning in SNAMP. The final interviews aimed to assess perceptions of project outcomes and impacts. Most questions were different in each round of interviews but some questions were asked every time such as questions about forest health. Interview transcripts were imported into NVivo (NVivo QSR version 8.0, 9.0, 10 and for Mac, QSR International Pty, Victoria Australia, 1999-2014) and iteratively coded for emergent themes (Lofland and Lofland 1995).

The email contacts maintained by UC Cooperative Extension to promote SNAMP events and update stakeholders were invited to respond to a web-based survey in the summers of 2010 and 2014, in the middle and toward the end of the project. The list was comprised of individuals who wanted to keep informed about SNAMP progress, or who had attended SNAMP events, or who had a known interest in Sierran forest management. The email survey questions were left open to participants for 6-7 weeks. The 2010 survey was implemented with one initial invitation and three reminders while the 2014 survey had six reminders. The 2010 survey invitation ultimately went to 647 valid email addresses and the 2014 survey invitation went to 801 valid email addresses. Return rates were 26% in 2010 and 32% in 2014, similar to returns for other email surveys (Sheehan 2001). A wave analysis was used to check for non-response bias. Survey questions were on topics similar to those in the interviews. They were mostly multiple choice with the option for further comment, and were organized around the themes of who participates in SNAMP and how; what their different perspectives are on forest health, adaptive management, and the SNAMP process; and what they believe they are getting out of the project. In 2014, respondents were also asked their opinions about treatment effects, and how SNAMP

influenced those opinions. These results form the core of the Participation Team integration report (see Part VII of this Appendix "An in-depth look at learning: Participant responses to treatments" and SNAMP Final Report Chapters 3 and 4).

The email surveys collected almost exclusively ordinal and categorical (interval) data. For this reason Chi-square analysis was used to compare results from 2010 to those from 2014, as the most straightforward method requiring the fewest assumptions for these types of data. (Planned future analysis will draw on logistic regression techniques and a more generalized analysis using the collected demographic data). Respondents were from the community of interest in Sierran forest management that wanted to maintain email contact with SNAMP. The listserv not only contained participants in SNAMP, but overall included a large spectrum of stakeholders some of whom were deeply involved in Sierra forest management and had instigated litigation with the Forest Service in the past, as well as those who had limited connection to the subject or project but still expressed enough interest to be on the mailing list.

While the interviews were designed to allow for in-depth conversation about the issues raised in SNAMP, the email survey provides an idea of the extent of various ideas and opinions among the SNAMP community of interest, and of the relationship between interest group affiliations and responses to the project. For the purpose of this report, because of the SNAMP emphasis on including different interest groups and to understand whether or not SNAMP brought those different interests together, our analysis of responses emphasizes comparison by interest group. In accordance with our mixed methods approach, interview and email responses are for the most part reported together. The interview statements are designed to shed light on and expand on the email responses.

Interviewee and survey respondent demographics

One hundred separate interviews were conducted with 58 different people. Of the 58 interviewees, 10 were interviewed because they had never attended a SNAMP meeting, and 4 were initially interviewed for their historical knowledge of the study areas. Much of the analysis focuses on the 47 participants who were involved in SNAMP at some level including both those who were very active as well as those who had only attended only one meeting.

Of the 47 interviewees who attended a SNAMP event of some sort, just over half of the participants were male and all were between the ages of 32 and 80 with an average age at first interview of 53 years old. All but one interviewee had attended some college and the vast majority had completed college, with almost half the group going on to postgraduate work. They had diverse income levels ranging from $19,000 or less up to $140,000 or more, though just over half the group had incomes over $100,000, and they ranged in experience with natural resource or forest management issues from a few years to over 50 years with most between 11 and 30 years. Most had grown up in suburban or rural settings that were not forested, but more than half lived in forested environments as of the interview. The vast majority was white, but people of American Indian and Asian ethnicities also participated.

The demographics of respondents to the 2010 survey were not significantly different from those in 2014, so we report the demographics of only the participants in the 2014 survey. While more than half of the survey respondents came from the two study areas, there were many respondents from other parts of California and some from other states (Figure F2). Respondents were from a wide range of affiliations (Figure F3). Respondents were 65% male, with the highest education level reached for 32% of interviewees being a Bachelor's degree, 40% a professional or graduate degree, 16% attended some professional or graduate school, and 9% attended some college or trade school. Less than 1% had never attended college or trade school. About 8% made less than $50,000 per year in household income, 51% made $50,000 to $100,000, and 41% made more than $100,000. Average age was 59 years. A little over 43% of our respondents grew up in a rural environment, 18% in a forested one, and 21% in an urban area, 38% in the suburbs. Slightly more than 65% lived in a forested environment when they participated in the survey.

Results: Participant views of SNAMP

Conducting three sets of interview surveys and two email surveys during SNAMP allowed general and in-depth information on the status of, and changes over time in, our approach to collaborative adaptive management. The goal was to find out what people learned, whether or not we were missing important stakeholders, if stakeholders had or developed relationships, whether information was produced and shared transparently, and how they responded to the adaptive management process, including the UC role. In this section we use

both these sources of data to explore the impact the SNAMP science and process had on its participants and draw conclusions on SNAMP's future impact on forest management in the Sierra Nevada.

The UC role: Facilitating transparency

The 2014 survey data can be used to look at how respondents, toward the end of the project, viewed the SNAMP process and how it was facilitated by UC (Figure F18). Members of the UC Science Team were excluded from this analysis. Respondents were asked how much they agreed with statements about the way that the University of California shared its experimental questions, methods and progress with the public as part of SNAMP. When asked about the UC impact on the SNAMP process, the strongest levels of agreement were with the statements that UC took participation seriously, meetings were well organized and facilitated, participants could easily prepare using SNAMP agendas and other materials, and participants had adequate face-to-face contact with scientists and the Forest Service, similar to what was found through the meeting evaluations reported in Section III. This last statement is an indication of the importance of direct contact with managers and scientists. This kind of direct contact was an emphasis in SNAMP because we had previously observed that even in the most participatory projects the public often does not have direct contact with the scientists conducting the studies that are used in making management decisions.

High levels of agreement were achieved in the 2014 email survey with statements about understanding scientific results, having open discussions with the Forest Service, scientists, and other participants, and learning new things at SNAMP meetings. The SNAMP approach definitely increased the transparency of forest management for respondents, with 94% reporting that transparency was enhanced by the UC role in SNAMP. Two thirds agreed that because of the UC role in SNAMP, they were better able to participate in Forest Service planning processes overall (Figure F18).

Generally the email survey responses were similar in 2010 and 2014. The only significant ($p<.05$) changes were increased strong agreement that respondents "feel a part of the project" (7 to 16%), and "have had enough opportunities to provide input into UC research" (7 to

15%). There was significantly decreased overall agreement with the statement that SNAMP meetings are missing important stakeholders (49 to 37%, $p < .05$). In other words, almost 2/3rds of participants did not feel that stakeholders were missing by the end of the project. This improvement stakeholder participation in SNAMP was also brought up in the early interviews:

> "I think that [SNAMP events] have been pretty good – there have been a lot of discussions at the meetings, a lot of information presented and disseminated... The one comment that I would have is that some of the earlier meetings, there were a lot of stakeholder groups that were not there and their attendance would have been good. The last Integration Team meeting had a great diversity, I have never seen such a diverse group at a SNAMP meeting! And that was great. Just a really diverse group at that meeting – ideally I'd like to see that continue to have them interested enough to attend the meetings." UC Scientist 2008

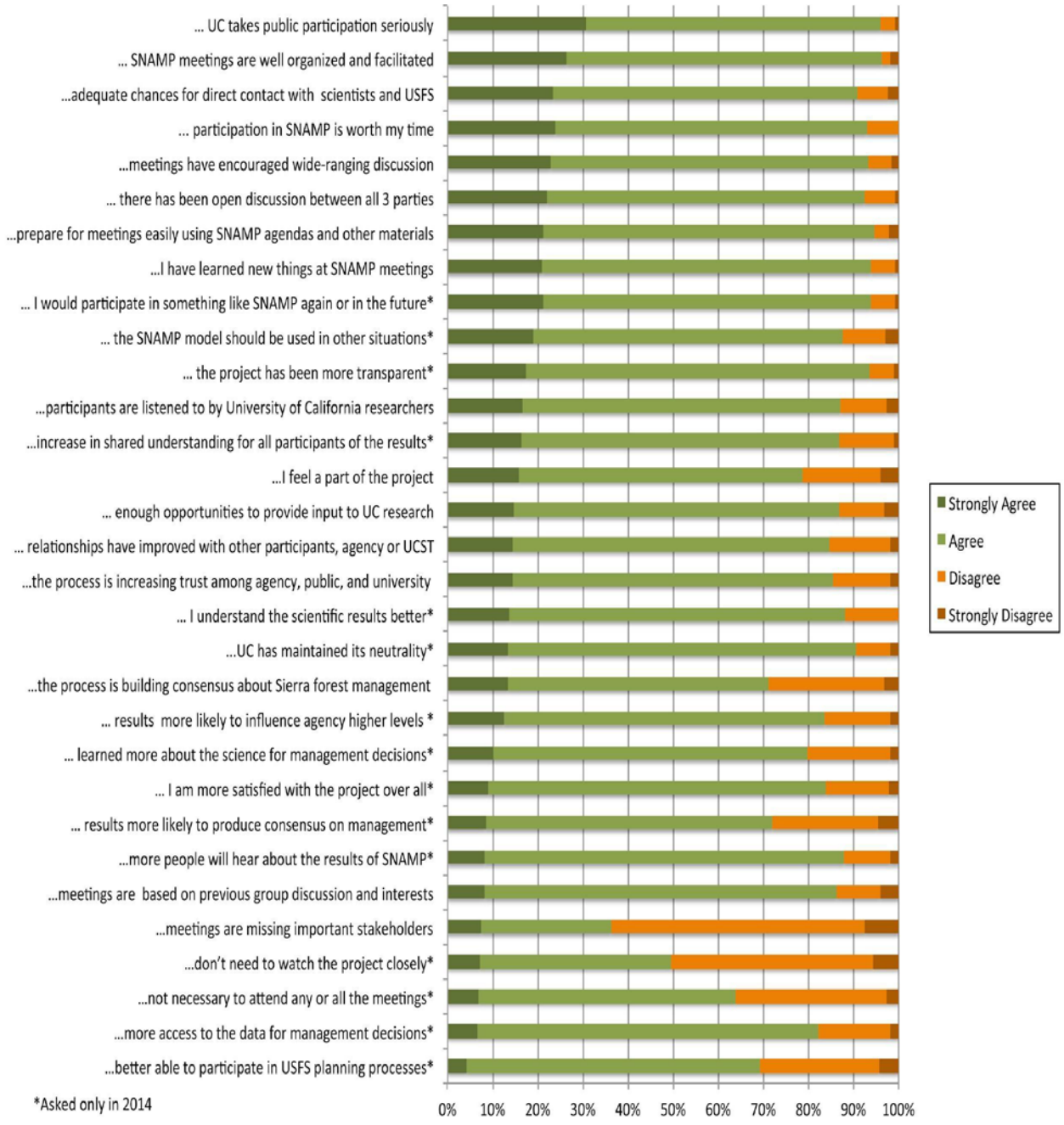


Figure F18: Results from 2014 email survey of people interested in Sierra forest management. Respondent agreement with statements that because of the UC role in the SNAMP process, they believe that…

Inclusiveness through participation

Respondents to the email survey did not feel that important stakeholders were missing from the process (Figure F18), but participation was affected by the ability and interest of

stakeholders in attending events. SNAMP intentionally provided numerous ways of participating to allow the variety of interested parties to take part. The 2014 email data shows the SNAMP website served close to 80% of participants and that just over 70% also attended a UC led meeting of some sort (Figure F19, see section III of this appendix for more information about participation options and website use). Nearly half of the participants attended at least one integration meeting for in-depth study of SNAMP topics and face-to-face contact with scientists in particular topic areas. Of these, integration meetings on the owl and fisher drew the largest number of attendees. A little over a quarter of participants said they had attended one SNAMP event, another quarter attended 2-4 events, and another quarter had been to 5 or more events. About 3% did not participate in any way, and the remainder participated by other means.

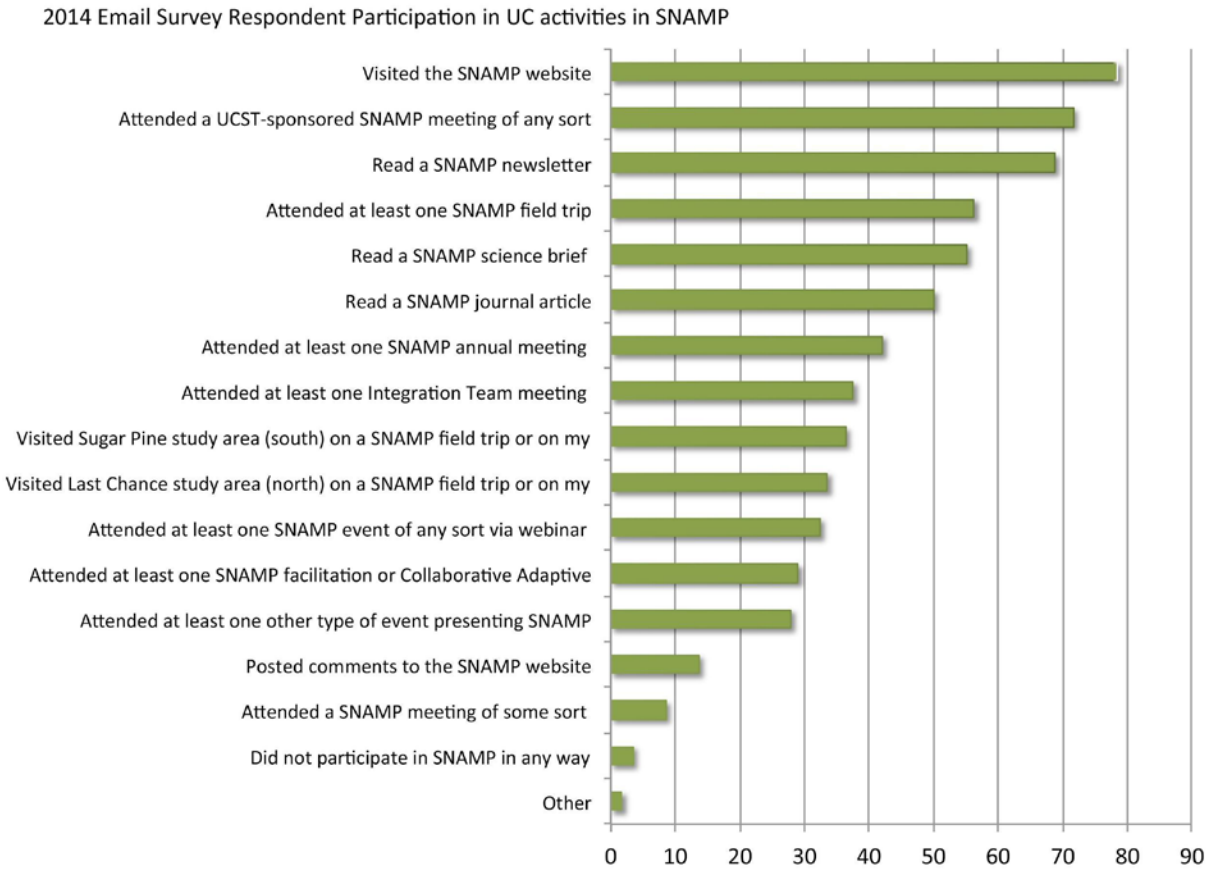


Figure F19: The percent of 2014 email survey respondents participating in various UC-sponsored SNAMP activities.

UC's transparency and multi-faceted outreach methods did help make it possible for more people to get information from SNAMP. Email survey volunteer comments included: "I was not actually involved in any part of the SNAMP project, but I have appreciated receiving the emails", and "I would have like to have taken a more active role in SNAMP, but it really requires $$ of support of some time. Just plain citizens could not afford time and travel...Remote hookups don't work out here in the boonies..." 2014 email respondents were asked about why they did or did not participate in SNAMP functions (Figure F20). Most stated that they simply did not have the time, but distance and cost were important too. It is also clear that participants picked the topics they were most interested in to follow. About 10% were dependent on web-based materials and webinars to participate.

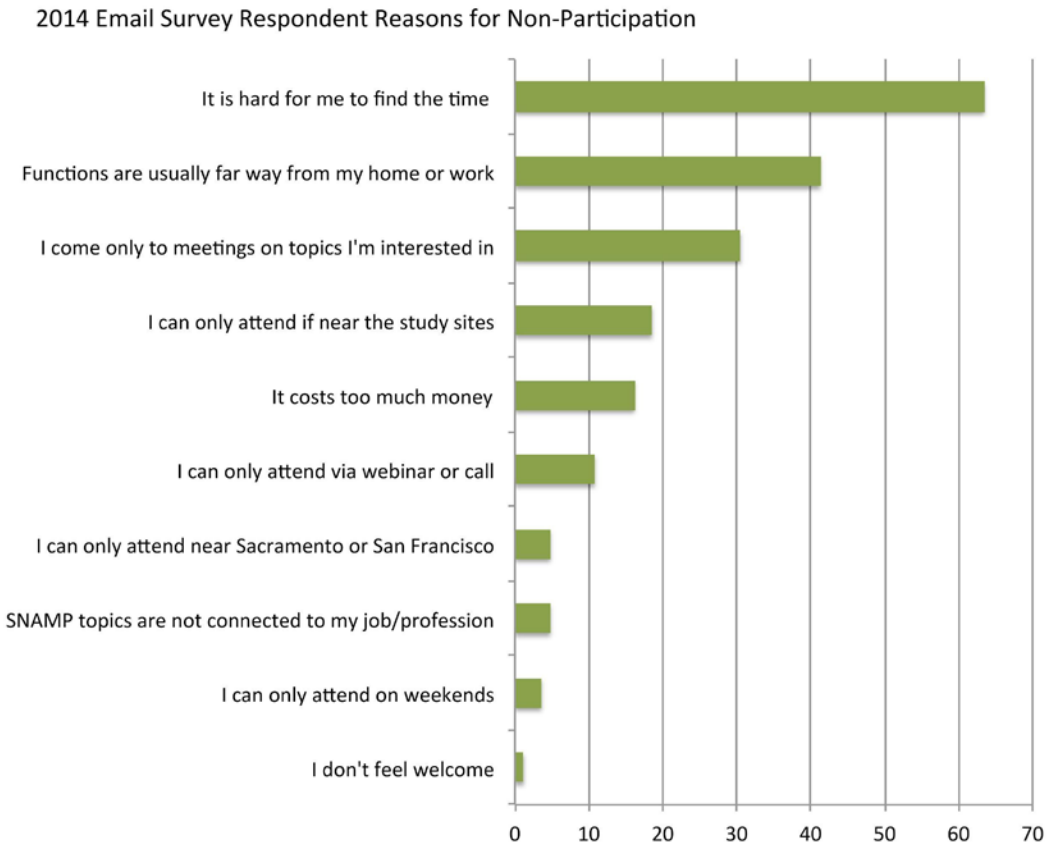


Figure F20: Reasons offered by 2014 email survey respondents for not participating in various UC-sponsored SNAMP activities, in percent.

Relationship building

Starting the project with a strong emphasis on project transparency and participant inclusiveness laid the foundation for what we hoped would be the lasting impacts of the project – improved relationships, shared understandings about the scientific basis for forest management, and ultimately reduced conflict. Our results show SNAMP had an impact on all of these aspirations. More than 85% of 2014 email survey respondents agreed that "relationships have improved among agencies, stakeholders, and the UC Science Team," and that the process was "increasing trust" among them (Figure F18). One 2014 email survey respondent volunteered that "it has given a number of people with different backgrounds some common experiences, knowledge, and exposure to the science."

We can look in detail and over time at the process of relationship building in SNAMP through the three rounds of interviews conducted throughout the project. When asked about the impact of SNAMP on relationships in general, the participants in the first interviews leaned toward slight improvements from SNAMP saying things like "I think so..." or "I hope so..." with a few saying "I don't know" as well. Those participants who observed a tendency toward improved relationships felt it was based on increased transparency and communication opportunities as well as the facilitation conducted by UC Extension. Some thought relationships had not changed and that the stakeholders had not been convinced to change their preconceived adversarial positions based on SNAMP. Some also thought it was prudent to withhold judgment till treatments were complete or final results were released.

To explore these relationships further, in the first interviews we asked specifically about participant opinions of the dominant groups involved in the project, the SNAMP Memorandum of Understanding Partner agencies (MOUP or MOU Partners), NGO stakeholders, UC scientists, and the Forest Service. For the most part interviewee opinions of the SNAMP MOU Partners had not changed much. Many were unclear as to who they were and what their role was and others felt that there had not been enough interaction yet to cause a change in opinion. However, for those intimately involved in orchestrating and funding SNAMP, opinions of the MOU Partners had already developed. Some noted the difficulties associated with the state agencies and their involvement in SNAMP.

> "I don't know about my opinion of them but I have a better understanding of their interests and their fiscal struggles, but also how they think and what they are going to focus on. Helped me understand those groups much better. Especially with California State agencies – they have their own internal struggles themselves, fascinating." Forest Service 2008

Similarly, opinions of the environmental NGO and forest products participants were mainly unchanged. Some participants felt that their preconceived ideas (either positive or negative) had not been changed and others felt they had not had enough exposure to this group to have impact their opinion. Again, in this early phase, a few expressed the sentiment that they were waiting to see how other participant reactions might change once the treatments went in and results were shared.

Participant views of UC scientists were also unchanged but not due to lack of interactions. Many comments talked about the high regard interviewees already had for universities and that had either been enhanced or unaffected by SNAMP. For those who had improved images of UC scientists, participants mentioned the increased commitment this type of project required.

Where opinions about the MOU Partner agencies, UC and other stakeholders were unchanged, opinions of the Forest Service in these first interviews were "somewhat" improved by 2008 and 2009. Stronger sentiments came from some of those affiliated with the Forest Service who saw changes they were proud of within their own agency.

> "Maybe a little bit to the positive. They are now stepping out and engaging the periphery public, local communities, they are engaging people more. I think that will be able to be sustained once this is over because of the relationships being made." Environmental NGO 2008

> "The opinions of the people I am working with here has changed. They are working harder at making connections, facilitating, so on. I have a greater respect for my own employees." Forest Service 2008

In the midpoint interviews we asked about an individual's increased familiarity with other's perspectives and individual changes in opinions without prompting about who or what

organizations. Most of the conversations about change focused on environmental NGOs and showed some dramatic improvements in relationships with, and opinions of, environmental NGOs. However, it was equally likely that interviewees felt their knowledge of other's perspectives, and their own opinions of other groups, did not change. Following these larger general tendencies were changing opinions about the Forest Service, both positive and negative.

> "...[two members of an environmental NGO] who sat next to me… you would think that someone who doesn't think like you, that they must be idiots, but I could tell that they were serious about doing something right. I think by working together we can get stuff done and make a healthy forest… I hadn't been around people like this till this project, probably didn't want to be… I am now willing to work with them. 10 years ago I was not. " Local government 2012

> "I have a little more faith in the Forest Service than I did at the beginning but underline 'a little more'. They are trying very hard to move in the right direction but, like making a ship turn around, it takes a long time." Unaffiliated citizen 2012

Our analysis of the first interviews showed a group that did not know each other well and so had limited knowledge of each other's perspectives and views but revealed a growing understanding of the Forest Service. The midpoint interviews uncovered a more comfortable group that had spent time together hearing each other's views in private conversations as well as in question and answer sessions in formal presentations. For some participants, these experiences increased participant knowledge of environmental group positions and improved participant opinions of those groups. To explore this in the final interviews conducted from 2013-2014, we specifically asked about changes in opinions about the Forest Service and the University of California and asked generally about relationships between stakeholder groups and opinions about other participant organizations.

Comments from the general questions in the final interviews elicited remarks about all the groups, not only focused on environmental or Forest Service groups, and fewer people felt that their opinions and relationships had not changed during SNAMP. Participants noted changes in the relationships between groups normally opposed to each other and comments demonstrate that the project also fostered extensive learning about the Forest Service, an important step toward improved relationships. Perceptions of the university were generally positive but many

people learned about the politics and bureaucracy that exist in universities and some saw scientists as poor translators of science for a public audience. Fostering actual relationships with university scientists did not come up as a goal except for a few Forest Service participants. Many interviewees who were highly involved in SNAMP expressed "disappointment" with the MOU Partners citing unreliable attendance and lack of engagement due to staffing turnover. However, general SNAMP participants, and even those from agencies and the university who were not involved in the logistics behind SNAMP, did not portray the state and federal partner agencies in a negative light and instead, greatly appreciated their input and funding.

The new development in SNAMP's NGO, industry and other non-agency relationships involved connections between groups normally opposed to one another. In 2013/2104, comments about stakeholder groups more often contained descriptions of environmental groups and forest products groups working together. Participants reported opinions and relationships that had grown past positive interactions into collaborating both inside and outside of SNAMP.

> "...the guys from…that saw mill, they were almost at everything I have been to lately, Dinkey Creek or SNAMP or whatever. I think that has really helped bridge the gap between the environmentalists and them. [I think it] really helped being in the same room, it made all the difference in the world." Local government 2014

> "...life has changed a lot in the last 5 years. I have positive things to say about [one environmental NGO representative]. He has actually gotten pretty close to some of the researchers. The [SNAMP and Dinkey Creek] research has really helped build the trust level for some who formerly were adversaries to Forest Service management… And as far as [the environmental NGO representative] and ourselves we have actually a pretty close relationship compared to the past." Forest products group 2014

In terms of opinions of the Forest Service, the dominant trend throughout the whole project was an increase in understanding about the agency and its constraints. Our final interviews showed that this increased familiarity with Forest Service limitations usually led to improvements in perception of the agency but not in all cases. Some participants continued with the same opinion of the agency though with more understanding for why it acts the way it does. However, there were also a very few voices who felt that what they learned in SNAMP caused them to have a less favorable opinion of the Forest Service at the end of the project. Increased

understanding of the Forest Service through SNAMP, regardless of changes in opinion, will likely facilitate improved relationships for the Forest Service in its collaborations going forward.

The variety and types of comments about what participants learned with regard to the Forest Service is surprisingly large considering that educating the public about the Forest Service was not an explicit goal of SNAMP and time was not specifically dedicated to this in meetings or writings. Participants learned an immense amount about the agency's mission and how the agency conducts management, from the information that goes into decision-making, to goal setting, to processes and logistical constraints of all sorts. Funding, public participation and internal functioning constraints, the complexities of the timber market, and the differences in all these variables across national forests and even between Districts were all mentioned as learned by one or many more people. Learning about what capacities the agency does have for partnering and managing is also a crucial concept for collaboration going forward and recognizing how hard it is to change the agency is an important part of working together successfully. Some participants were pleased with changes they saw already in improved outreach and communication by the Forest Service. Continuing a trend that we saw in the earlier interviews, some Forest Service employees improved their opinions of their own agency. In the following quotes it is apparent that though these speakers said they did not change their opinions of the Forest Service, what they learned in SNAMP is representative of many other participant comments, and will impact their relationship and interactions with the agency in future collaborations.

> "I was encouraged that the Forest Service was very actively and engaged in the process… It was interesting to learn about many of the difficulties that they face, I hadn't thought… about thinning contracts and the need to be able to market those products to pay for that work and all the problems associated with that in trying to make it a viable undertaking... I am more sympathetic towards their problems in implementing forest management practices. [My opinion is] not better or worse just better appreciation of all of the intricacies that are involved." MOU Partner 2013

> "[I have learned both] from SNAMP and Kings' River fisher project about timing and capacity for collaboration. Timing for treatments and capacity of the Forest Service to plan and implement: contract, administration, management and conclusion… As a general matter I think the agency staff tend to be a group of people who want to see good

things happen... [But overall my opinion is] the same... As an agency as a whole [I see it as] not much different." Environmental NGO 2014

"...we knew a lot of people in forestry [the Forest Service] prior to this. Our next door neighbor works for forestry. Just by being exposed to more people from forestry of course it is an opportunity to find out what they are doing, how forestry is organized, and stuff like that, what they are interested in and what they aren't interested in. So the SNAMP lectures sort of broadened our knowledge about how the forestry service works." Unaffiliated citizen 2014

With regard to the UC Science Team, most interviewees at the start of the project and the end of the project, held the university in high esteem as an "objective", "unbiased", "trustworthy", "independent", "credible", non-political source of science. Most participants also felt that the UC Science Team would produce information that would be useful to managers. Many strongly emphasized that the UC Science Team had better produce useful results given the large quantities of time and money that had been spent in SNAMP ("Sure in hell better [produce information that is useful to forest managers] for what they are getting paid!" Local government official 2014). Some noted that pieces of information have already traveled the loop and have been used by the Forest Service.

Nevertheless, notes of criticism were also apparent in the comments regarding a lack of real world experience in academia. Participants also learned about UC and its scientists' limitations and constraints such as interacting with agencies or the public and contracting for this kind of a project. Some MOU Partners expressed frustration with the university based on their behind-the-scenes experiences with the university system. UC scientists learned about their own organization as well - how it is hampered by internal politics and bureaucracy and how scientists limit themselves to the ivory tower and resist political involvement.

"I have learned how strange structurally they are about contracts and how they don't, or that they are not used to, transmitting their research information to the public or outside parties. That it is awkward for them. That they don't integrate or have much interaction with many of the agencies that their research would be helping… As well as seeing how it was very uncomfortable to talk to the public at the open public meetings and how uncomfortable some of them were with that. It's a combination of not having the skills and not being used to it." MOU Partner 2013

When asked if experiences in SNAMP changed participant opinions of the university most respondents said no, their generally positive opinions had not changed. A few SNAMP MOU Partner and Forest Service participants disagreed and felt that their opinions of the university had worsened based on SNAMP. These participants generally declined to explain.

In the final interviews, frustration with the SNAMP MOU Partners came up again from those intimately involved in the inner workings of SNAMP. The dissatisfaction seemed to stem from the frequent changes in representatives on the part of the Forest Service as well as the state agencies. The changes in agency contacts made it hard to keep up the intensity, interest and engagement of those agencies and made building lasting relationships very difficult. Also, a few participants perceived the MOU Partners as entrenched in their views and unable to support topics outside their official agency interests. Positive comments came from a few active agency representatives and the rest of the participants who appreciated the agencies' input and were grateful for the funding.

> "I am not as confident in the MOUP relationships improved. They have changed so much over time and there have been no consistent representatives from the California Resources Agency or CALFIRE or Fish & Game so relationships aren't as well established but maybe the structure and processes and importance of those relationships will be remembered in another project." UC scientist 2013

Shared understandings

Social learning in the adaptive management context is reaching "an agreement on relevant knowledge necessary for addressing a problem" (Ansell and Gash 2007) and supports the progression of the adaptive management cycle. Facilitation of well-structured and organized meetings that respect diverse sources of knowledge can create an environment conducive to developing shared understandings (Arnold et al. 2012). The email surveys indicate general satisfaction with this in SNAMP. Multiple formats for sharing scientific plans and results and getting feedback were used as has been shown beneficial in other studies (Stringer et al. 2006; Arnold et al. 2012). Throughout the project the Participation Team worked to create new events and formats to address needs that came up as part of an iterative public participation process (Stringer et al. 2006).

More than 85% of 2014 email respondents agreed that there was an "increase in shared understandings" as a result of the UC role as a third party in the SNAMP process (Figure F18). In the midpoint interviews we focused on this concept of shared understandings and found support amongst our varied interviewees for the evolution of shared understandings within the SNAMP participants. Observations of shared understandings were frequently associated with the wildlife portions of SNAMP and attributed to the Integration Team meeting format and facilitation. The few who disagreed, felt it was due to the short project length or that other projects were more successful examples.

> "Yes, my views are getting closer to others. It's only natural to the extent that you all sit in a room and look at an issue evaluating monitoring data … and you are doing it together … there is convergence that can occur and has occurred in this case." MOU Partner 2012

The development of shared norms and understandings is argued to be key to successful teamwork among participants with divergent perspectives (Sulak and Huntsinger 2012). The goal is to deconstruct polarizing issues (Arnold et al. 2012) and create a hybrid culture with a shared language (Sulak and Huntsinger 2012). As an example of how this was addressed, SNAMP's Collaborative Adaptive Management workshops (see section IV of this appendix) helped participants learn communication strategies for productive meetings and to create a common language to help build the long-term relationships support learning and adaptation (Stringer et al. 2006). One focus of the meetings was discussion of the variety of definitions of "adaptive management" in Forest Service literature and comparing these to Science Team and stakeholder definitions.

A clear definition of adaptive management was also initially elusive in our interviews. Both in the initial interviews in 2008-2010 and in the final interviews 2013-2014, we asked for participants to share their definitions of adaptive management. In the early conversations, support for adaptive management and its use in the forests of the Sierra Nevada was widespread, but it was difficult for interviewees to describe the concept. Monitoring or learning from past management were concepts important to at least half the interviewees but usually came from

those in agencies, the university or those very active in SNAMP with many years of natural resource work or advocacy. Other similar concepts were that adaptive management must be science based and that it entails "learning by doing." Some did not think of it as a process but an end point and mentioned ecological goals or required a certain kind of treatment. The inclusion of public input was added into definitions for a few participants. A small number admitted they did not know what adaptive management really was and some were skeptical of the term. The academics in the group mentioned experimentation as crucial to the process of adaptive management.

By 2014, shared understandings of adaptive management did seem to have developed. In the final interviews in 2013 and 2014 we heard more people talk about experimental, science based approaches with monitoring components and people started using terms like "cycles" and "loops" in their descriptions. The importance of learning was still strong and we saw the addition of many more comments about public participation being an essential aspect as well. The only skeptical voice was concerned that SNAMP recommendations could get ignored in the future under the guise of new information that may or may not be transparent and could be political rather than scientific. Another issue raised was based in experience with the Forest Service's rigid structure that leaves little room for the flexibility required to do adaptive management.

> "I look at it as a cyclical process of implementing management, testing it with monitoring, sometimes research but mostly monitoring, making evaluation and then learning from that and using what we learn to change our management if necessary – sometimes we learn we are doing ok." Forest Service 2013

> "I define it differently now with SNAMP and other things, because now it has to be a collaborative, called "CAM"... We have a pretty good model for it now. What we did with SNAMP we made it participatory." Forest Service 2013

When asked if participants thought adaptive management was a good strategy for the forests of the Sierra Nevada, the answer in the final interviews was again positive, but the answers were much more detailed than the simple "yes" answers from the 2008-2010 surveys. The 2103-2014 participant answers more clearly showed understanding of the complexity of the management, financial, and administrative setting.

Though we saw these shared understandings develop, consensus was difficult to achieve. A smaller 2014 email survey majority, a little over 72% of respondents, agreed that that because of the UC role in the SNAMP process, "project results are more likely to produce consensus on forest management" (Figure F18). A look at the 2014 email survey voluntary comments helps to explain why a smaller majority agreed with the statement about consensus. Comments include, "I seriously question the necessity for consensus", and "I am doubtful there will ever be consensus on forest management...too many perspectives." In fact, reaching consensus was not an explicit goal of the project. Arnold et al. (2012) in their review of adaptive management processes point out that "although consensus is often loosely equated to agreement by all parties, it more accurately reflects the perspective of stakeholders with the most power and a lack of active opposition by others."

Effectiveness: Reducing Conflict

Reducing conflict was referred to several times as a foundational goal of SNAMP, from the creation of the MOU onward. Trust between the public and the Forest Service is often espoused as a key to reducing conflict over forest management. More than 86% of 2014 email survey respondents agreed that the SNAMP process was increasing trust among agency, public, and university participants. A majority even agreed that they did not find it necessary to attend any or all the meetings as a result of the confidence in the process with UC participation (Figure 18). An email respondent volunteered that "The science on the effects on some of these management techniques has been really thin. Working alongside the scientists to understand the data, methods, and results, has really helped groups typically outside the process and lobbying lawsuits into the fray to become part of the process."

However, the final interviewees were lukewarm on SNAMP's progress toward the ultimate goal of reducing conflict over forest management in the Sierra. Some were positive, hoping that the relationships, partnerships and shared understandings developed during SNAMP would reduce conflict but many more resigned themselves to a perception of the inevitable nature of conflict over natural resources. One person suggested that environmental groups took a "wait and see approach" with SNAMP and may go back to litigation if they do not see the results

they like. Basic philosophical differences were the source of many disheartening comments where people expressed opinions such as: one project cannot solve all the diverse opinions of the environmental and social issues in the Sierra; SNAMP cannot change someone's value system; preconceived notions are hard to overcome.

> "Maybe a tiny bit. I think there are just really some basic philosophical differences in the way some people think the forests should or should not be managed and some feel the forests should be managed like National Parks. SNAMP will have an impact on some individuals but certainly not all." Forest Service 2013

The idea that forest management is often gridlocked by controversy and litigation is widespread. Broussard and Whittaker (2009) found an increasing trend in the number of NEPA-Forest Service cases in the federal courts between 1970 and 2001. Environmental groups were the most common litigants and timber harvesting, management plans, and endangered species were the subject of the majority of cases in both the U.S. District Court and the U.S. Circuit Court of appeals. Litigation is costly and time consuming, and emphasizes and tends to reinforce conflicts rather than creating constructive relationships. In the 2014 email survey, respondents were asked if some of the innovations in the SNAMP adaptive management model would be helpful in reducing litigation (Figure F21). A majority of respondents believed that scientific learning, building relationships, adaptive management, and the involvement of university scientists helped to reduce the likelihood of litigation. Science team members were excluded from this analysis.

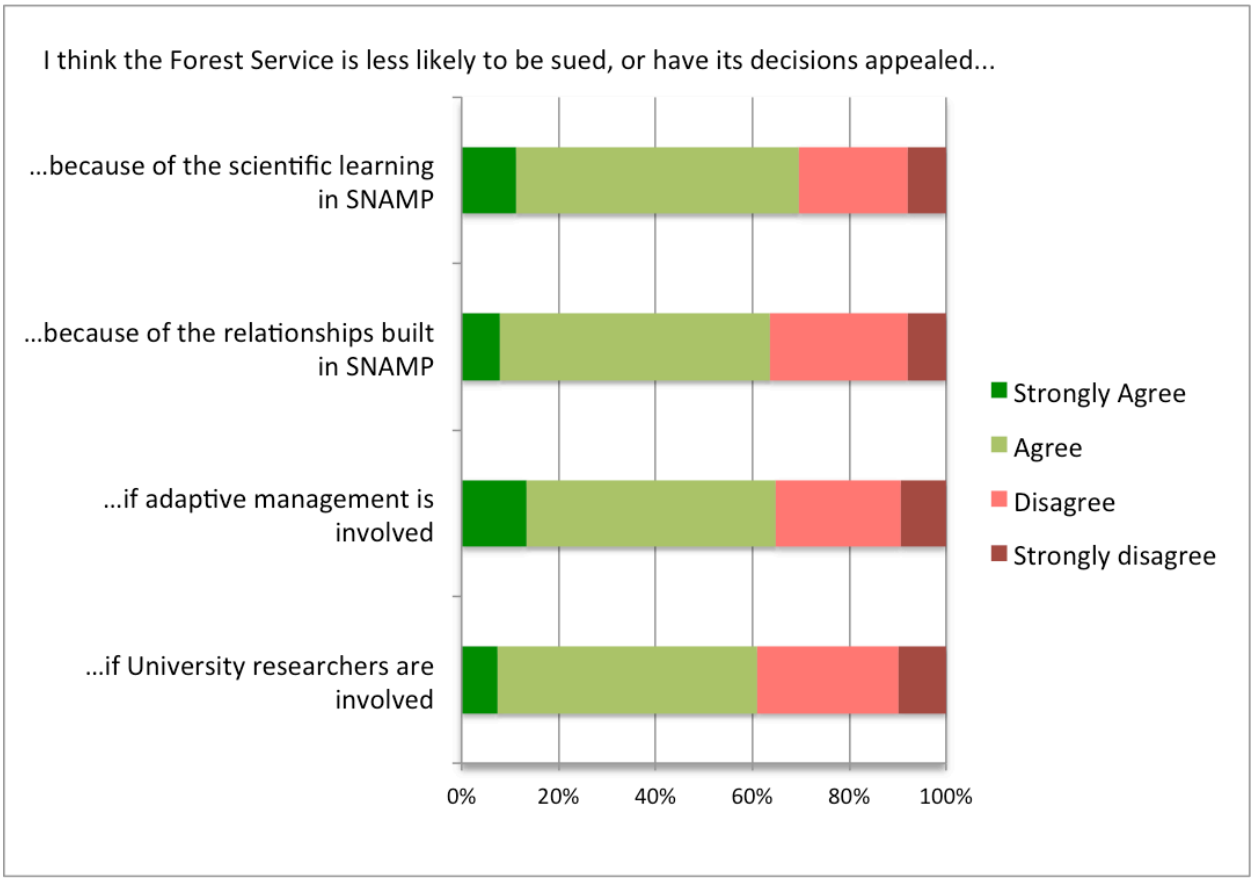


Figure F21: 2014 email survey respondents agreement with statements about SNAMP practices and their influence on the likelihood of litigation.

Many of the 2014 email survey respondents included comments explaining their responses, for example, saying that the Forest Service would be less likely to be sued if decisions and actions were based on any form of independent science--this supports the notion that a third party monitor may help defuse controversy. A comment was made that "having a third party that is reputable and knowledgeable and communication facilitation is the key to building trust" and another comment added that "science with monitoring must be present to balance politics and bad science"; possibly this person meant "to counter" rather than "to balance." Commenters mentioned an appreciation for the direct contact with scientists. There was also a general tone in the comments that lawsuits are not constructive, and in some cases, are instigated by people who will never be swayed by science, for example, "While SNAMP has seemed to have a positive impact on lessening controversy about forest management on public land, some entities commonly resorting to lawsuits to challenge Forest Service projects are simply dogmatically

opposed to any commercial activities on public lands [and] are unlikely to be deterred simply because of SNAMP." Others commented that those who do not see the need to carry out fuel reduction should just "get out of the way" before the entire forest is lost, and that "if they don't like our product they will sue us regardless."

Overall, the 61 comments volunteered in the 2014 email survey fell along the following lines:

1. Lawsuits are agenda-driven, those suing do not listen and nothing will help
2. Science can help, especially if the Forest Service puts the results to good use
3. Shifting to community and stakeholder involvement, working together, adaptive management can build constructive decisions and reduce litigation

The first view is by far the most common among the email survey comments. There is a widespread belief that nothing can be done to prevent litigation, because the litigants are ill-informed, or have an agenda, or everything is decided by politics. Nonetheless, within this somewhat gloomy context, 2014 email respondents were still generally positive about the potential impact of SNAMP practices, with the possible exception of those affiliated with the forest products industry.

These 2014 email survey results are echoed in the final interview results. There was support for a neutral third party and relationship building but possibly more important is using the best available science.

> "For many it doesn't matter what the study outcomes are or the relationships… Some groups will sue regardless." Native American Tribe representative 2014

> "... it's really hard to sue when the best available science disagrees with your point of view. The more quality science comes out of our projects then the less likely we are to get sued." Forest Service 2013

The 2014 email survey respondents were categorized by whether they were primarily associated with the Forest Service, an environmental NGO, local government, an industry organization, or participating as a member of the general public. Responses for industry

organization members did vary significantly ($p<.05$) from the averages presented in Figure F21. They more strongly disagreed with the others that the involvement of university scientists, adaptive management, scientific learning, or building relationships reduced the likelihood of litigation. The volunteer comments from this group uniformly expressed the opinion that litigation was capricious and not related to actual facts or responsive to science. As one commenter wrote, "it just takes one nut." Those involved in forest products are clearly the most frustrated by the current conditions for forest management, and their opinions are somewhat isolated. In recent decades, the industry has undergone a steep decline, along with timber cutting on national forests in the Sierra Nevada.

Another example of the differences among groups is the responses to the statement about the involvement of university scientists reducing lawsuits, with Forest Service affiliates most strongly agreeing with the statement, and forest products industry affiliates most strongly disagreeing (Figure F22). Of the four statements, the Forest Service affiliates most strongly supported the statement about scientific learning. Local government representatives most strongly supported the statement about relationship building; NGO members most strongly agreed about adaptive management; general public members most often agreed with the statement about scientific learning; and the industry affiliates most strongly supported the statements about relationship building and scientific learning, although they were the least likely to agree with any statement.

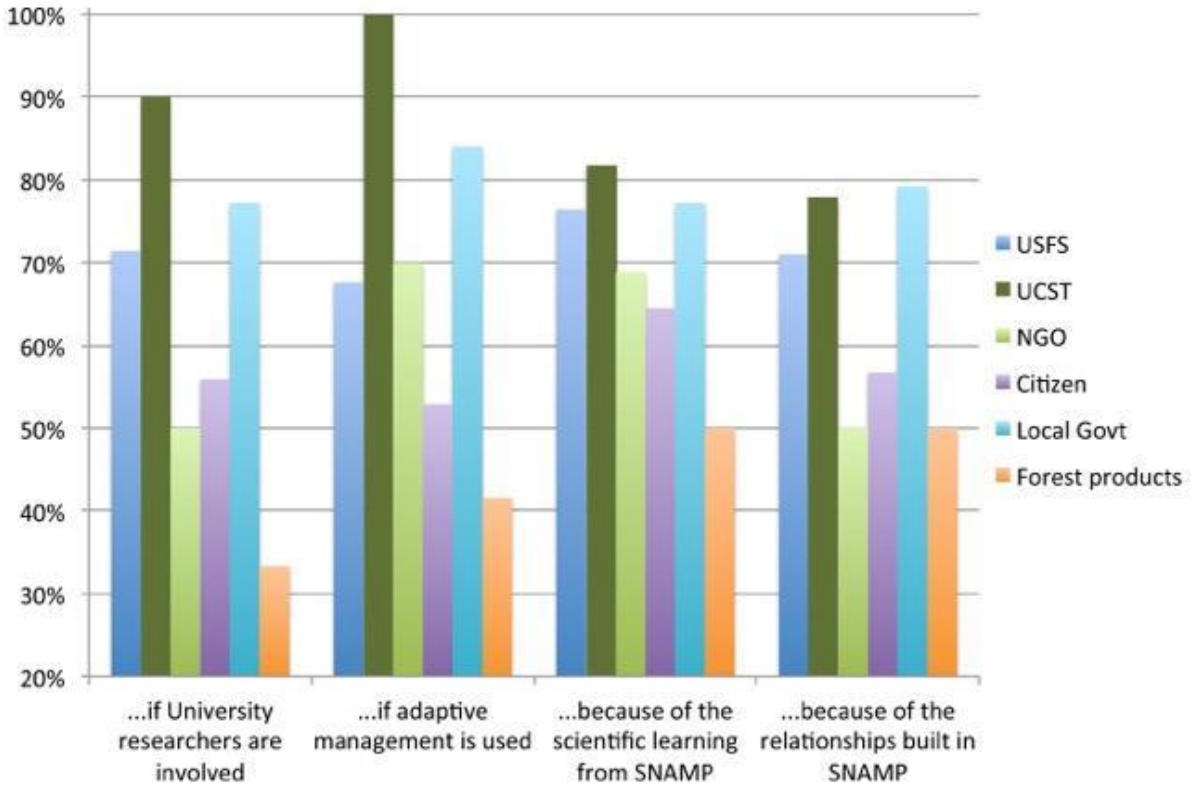


Figure F22: Percent of respondents agreeing that particular SNAMP activities reduced the risk of litigation: "I think the Forest Service is less likely to be sued, or to have its decisions appealed, if…"

SNAMP's third party model

SNAMP's collaborative adaptive management third party model (see section II of this report for more discussion of this model) was created at least to some extent to reduce conflict over forest management in the Sierra. It was thought that a partnership between agencies and stakeholders from all sides of the issue would be most fruitful with a "neutral third party" acting as the outreach and science provider in the adaptive management cycle. Here we present participant reactions to this model and their interpretations of its benefits and detractions. Because this collaborative adaptive management model is not simple or easy to interpret, expectations of UC function in the third party role were mixed and not all participants were satisfied. However, for the most part the neutral third party role was appreciated, UC was expected and seen to be independent and unbiased, and UC was perceived to have conducted

itself credibly. This trust that the third party is unbiased and independent is essential for the third party model to function smoothly. One non-participant interviewee went as far as to say that UC's involvement allowed her not to participate since she trusted the university.

> "I think that the expectation is that their role is critical… because they are third party professional scientists that have the respect; if it was a Forest Service study it wouldn't have that respect." Forest Service 2008

> "I think when you have a university, if UC or some other university, it brings that presence of academia that really makes things feel more legitimate – science and research and intellectual behind it – give it more authority and credibility." MOU Partner 2014

As the third party science provider, the UC Science Team received high marks for being responsive to stakeholder input. This was an important part of the collaborative adaptive management process model but difficult to actualize at times. Scientists sometimes believe the scientific method cannot accommodate much public input but overall there was sentiment that the UC Science Team was responsive to stakeholder needs even if their scientific methods were not altered by stakeholder input.

Nevertheless, there were bumps in SNAMP's third party arrangement. One issue that was apparent immediately was the difference in expectations between UC scientists and the Forest Service managers and MOU Partners. There were strong differences of opinion as to the original subjects to be studied, biodiversity or specific species, as well as other debates over including water or economic impacts. Some managers hoped for direct UC input into the planning of the treatments, they saw this as a partnership with the university. The UC scientists were functioning under their interpretation of the scientific method where, in order to test the impacts of Forest Service treatments, the Forest Service had to do the treatments as normally as possible, meaning without additional scientific resources. This came as a surprise to some Forest Service managers and dislike of this "siloed" type of engagement was a problem for an environmental NGO and an unaffiliated citizen too. Even to UC scientists the line was vague at times. Some participants expressed frustration that the university was not 'monitoring' or not monitoring what was important. One participant thought that the university, based on its field

data, should have told the public that neither study area project really looked like a SPLAT "a la Finney" and that the university should "blow the whistle" on the Forest Service.

> "On Monday I received a message from [the UC coordinator] about meetings this summer with the MOUP and I was a little taken aback – why wasn't I involved and asked about planning? Our connection with the scientists has been minimal – I really looked forward to a learning experience and working a lot with [UC Scientist] Scott Stevens but that hasn't happened at all – that has been disappointing." Forest Service 2008

> "Well the role [of the university] is to do the monitoring and the evaluation but I see backpedaling on that too. We know they won't recommend management but will they get us close enough that we can identify the management?" Forest Service 2013

> "I thought we weren't making management recommendations. I think they [the scientists] use good science but I don't think it is their place to make management recommendations. Well maybe recommendations but not… not terribly clear on what's happening for SNAMP for that, where the line is drawn. Do we present the science and they take it from there or do we make actual recommendations and they take it from there? I can't answer this one." UC Scientist 2014

Disconnects such as these created a need for the UC Science Team to create a Neutrality Agreement that helped describe the UC role and what scientists could or could not do with regard to the science involved in SNAMP. In our first and final interviews we asked about UC's performance and how it could have done better with regard to its neutrality. Most participants felt that the UC Science Team had performed well and followed its Neutrality Agreement. There were only a few suggestions of how the university could have done better and there were a few instances that participants cited where there had been conflicts – a scientist spoke to the press regarding opinions about the Forest Service and Forest Service management and there was one instance where UC's transparency was called into question.

The transparency of the scientific results and process was a very important tenet of the UC third party system. UC made a concerted effort to release SNAMP results and process updates to the MOU Partners and to the public directly and simultaneously. This ground rule as well as the idea that SNAMP science would not alter the normal way the Forest Service implemented treatments were both difficult to achieve in reality. After the study area expansion, the Owl Team had to share information with the Forest Service based on contracts that predated

SNAMP and the Fisher Team also had to share denning information with the Forest Service as required by law. The transparency issue with the Owl Team arose because the sharing of results was done in a way that looked to some like the Forest Service was able to alter the results of the report. In the case of the fisher, the sharing of that information was seen by some as a positive example of a small adaptive loop within the larger adaptive management cycle.

> "...one of the owl reports was modified by the Forest Service and they changed it... They may have had good reason to change it but the perception of influence, that the Forest Service reviewed it prior to the rest of the MOUP… I am not saying there is bias but there is the perception." MOU Partner 2013

Another complication of an outside entity performing in a third party role was the funding. The relationship building section above touched on the tensions within and between the MOU Partners and the university with regard to engagement and budget constraints as strains on building relationships. Interviewees commented that the conflicts over funding were extremely difficult hurdles for the three party model to grapple with when faced with annual funding cycles, a major international recession, and a 7-10 year expectation of consistent funding from the university and the stakeholders. Some participants felt that the state could have funded the project better, especially as the state was seen as the instigator of the project, while there was also an understanding that this project was given to the Department of Water Resources without much support. The UC Science Team was seen by some MOU Partners as always looking for "a handout" which was particularly frustrating as the country crashed into a recession and California was cutting "billions from state budgets." Many actively involved participants mentioned that multi-year projects like this need funding sources that can accommodate much longer commitments. The annual funding appropriation systems for these agencies was not a good fit for this decade long project.

The reliance of the project on multiple entities and the purposeful structure that separated the management from the science, created a lack of control over the implementation of the treatments. Participants mentioned that coordinating timing between many science teams as well as across a multiple universities and federal and state agencies was challenging and in the end

culminated with parts of the project at vastly different stages of study as well as little to no post-project monitoring due to Forest Service treatment implementation delays.

> "They [UC] were an integrated player putting on the ground the objectives, very dedicated people who wanted to see the results. Unfortunately the Forest Service couldn't do the projects in a timely manner, that greatly compromised the work the university researchers were able to do and will grossly impact the quality of the university report in a negative way unfortunately. SNAMP doesn't have the post-project monitoring. Absolutely no fault of the researchers." Forest products group 2014

Though the third party model may have had its difficulties, most SNAMP participants welcomed the process and felt it could and should be transferable to other situations. Perhaps most important, in thinking about the future potential of collaborative adaptive management projects, one of the highest levels of agreement in the 2014 email survey was with the statement that "participation in SNAMP is worth my time" and "I would participate in something like SNAMP again or in the future." The large majority of respondents also agreed that "the SNAMP model should be used in other situations."

In the interviews, we also asked about these latter two concepts and found strong support for both. In the first round of interviews people said they wanted to stay engaged with the project either because they had to as part of their job or because they were interested in it. In the final round of interviews almost all participants said they would participate in something like SNAMP again. The only participants who expressed trepidation were SNAMP MOU Partners and UC scientists concerned about the funding for such a long project. Most interviewees also supported the application of the SNAMP model to other collaborative adaptive management situations with two common sticking points, the funding for an outside third party or the perception of bias for an internal one.

Learning

Inextricably linked to our fundamental principles of transparency, inclusiveness, relationship building, and effective adaptive management was learning. As a result of the UC role in assessment and facilitation of SNAMP, approximately 95% of 2014 email respondents agreed they learned new things at SNAMP meetings, 88% agreed that they understood the

scientific results better, 90% agreed they learned more about the science behind forest management and decision-making, and we saw interview evidence for all this learning contributing to growing shared understandings throughout the project. Learning also played an important role in the relationships section of this appendix where increased understanding of Forest Service management led to a more sympathetic attitude toward the agency and learning about other stakeholder groups, environmental NGOs, other agencies or forest products groups, helped build relationships.

As part of learning, having face-to-face exposure to scientists was greatly appreciated by participants, with more than 90% agreeing they had "adequate opportunity for face-to-face contact with UC scientists and/or Forest Service representatives" and 87% agreeing that they had "enough opportunities to provide input into UC research." Volunteer comments included pointing out "how intimidating it was to query some of the scientists...and how much they needed someone to challenge their thinking." UC Science Team members also felt they gained from the contact, with one interviewee stating that they learned how important the terms used were, and how important it is to use descriptive rather than "normative" terms like "catastrophic."

> "I learned a lot from the UC Science Team and the Forest Service managers... about language around role of fire in a landscape. I had no problem talking about 'devastating' or 'catastrophic' when we started SNAMP and now I know those are terms to be avoided. We need to be more descriptive not value laden and define in terms of outcomes not values that differ between people and may disengaged some. Language is more important than we realize… I was aware of it but SNAMP has made me relearn it and be more aware of it." UC scientist 2013

These sentiments about the importance of face-to-face contact were echoed in our interview conversations. We did not specifically ask about this attribute of our meeting planning, it was mentioned unsolicited usually in conversations about SNAMP's impact on relationships between participants:

> "The field reviews provided opportunity for one-on-one discussions that would have not otherwise occurred and so from that aspect [they were] very positive. I would not have had much interaction with [environmental NGO group] except for the SNAMP field trips.

> Now we are on a first name basis and can talk about just about anything. Wouldn't have occurred without SNAMP field trips." Forest products group 2014

The value and importance of field trips, for both learning as well as changing opinions about other participants and building relationships, was clearly prominent in the interviews across all three rounds from 2008-2014. Physically being in the woods helps to clarify discussions reducing the likelihood of miscommunication, encourages more casual conversation that help participants understand differing points of view and learn from each other as well as the trip leaders and just simply sharing a ride can provide a great space for frank and honest conversation. "There is nothing better than staring at the woods and a tree and having a discussion" because "when you are there you don't have to visualize you can actually see it." Interviewees appreciated the "hands-on" nature of field trips and they said the trips "deepened my understanding." For some, field trips were crucial because "until I see the issue in the field I do not fully understand it…"

> "I have been on plenty of field trips outside of SNAMP that have been unpleasant – head banging - and that hasn't cropped up in the SNAMP trips. That makes for an easier and more productive learning environment. Either by the handy facilitation or a different social dynamic among the people involved and I think that is another sign of a learning environment that is shared and productive." Environmental NGO 2012

An extensive discussion of the final interview and 2014 email survey results on learning about the scientific topics in SNAMP is contained in the Participation Team contribution to the integration chapter (see chapters 3and 4 in this document and below in part VII). Conclusions from that analysis showed that participants learned from SNAMP and participant opinions were affected primarily in terms of forest health, fire behavior and fisher but also with regard to forest management, wildlife biology, and hydrology. In many cases participant opinions were bolstered and affirmed by SNAMP and some participants changed their preconceived opinions dramatically.

> "...others bring up, as well as me, the results of SNAMP… outside of SNAMP meetings so it is part of a larger conversation, signaling to me that it is a productive learning environment because people are taking it out of the environment." Environmental NGO 2012

Looking over the interviews broadly, the fisher part of the project stands out as a focal topic for participants. For example, the word "fisher" is more than twice as commonly uttered in our interviews as the word "owl." Some participants were not familiar with the fisher before their participation in SNAMP and so were excited to learn what they could about this new animal in their backyards. Participants were impressed with the project's basic biological discoveries and the remarkable findings about the harmful, and surprisingly common, impacts of rodenticide. The findings from the fisher study were also quickly able to feed back into management due to Forest Service regulations requiring use of the best science available.

Another important area of learning expressed by the interviewees was about the adaptive management process and the role of the public in forest management. When asked in 2012 about the most important, interesting or useful thing learned from SNAMP many answers focused on the public portion of the adaptive management process. Participants, especially some Forest Service, university and agency participants, appear to have learned the how and why of public involvement in forest management. This came up most frequently in the 2012 midpoint interviews and less so in the first or final interviews.

> "[I learned about the] participatory model – the word "collaboration" in adaptive management system. Adaptive management only works for public resource management if it is done in a participatory way." Forest Service 2012

VI. An in-depth look at learning: An evolving concept of "forest health"

Forest health is a topic that was originally a part of the SNAMP workplan but was ultimately only partially addressed through SNAMP science. Yet it was a term that was used frequently without much attention to the varied definitions commonly associated to it. This section looks in-depth at the term and tracks SNAMP participant definitions during the project to detect if SNAMP's emphasis on learning created a shared understanding of the term forest health.

The term "forest health" has long been used in forestry programs throughout the United States (Sulak and Huntsinger 2012). The phrase appears in national policy in the Healthy Forest Initiative (2002) and the Healthy Forests Restoration Act (2003), among others. The Sierra

Nevada Framework of 2004 calls for using adaptive management to implement Forest Service programs for creating healthier and more fire-resistant forests (USDA Forest Service 2004). There is, however, little consensus on what a healthy forest is. It has been suggested that this lack of definition can hinder public participation processes (Hull et al. 2003). Shared learning is an important component of adaptive management. Earley and Mosakowski (2000) found that developing shared agreements about the meaning of crucial terms could contribute to the development of a "hybrid culture" of shared norms that helped interdisciplinary teams work together on controversial problems. It may also be the case that in participatory adaptive management for forest management, shared agreement on terms like forest health might help develop a hybrid culture of shared norms that could lead to broader acceptance of what constitutes successful management action and outcomes.

The term "health" applied to ecosystems has been described as normative, because it is value-laden, implying that there is a healthy ecosystem state that is better than other states (Lackey 2001). In fact, conditions are seen as healthy through the lens of an individual's values and policy preferences, or through individual mental models shaped by experience and culture (Norman 1983). Deciding what ecosystem conditions are healthy is the product of political or social deliberations, not scientific results (Lackey 2001; Hull et al. 2003; Warren 2007). Yet the term forest health conveys, in non-technical terms, the message of a positive goal for the forest -- something that stakeholders can rally around, and defense of the term and attempts at definition are common (Ross et al. 1997; Rapport et al. 1999; Raffa et al. 2009).

An adaptive management program is often described in the scientific literature as management designed as a series of experiments to test and evaluate management alternatives, so that managers can learn from their management outcomes (Walters and Holling 1990; Gregory et al. 2006). Adaptive management, however, cannot set the goals for the forest, making a shared understanding and appreciation for these goals crucial to the perceived success of a management initiative. Participants will ultimately assess the success or failure of the project based on their understanding of the goals for the project. If forest health is the goal, different understandings of the term could cause different assessments of the results.

Data sources

In all three sets of interviews, 2008-2010, 2012, and 2013/2014, we started off our conversations with questions about perceptions of forest health. In the first round of interviews we asked questions like: "Have you heard people use the term forest health? What comes to mind when you think of the term forest health? Do you have a particular way that you think of forest health? What would you look for to determine if a forest was healthy?" We lead off the questioning in the later two rounds of interviews with "How would you define forest health?" but inevitably for all the interviews, the follow up questioning turned toward the more concrete "If you were standing in front of a forest what would you look for to determine if a forest was healthy?"

To look at causation for the observed changes in definitions of forest health, and to look more broadly at the impact of SNAMP on forest health definitions, we asked interviewees directly if SNAMP had affected them. In both the midpoint, 2012 interviews and the final 2013-2104 interviews, we asked: "Has your definition [of forest health] changed due to what you have learned from the UC Science Team through SNAMP? Could you share an example? If no, why not?"

The first email survey (2010) began with the question: "First, we would like to know what you think about forest health so that we can conduct outreach that is meaningful for you. Below is a list of statements different people have made about forest health. Please indicate how much you agree or disagree with each statement. A forest is healthy when…" This was followed by a list of 10 attributes collected from either interviewee responses or from scientific literature.

The final email survey (2014) also began with a question about forest health: "First, we would like to know what you think about forest health in the Sierra Nevada. We are seeking opinions here, there are no right or wrong answers. Below is a list of statements different people have made about forest health. Please indicate how much you agree or disagree with each statement. A forest is healthy when…" This time there were 20 forest health attributes to rate also based on either interviewee responses or on scientific literature (Figure F23).

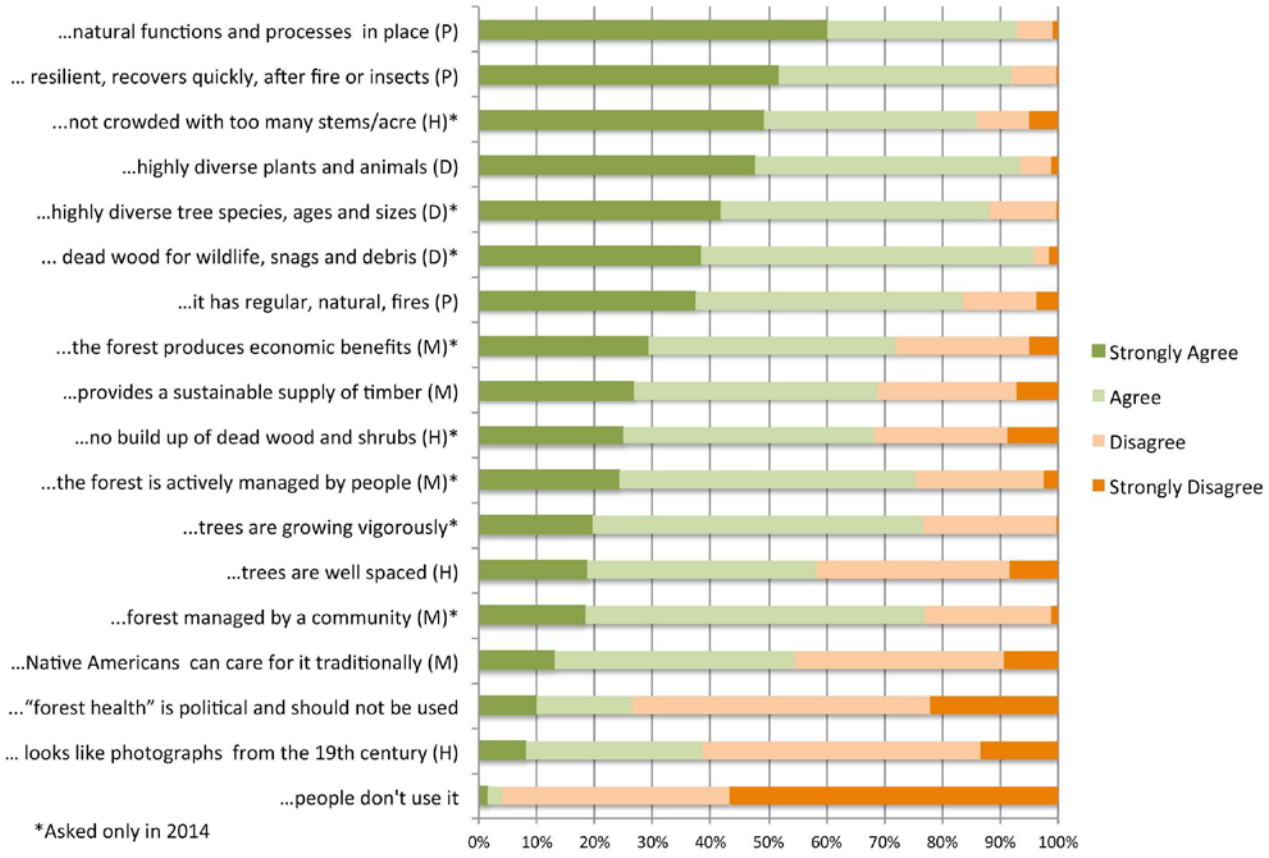


Figure F23: Respondent level of agreement with statements about what defines forest health, 2014 email survey. "A forest is healthy when…"

Four different ways of seeing of forest health

Four main forest health definition themes emerged from our analysis of the first interview responses (Sulak and Huntsinger 2012). Though interview participants typically made comments that fit more than one theme, they were categorized by their major emphasis when responding to questions about forest health. Each categorization was done without bias from knowledge of professional affiliations or previous categorizations for the later interviews.

Although we emphasize the differences, some common themes were apparent in all three rounds of interviews that formulated our forest health themes – fire was an important component to almost everyone, forest stand condition and structure were also popular components, and the condition of the trees was a part of many descriptions. Forest, water and wildlife components were broadly mentioned.

These four themes first emerged in the 2008-2010 interviews and represent views held by participants prior to the inception of the project. By looking at the tendency of our interview and email survey participants to incorporate these four original themes into their definitions, or create new themes, over the course of the project we hoped to see convergence showing the evolution of shared understandings for our participants (Sulak and Huntsinger 2012). The four distinguishing groups of forest health definitions were: Theme 1: Diversity, made up of those who related forest health most strongly to diversity or biodiversity; Theme 2: Process, populated by those who emphasized having functioning natural processes or resilience as indicative of forest health; Theme 3: Historical, comprised of participants who focused on historical conditions, often mentally comparing pictures of pre-suppression forests with those of today; and Theme 4: Management, involving respondents who were more focused on active human management as the determining factor for their definition of forest health.

Theme 1: Having diversity

A very common definition of forest health included *species diversity* or *biodiversity* as the crucial indicator of forest health. The diversity theme refers to descriptors such as the variety of tree species within a forest, diverse habitat structure and an emphasis on the myriad of other flora and fauna as well as water and watersheds. Commonly these definitions extended past diversity into ideas of process, resilience and balance but diversity was the primary component.

> "[To me, forest health is] biodiversity, maybe not too heavy a dying rate… Healthy forest equals a mature climax forest. [I would look for…] again, number of dead trees, large trees, bird poops, thickness of the duff for good water retention and little run off, lots of diversity all the way down to microscopic and then up to larger animals, the opposite being a forest clear-cut." 2008

Statements in the 2014 email survey that might be seen to correspond to a diversity theme were uniformly agreed to by a majority of participants (Figure F23, see "D" after statement). A third or more of the respondents strongly agreed to the three diversity related statements, and there was around 90% agreement overall on them.

Theme 2: Functioning processes

Ecological processes was also a popular way to define forest health. This theme's definitions commonly focused on the forest ecosystem as a whole and its resistance to change or resilience disturbances such as fire or insect outbreaks. Again, these definitions did have overlaps, and people with this mindset may have also used a pre-European setting as a benchmark, but their dominant focus was on the processes that created or maintained what they considered a healthy forest. There was a strong overlap between process definitions and diversity definitions due to the diverse set of species and relationships needed to foster an idealized resilience.

> "[To me forest health is] resilience in the face of change. Diversity in terms of stand structure, landscape makeup, species composition. Disturbance processes – are they active? Can I see that they are functioning? Successional processes – are they operating? They are really important." 2008

In the 2014 email survey, the two most strongly agreed to statements were about process, with more than half the participants strongly agreeing and more than 90% overall agreeing that an indicator of a healthy forest was "having all natural functions and processes in place." Respondents were a little less certain about the role of "regular, natural, fires," even though fires are often referred to as a crucial natural process. Still, more than 80% of respondents agree that a healthy forest has regular, natural fires (Figure F23, see "P" after statement.).

Theme 3: Looking like historical conditions

Those in this theme prioritized *historical conditions,* or looking like a pre-contact forest, in their descriptions of what forest health meant. Historical definitions generally focused on what most of us think the forests of pre-European times dating to 100-150 years ago in California looked like, with widely spaced trees and an open understory. The emphasis is on how the forest *looks,* rather than what is going on in it. This group wanted restoration efforts to recreate this earlier forest. Descriptions tended to reference snapshots or photographs, or a mental vision, of an earlier time, and frequently associated current conditions with a lack of fire in the Sierran forests. Water, diversity, ecological processes and wildlife were common secondary elements of these definitions.

> "I think of a healthy stand of a variety of species of trees that are appropriately spaced, what I mean by that is, when I go back and look at historical photos of Mark Twain or Teddy Roosevelt traveling the Sierra you see a landscape with fewer larger trees and a grassland mountain meadow vegetation type." 2008

From the email survey, the idea that an uncrowded forest was a healthy forest was strongly supported with close to 50% of respondents strongly agreeing and about 85% overall agreeing to it. On the other hand, "widely spaced trees," and "looks like a photograph" from the 19th century were not so strongly supported as indicators of forest health (Figure F23, see "H" after statement.).

Theme 4: Active management

Active human management was a prominent component of the definition of forest health for this group. This idea of active human management or intervention as part of what forest health entails was mentioned infrequently by interviewees in other categories.

"Forest health is better management." 2009

"…It is managed, not preserved, especially managed and not preserved." 2010

Email respondents almost unanimously did not espouse human exclusion from the forest. The least popular statement in the survey about forest health was that a forest was healthy when "people don't use it": 95% of respondents disagreed with that statement, and more than half strongly disagreed. More than 70% of respondents agreed that a forest should be actively managed, and that it should provide economic benefits. Email responses did indicate that by who and why management was carried out was a consideration that affected agreement with management related statements. Just under 70% thought a healthy forest should produce a sustainable supply of timber. While more than 75% agreed a healthy forest is one managed by a community, a bit more than 50% agreed a healthy forest was one managed by Native Americans in traditional ways (Figure F23, see "M" after statement).

Forest health definitions over time

As reported in the integration chapters (chapters 3 and 4 and in part VII below), two thirds of respondents to the 2014 email survey agreed that during the SNAMP project, their views of forest health had undergone change, and half agreed that their ideas about forest health changed because of their experience in SNAMP. In terms of participant agreement with statements about what constitutes forest health, there were significant changes over time in agreement with some statements between the 2010 and 2014 email surveys ($p<.05$). In the email survey, the proportion of those strongly agreeing that a healthy forest is one with natural functions and processes in place increased significantly, from 51 in 2010 to 60% in 2014. The proportion of respondents strongly agreeing a high diversity of plants and animals is important also increased significantly from 38 to 48%, as did the proportion strongly agreeing that a healthy forest is resilient (41 to 52%), and the proportion of those agreeing that a healthy forest should provide a sustainable supply of timber (18 to 28%). On the other hand, those agreeing that a healthy forest has well-spaced trees declined from 29 to 19%. Agreement with the remaining questions asked about in both years did not waver.

Unlike the email survey data that can be used to make inferences about those who had an interest in Sierra Nevada forest management, the interviews attempted to represent a diversity of views. The interview numbers reported here do not reflect proportions of a population but are used to show trends. The interview numbers support the email survey information and tell us that there are areas of forest health definition convergence even when a diversity of opinions is sought (Figure F24).

In the first round of interviews, there were 12 SNAMP participants categorized into the theme of diversity and 9 into the theme of process (n=34 SNAMP participants). The management and historical groupings respectively contained 7 and 6 participants. Interviewees were selected for their differing backgrounds, affiliations, and viewpoints and we did see some correlations between forest health definition and type of participant in the early interviews. Forest Service participants were the only group represented fairly evenly through all of the themes. The diversity and process themes were more likely to be composed of UC scientists, agency representatives and other active SNAMP participants. Not included in the analysis here,

but the SNAMP non-participants tended to affiliate with the historical and management themes (Sulak and Huntsinger 2012).

When compared to the first set of interviews, we saw shifts in the tendency of our 2012 midpoint interviewees to affiliate with the different forest health categories (n=27 SNAMP participants). Process became dramatically more common (15 participants), diversity slightly less so (9 participants), and management (2 participants) and historical (1 participant) much less common. Most professional affiliations were spread throughout the forest health theme categories except Forest Service (4 participants) who were now all categorized into the process group. This is a distinct change from the first interviews where the Forest Service participants were spread pretty evenly across the four forest health themes.

The general categorical trends continued in the third and final round of interviews (n=26 SNAMP participants). Process continued to become dominant (17 participants), diversity lost ground (6 participants), and management (2 participants) and historical (1 participant) stayed steady though still much less common. One person defied categorization with a very vague answer and lots of honest "I don't know" comments. In fact, many people throughout the three rounds of interviews began their comments with a qualification: "I am not a forester but…" Again in the final interviews, like in the 2012 interviews, most professional affiliations were found across the categories except Forest Service participants (5 participants) who were all categorized into the process group.

The only affiliation group that did not change its category was forest products. There were two forest products participants in each round of interviews (not always the same person) and they consistently affiliated with process definition.

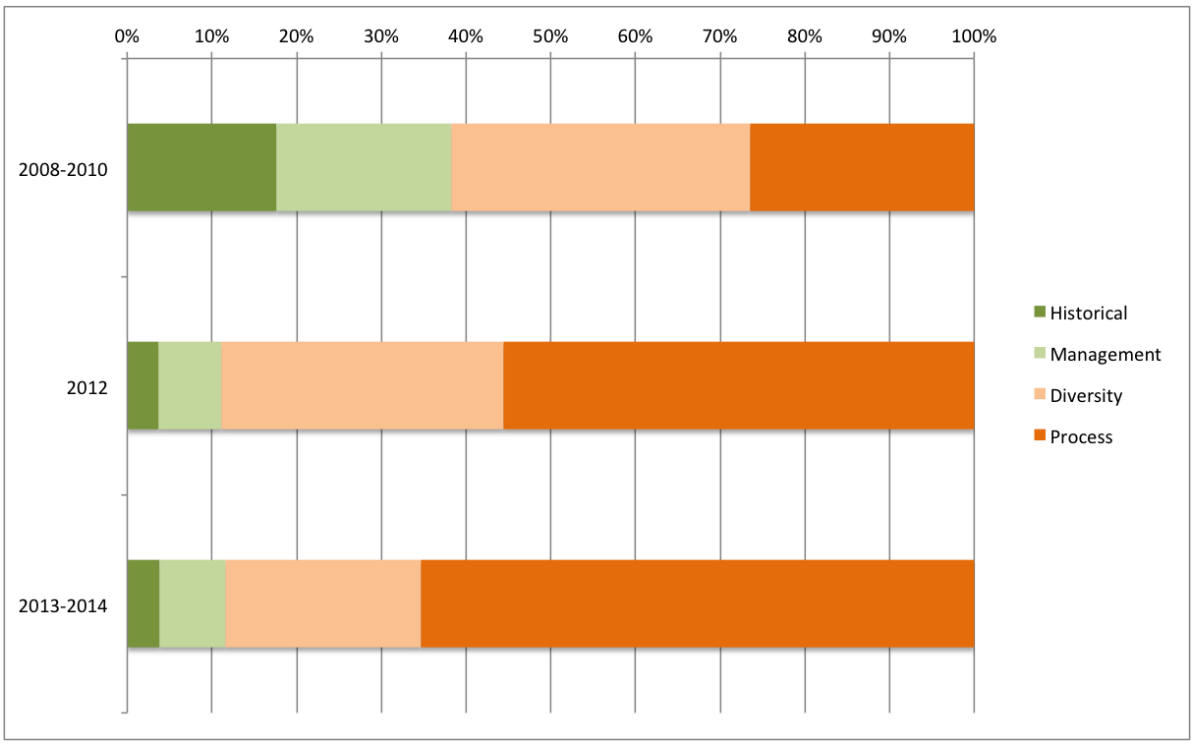


Figure F24: Proportion of interviewees by year of interview categorized into each forest health theme.

Evolution of category: Theme 1 - Diversity

The demographics of those from the first set of interviews who described forest health by the diversity theme reflected the overall interviewee pool and only differed in that they claimed slightly fewer years of experience in natural resources (mainly 30 years or less). In the second round of interviews the diversity participants lost numbers but set themselves apart by being composed of more women than any other group in relative and absolute numbers but this was not the case in the final interviews.

By the final interviews, diversity was a theme that, though not dominant in definitions, did appear in the majority of interview conversations about forest health. Frequently when asked for a formal definition of forest health, answers would be heavy in functioning ecosystems and processes but when asked what to look for if standing in front of a forest, the responses were about looking for signs of diversity as metrics for forest health.

> "...Personally I would look at it as one that is resilient to large scale insect and disease outbreaks and fires." What would you look for to determine if a forest was healthy? "Probably a combination of the diversity, species diversity, age class diversity, and size class diversity, density (stocking levels – if it appears to be under or over stocked), and just overall forest structure…" 2014 Process

Evolution of category: Theme 2 - Process

At the start, the characteristics of those who comprised the process group in the first round of interviews diverged the most from the overall interviewee demographics: only long-term active SNAMP participants, all college graduates mostly with graduate degrees, and slightly higher incomes. All of the participants in this category had been involved in SNAMP since inception or the start of active work in 2007. In fact, out of the interviewees as a whole, the term "resilience" tended to come from participants who were actively involved in SNAMP.

In the 2012 round of interviews, the process participants were similar in demographics to the first round but the addition of new interviewees did diversify the group slightly. (Six of the participants had been categorized into the process group in the first round of interviews and two each moved from diversity and historical into process with this round of interviews.) These participants were still dominated by long term SNAMP affiliations, many starting with the project before 2007. Even for those new to this round of interviews and this category, they also claimed long tenures with SNAMP starting in 2008 and 2010. Similar to the first round of interviews, mentions of the term "resilience" in these 2012 interviews also tended to come from active SNAMP participants. The term was mentioned by most of the process theme participants but also by two diversity theme participants.

Though the process group dominated the participants in the final round of interviews, the participants in this theme were still well educated (all but one completed college or a higher degree), had high incomes (half made $100,000 or more per year), and had been with the project for a few years (all started with the project in 2011 or before). In other ways, since the process group now claims most of the study's participants, they represent the group as a whole - they ranged in age from 30-69 years old, contained about half of the female participants, a little less than half grew up rural or forested or live in forested now, and they ranged up to 40 years in experience in natural resources. In this round of interviews, use of the term "resilience" came

from the process group as well as one diversity and one historical participant. Overall mentions of the term "resilience" did increase in frequency over the three time periods with half of all the interviewees using the term in the final interview. The following is an example of a final interview process definition:

> "Forest health to me is the ability of the forest to be in a state to regenerate and evolve when subject to disturbance." 2013

Evolution of category: Theme 3 - Historical

In the first round of interviews the historical group of interviewees was different in that it contained the most non SNAMP participants (Sulak & Huntsinger 2012). However, the SNAMP participants in the historical category that we focused on for this analysis were not different than the group as a whole. In the midpoint and final rounds of interviews the historical theme still appeared within interviewee's definitions but not nearly as frequently and was almost non-existent as a dominant theme (1 person each for midpoint and final interviews). A UC scientist from the midpoint interviews and an (otherwise unaffiliated) fire safe council participant from the final interviews were categorized into the historical theme. They both had been categorized into other themes in previous interviews but in these two conversations they leaned on historical components in their forest health definitions.

These interviewees were not alone, historical reference points were still important to many participants in the learning and final interviews. Overall, 8 people categorized to forest health themes other than history mentioned historical reference points in their descriptions of forest health in the midpoint interviews. Participants made comments such as this one - it incorporates a historical reference point but places another theme higher in importance.

> "I define [forest health] as a desired condition in the forest that reflects both the historic conditions and current conditions being evaluated and measured with a measure of resilience or ability of a forest stand to come back after disturbance." 2012 Process

In the final interviews, historical reference points also came up in other interviewee descriptions of forest health from a variety of participant types. These people talked about

aiming for “original or native” conditions, “alignment” with or “mimicking” historic patterns and bringing the forest “back to a resilient natural state." One person talked about protecting the post-European human features of a forest.

Evolution of category: Theme 4 - Management

In the first interviews, the management group diverged in that it contained no university or agency representatives. They also tended to be older, over 50 years old, and claimed either less than 10 or over 30 years of time in natural resource work. In the midpoint and final interviews, management as a theme was again less common but still strongly advocated by those in this category (2 participants each round of interviews).

In the midpoint interviews, the two participants in this category were a local government representative and an unaffiliated citizen. Their demographics are similar to the first round of interviews in that they were older, in their 60s and over 80 years old, one called himself a rancher and a logger and the other was with the Forest Service before he retired, neither graduated college and they both had 50 or more years of experience in natural resource work.

The management theme persisted in the last round of interviews and was advocated here by one person affiliated with an environmental organization and the only person, a local government representative, who was categorized to this theme in all three interviews. The quote below gives more depth to this person’s definition, showing an appreciation for Native American management. The other person, affiliated with an environmental NGO, was categorized in previous interviews into the process and diversity themes and that is apparent in the quote.

> “I describe it as a managed ecosystem – [now] it is not managed, white man has messed it up the last 100 years.” 2014

> “Forest health is smart management – it’s not just clearing its not just leaving things – it’s looking at the whole picture, plants, animals and the surrounding communities.” 2014

Humans, nature, and forest health

The interactions, connections, influence and impacts between humans and the environment have been subjects fraught with controversy for centuries. In our interviews we looked for strong opinions about this subject on either side. Those who see a necessary connection between humans and nature can be seen in our management group. As in the email surveys, those who see humans as having a negative impact on nature and forest health were few and far between in our interviews. The strongest sentiment found amongst our first interviewees is represented by this quote:

> "Depends on how much humans have inserted themselves into modifying the operation and function – where humans have a moderate influence say on fire regime, high elevations, [the forest is] probably pretty healthy." 2008

In the latter two interviews, 2012 and 2013 this person did not mention this idea of human influence again. In the midpoint interviews, the human-nature relationship was touched on by four participants outside the management theme. Some mentioned a sentiment implying that less human impact allowed a more natural and better forest, though difficult in this fire suppression era, and one leaned the other way, advocating for human use of the forest.

> "[A healthy forest is] ...not terribly impacted by human behavior – garbage or roads, and lumbering possibly, and things do need to be thinned out especially if we don't have fires. I would accept some human impact under the circumstances that exist now. We have too many people in the world now." 2012

> "Because we are next to all the forest areas it is important that we are able to access them but also to take care of them. ... it is good to have that usage." 2012

Similarly, in the final interviews, outside of those categorized into management, only two people mentioned anything related to nature being impacted positively or negatively by human influence. One person categorized to process talked about how it is important that these processes not be "... prevented by human intervention...." Whereas another participant specifically put human needs into her definition of process: "...and because we are people who need to build things, and need resources from the forest, there should be a little of that too but in a healthy sustainable way."

Recognizing forest health as a normative term

Some participants talked about the idea that the term forest health was subjective, or politically motivated and had negative connotations for them; to some the term really meant "cutting down trees." This sentiment was mentioned by interviewees across all the forest health categories.

> "I suppose it is first and foremost a political term – intended to be persuasive in one way or another." 2008 Historical

> "Forest health equals cutting timber with the excuse of making the forest healthier – [its] a con job." 2008 Process

In the midpoint interviews, a few participants also mentioned a skepticism of the term forest health. Unlike the earlier interviews, however, no participants mentioned a political or negative connotation for the word.

> "To me, it's an ambiguous term. It means different things to different people. There is not a clear consensus to exactly what it is. I don't personally like the term because it's kind of ambiguous." 2012 Process

> "It is a real subjective [term], it's in the eye of the beholder." 2012 Process

In the final interviews many participants mentioned a similar frustration with the term "forest health" calling it "a vague term", "nebulous", "subjective" and "...everyone's definition might differ…" or "...it means different things to different people…" One participant said she tried to avoid using the term due to the connotations connected with it. Two new ideas brought up in the final interviews were about the impact of agency affiliation on forest health definitions (mentioned by two people) and the importance of aesthetics.

> "...it's very complicated. I think it just depends on which agency you work for … or what kind of background you have." Process 2014

> "... I would ... add aesthetics--it appeals to my preconceived notions of what a healthy forest should look like. I wish there had been more discussion of this but probably

because this is something that science can't put its hand on, the aesthetics of a sustainable forest." 2014 Diversity

In the email survey, around a quarter of participants agreed that "forest health" was a term with political connotations and should not be used (Figure F23).

Impact of SNAMP on forest health definitions

We looked for the influence of SNAMP on participants' definitions of forest health in a few different ways: how the definitions changed for individual interviewees across two or three interviews, what the participants said themselves about the influence of SNAMP on their own definitions of forest health, and how definitions changed over time within the email survey respondents from 2010 to 2014.

Forest health definition changes across time for the same individuals

Of the 47 people who participated in our interviews, 23 of them did only one interview. For those that did more than one interview (24 people did either 2 or 3 interviews), we saw changes in the category of their answers for 13 of them, a little over half. Obviously, since the process category ends up dominating the final interviewees and the historical group all but disappears, the biggest shifts are into process and out of historical. As of a person's last SNAMP interview, six people ended up being categorized into the process group, mainly moving out of the diversity group and two moving from the historical group. Four people moved into the diversity group from both historical and process. One anomaly is an environmental NGO participant whose definition was categorized into the process group to start, then moved to diversity and finally into the management group. These results do not show causation but they do show that participants in SNAMP tended to move toward forest health definitions that were increasingly process based while involved in SNAMP.

Self-reported impact of SNAMP on forest health definitions

A few participants mentioned important changes to their definitions of forest health based on what they experienced in SNAMP. Some of these participants mentioned adding an interdisciplinary aspect to forest health definitions, another moved his definition away from a

historical perspective, and another changed her language and scale of analysis based on what she learned in SNAMP.

> "I have come to recognize that because of climate change for example, simply going back to a forest from 1850 or 1870 may not be the sole criteria...I had an overly romanticized idea of what an ideal Sierra forest should be..." 2012 Diversity

> "Mostly I thought at a watershed scale, so I never thought at a larger landscape scale and that helped me broaden my thinking…" 2013 Diversity

> "...it relates to a forest where the spacing or the density of the trees is unsustainable, I didn't really look at that prior to SNAMP…." 2013 Process

Overall, most SNAMP participants felt they learned to expand or extend their definitions or their preconceived definitions were reinforced. A few stated that their general definition of forest health did not change but the details did. Definitions evolved to be more holistic or include more aspects of forest health such as wildlife, water or the role of fire in the ecosystem. Some participant definitions did not change but they said they did learn from SNAMP about forest health, others learned about the forest management techniques to create forest health, a few were waiting for final SNAMP results, and others felt SNAMP had absolutely no impact on their thoughts about forest health.

> "I have become more knowledgeable, if you will, of what a healthy forest would consist of and what are the threats that face a healthy forest or a forest stand condition. … it definitely has strengthened my building blocks of forest management." 2013 Process

Regardless of whether a participant self-reported a perceived change in his or her personal forest health definition many of their answers did show how SNAMP influenced their definitions. The interdisciplinary format of SNAMP allowed many participants to learn outside their area of expertise broadening or expanding their definitions to include more aspects of forest health such as wildlife needs, water impacts and fire.

Through the interviews, both in actual definition changes, as seen in the increase of the popularity of the process theme definitions and decrease in historical definitions, and in self-

reported changes to personal forest heath definitions, we saw changes during the many years of SNAMP as well as a direct influence of the results of the SNAMP science.

VII. An in-depth look at learning: Participant responses to treatments

Similar in premise to Part VI, this section addresses the impact of the SNAMP learning experience on participant opinions of the response of the studied resources to the treatments. Here we also found strong shared understandings based in the findings of SNAMP and this analysis provides the basis for the Participation Team contribution to the full SNAMP integration in chapters 3 and 4 of this report.

The integration framework created by the UC Science Team for the SNAMP project attempts to graphically present long and short term responses to fuels treatments as studied in SNAMP (Figure F25). For each team the question posed by this diagram is: "what are the short and long term responses of study subjects (participants, water, wildlife, forest and fire behavior) to the Forest Service fuels treatments examined by SNAMP, called SPLATs, and then, as a whole, how can these responses be understood and integrated to be of use to forest management decisions for the Sierra Nevada?" The Participation Team used information gathered up to 2014, prior to the final SNAMP results and report, to address these questions. Data from interviews and email surveys of SNAMP participants pertaining directly to perceptions of treatment outcomes, and about the role of SNAMP in shaping perceptions, was used in this analysis. The focal questions can be restated for the Participation Team as, "how do SNAMP participants perceive the short term and long term responses of the studied resources to fuels treatments conducted by the Forest Service, and did SNAMP help shape these perceptions?" Overall, results demonstrated public endorsement of the fuels treatments by participants, showed that participants learned from SNAMP, and revealed that most participants thought that long term treatment impacts would be positive.

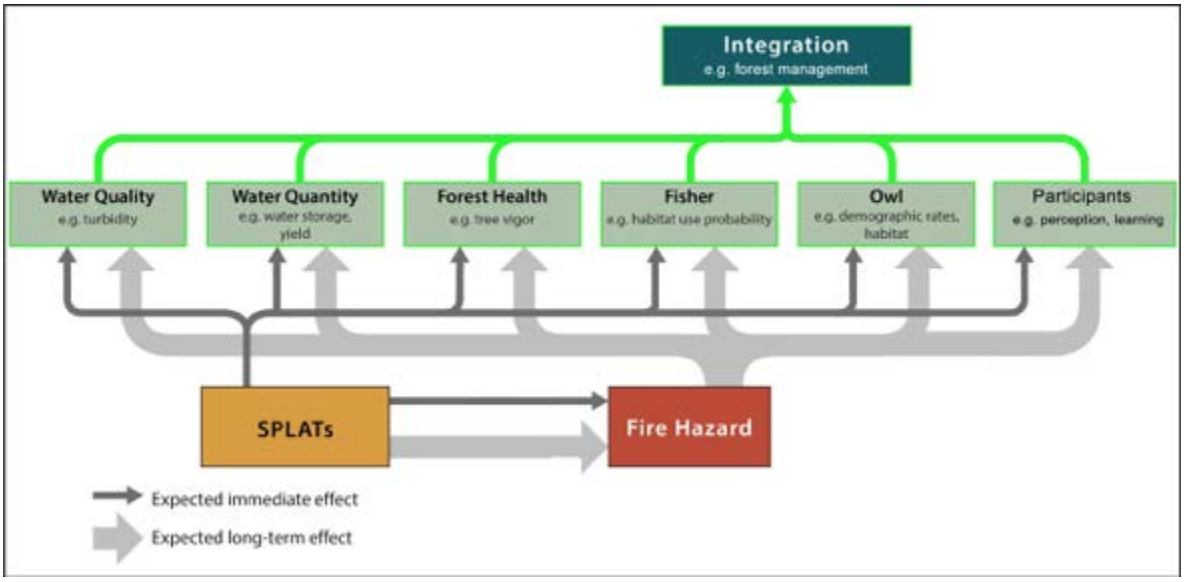


Figure F25: SNAMP integration framework.

Stakeholder opinions

Stakeholders were asked for their opinions about how SNAMP fuels reduction treatments influenced the resources studied in SNAMP, including forest health, Pacific fisher, California spotted owl, and water quantity and quality. Because the SNAMP process had a goal of improving relationships among groups, in some cases affiliations were used to differentiate respondents, breaking them into nine groups: UC Science Team, Forest Service, other state and federal agency participants, environmental NGOs (non-governmental organizations), forest products groups both for and not for profit, local governments, Native American Tribe representatives, and unaffiliated (including fire safe council members, local citizens and other types of interested parties) (Figure F26).

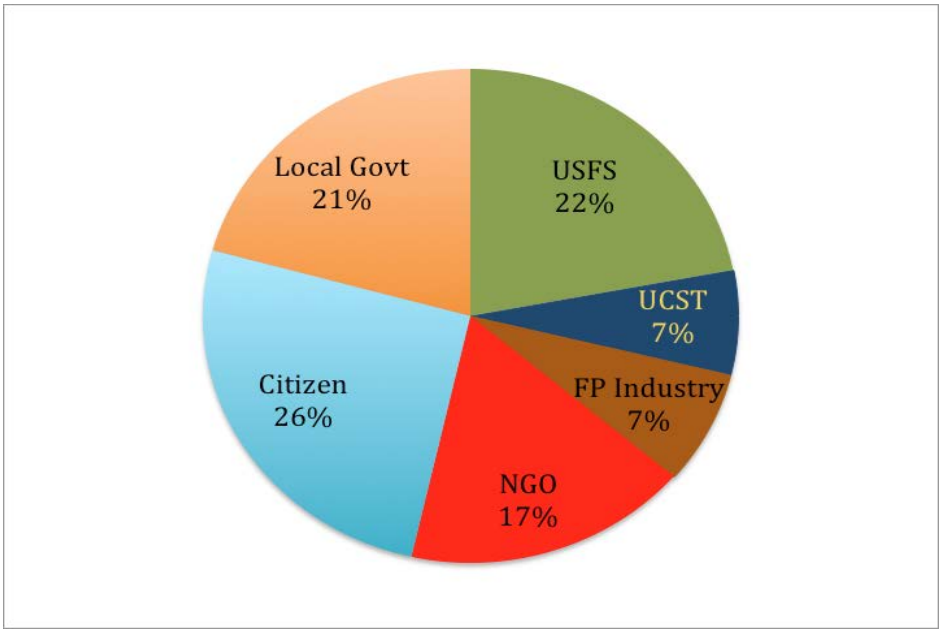


Figure F26: Respondent affiliations in 2014 email survey, N=258.

Fire and forest ecosystem health

Overall, email survey respondents felt that SNAMP fuels reduction treatments, and forest fuel clearing methods that reduce fire hazard in general, had the effect of improving forest health in the short term and long term (Table F7). Interviewees were also united in their opinions about the impact of treatments on fire behavior: all but one of the interviewees felt that the treatments would reduce the intensity of a fire in the treated areas. This was the dominant view across all interviewee categories. Concerns raised were that extreme weather and severe fires would likely overwhelm the treatments. It was also mentioned that some treatments still needed to be completed and cleared of debris piles. Several interviewees who spoke about the Last Chance site since the American Fire in 2013 felt that the treatments there did reduce fire damage, though it was difficult for some to tease out the impacts of treatment from the impacts of the back burning and fire-fighting. Some interviewees felt that the Sugar Pine treatments would likely have less of an influence on fire behavior because the treatments were implemented with a lighter touch, and others felt that neither treatment went far enough to actually create a fire-resilient landscape. The only interviewee who did not think that the treatments would have a "positive" impact on fire behavior answered "I don't know" and was an agency representative.

This person was not aware of any peer reviewed results where SPLATs had been tested by a fire, but also did not feel it was adequate to rely on modeling, and so felt unable to answer.

Table F7: Summary of SNAMP participant opinions of the impacts of fuels treatments on forest health.

Fuels treatment impact on…	**Respondents' Opinions** Email survey n=258 Interviews n=26
Forest health in general (email survey)	-Short term = 79% improved, 9% no change, 12% deteriorated -Long term = 72% improved, 19% no change, 9% deteriorated
Fire behavior (interviews)	-Fuels treatments could reduce intensity of fire -But could be overwhelmed by extreme weather and fires -Treatments needed to be complete and debris cleared
Sugar Pine project area forest health (email survey)	-Short term = 81% improved, 10% no change, 9% deteriorated -Long term = 63% improved, 26% no change, 11% deteriorated -Amount of material removed = 67% too little, 26% just right, 7% too much
Sugar Pine project area forest health (interviews)	-More healthy due to reductions in stand density and understory fuels -Treatments were possibly too light or not big enough
Last Chance project area forest health (email survey)	-Short term = 77% improved, 6% no change, 17% deteriorated -Long term = 65% improved, 23% no change, 12% deteriorated -Amount of material removed = 58% too little, 31% just right, 11% too much
Last Chance project area forest health (interviews)	-More healthy due to reductions in stand density and understory fuels, enhanced aesthetics and more similar to historical -Treatments were successful in reducing intensity of American fire (2013) -Treatments were possibly too light or not sure of opinion

The following are examples of interviewee responses to the question: "In your opinion, do you think the SNAMP forest fuel treatments in the Last Chance and Sugar Pine projects will affect fire behavior?" Some respondents addressed the effects of the American Fire in their responses:

"I think it would reduce the chance of a high intensity fire. And reduce the risk that the fire would get into the crowns of the trees after the treatment." Native American Tribe representative

"There was an interesting discussion about...the back burning that was intentionally done to control the fire once it got in there, how that is going to be teased out of the analysis to determine potential treatment versus fire impacts." UC Science Team

"I want to say it's too early to say it has improved. I think the forest stand conditions [in Last Chance] were in a more resilient stand condition when that fire went through… We did have mortality but that mortality, I want to say, was much less than what it would have been if we didn't have any treatment before the fire." Forest Service

"…hopefully it will but with the changing climate it's really hard to know what's going to happen. But it is really good ... that the Forest Service is taking this step to try to reduce that problem before we have another Rim fire for example…" Agency representative

SNAMP project areas

Given the interviewee agreement that fuels treatments could positively affect fire behavior it is not surprising that overall both the interviewees and email survey respondents saw the project areas as more healthy after treatments were implemented (Table F7). Of those interviewees who did not see the study areas as more healthy, some did not feel comfortable answering because they had not been to the study sites, a very few thought the treatments would have no impact, and only one person felt that the treatment areas are now less healthy. Similarly, email survey participants who had attended a field trip or visited the treatment sites were more likely to respond with an actual opinion, and less likely to say "I don't know."

Specific to the Sugar Pine project, the majority of respondents to the email survey agreed that forest health was improved by the treatments in the short term (Table F7). Environmental NGO respondents ("NGO" in the figures) were the most likely to be concerned about deterioration in forest health in the short term (Figure F27). Those in the forest products field and environmental NGOs were most concerned about deterioration in the long term – write in comments indicated that this was often because the forest products group thought the treatments

did not remove enough material to have a lasting effect. The results were similar for email survey participant opinions of Last Chance, except that the UC Science Team was divided about the short term effects, split between improved and deteriorated, and more often agreed the long term health deteriorated. Interviews and comments indicate that this is also because they felt the treatments were too light to last (Figure F28).

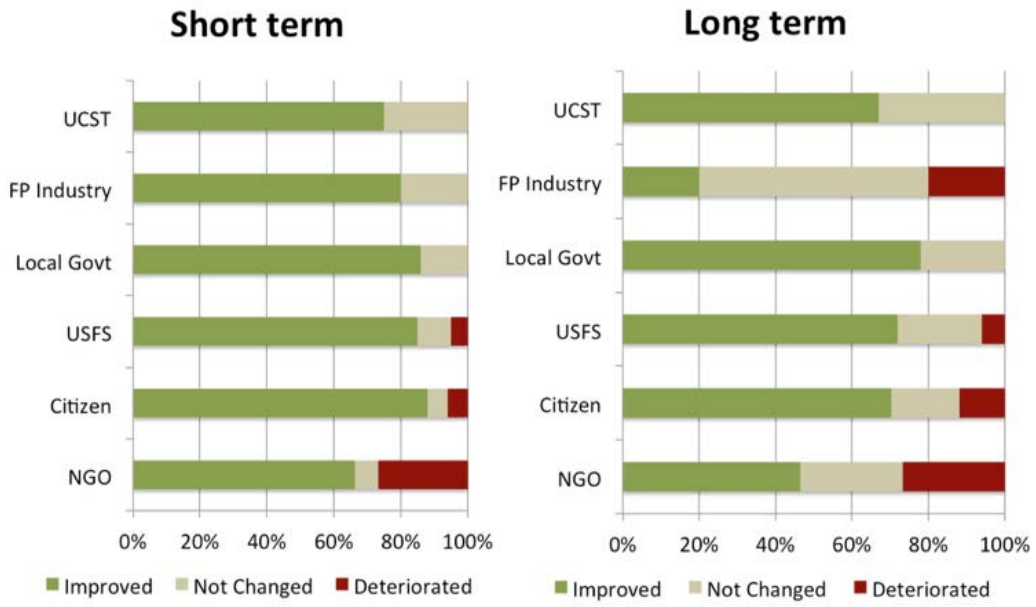


Figure F27: Perceptions of forest health after fuels reduction treatments at Sugar Pine, 2014 email survey, different affiliations. Altogether about 67% felt that the treatment removed too little, 26% just the right amount, and 7% too much material from the forest.

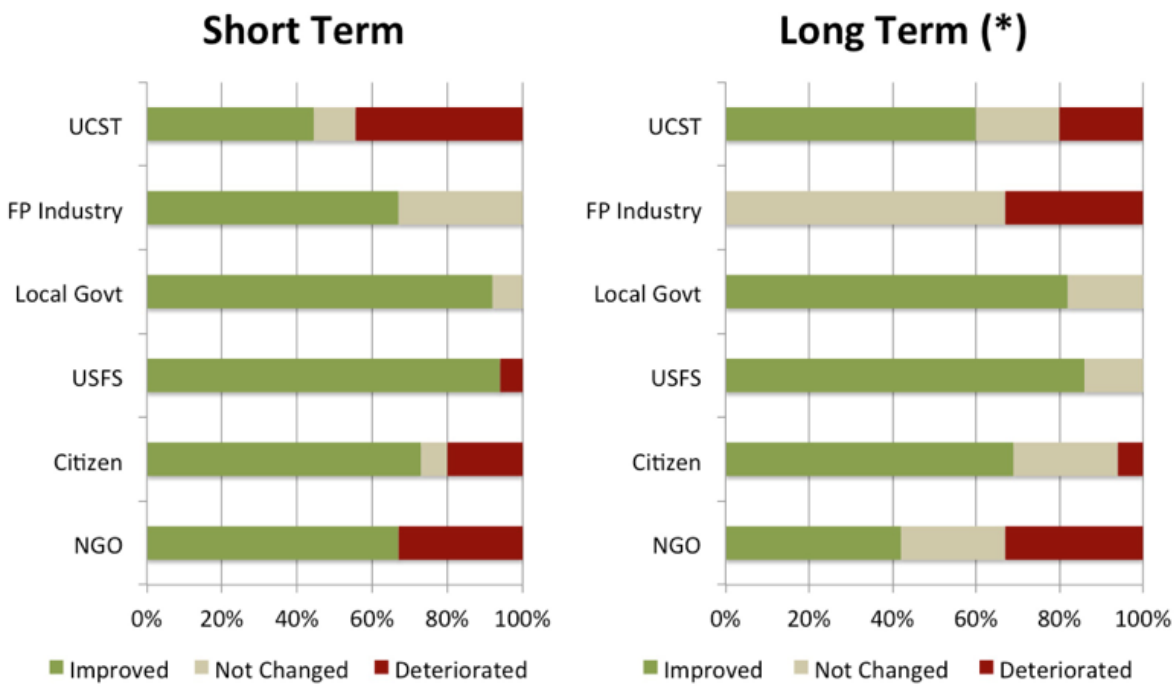


Figure F28: Perceptions of forest health after treatments at Last Chance, 2014 email survey, different affiliations (* = responses differ at $p<.1$, χ^2 by affiliation). Altogether about 58% felt that the treatment removed too little, 31% just the right amount, and 11% too much material from the forest.

For the Sugar Pine study area, those interviewees who answered from experience at the site after the treatments were implemented mostly felt the area was healthier (all groupings represented except agency participants, mostly because they had not been to the site) and attributed this to reductions in stand density and understory fuels increasing resiliency. However, some interviewees still felt an increased number, diversity and/or intensity of treatments needed to occur. For example, interviewees mentioned treatments could have poked holes in the canopy more like is described in Forest Service General Technical Reports # 220 and 227 (North et al 2009; González-Cabán 2009), should have increased heterogeneity more, and could have included more under-burning. Those interviewees who felt that there was "no change" in forest health after the treatments felt this way because not enough land was treated and the forest would subsequently not be able to withstand a wildfire.

Interviewees who had been to the Last Chance site and felt there had been improvement believed that the treatments created a more healthy landscape for the same reasons they did at Sugar Pine with the addition of enhanced aesthetics and increased similarity to historical forests. But compared to those who visited Sugar Pine, interviewees who visited the Last Chance site were more likely to say that they did not know if the forest health of the area had changed due to the treatments. All those who "didn't know" but had been to the Last Chance site were Forest Service, UC Science Team or agency participants and most are waiting for the final UC Science Team results to decide.

We pursued the emergent interviewee theme about the level, or intensity, of treatment through the email survey and found that about half the email participants felt that the two treatments removed "too little" material (Table F7). For the Sugar Pine treatment, those saying the treatments were "too light" were mainly US Forest Service, environmental NGO, local government, and industry participants. The UC Science Team respondents were more heavily represented in the "far too little" removed category and the general public was split between the "too little" and "just right" categories for the Sugar Pine treatment. At Last Chance, the US Forest Service, environmental NGO, UC Science Team, forest products, and general public participants were strongly in the "too little" category whereas local government participants felt more strongly that the treatment was "just right."

The following are examples of interviewee responses to the following question: "What is your opinion about forest health in the southern Sugar Pine project area now that the Forest Service's fuel reduction treatments have been implemented?"

> "I think that... it is probably closer to a reference condition and more within range… probably the biggest change may come through some increased resiliency to extreme fires." Environmental NGO

> "I'd say it has been... definitely improved. I think because the treatment areas have reduced density, they have opened more space for regeneration. And I think that those areas, when subjected to wildfire, inevitably will have a benefit to the areas that... have no treatments." UC Science Team

"...we are learning a lot about it. Most importantly we have been able to assist the community around it to learn more about what forest health is – not just going in and cutting things down or not just going in and leaving things alone either." Environmental NGO

"It's probably 100% better than it was 7-8 years ago when we started. Everything you guys have done, I drove up in there and looked at it, and had those field trips. I just love what is happening. I love the idea that they have environmentalists there to look at it and see what it takes to have that final healthy forest." Local government

"I recognize that not the entire areas were treated and that it varies from place to place. I would say that the fireshed as a whole is probably healthier, I think the treatments were done well and they tried to preserve biodiversity and tried to preserve multiple age stands and all the things I think are part of forest health." UC Science Team

"At extreme risk to wildfire. In my opinion in north and south sites, we aren't doing enough fuels reduction to do a difference if there is a wildfire." Forest products

"...part of the reasons that forest health didn't change significantly in the south is that there were a lot of other conditions that affected the potential to change the forest structure through treatment. Most of those are related to protecting stand density and larger trees and the heavier canopy even if it did pose potential fuel risks in order to protect the threatened species, the Pacific fisher." UC Science Team

The following are examples of interviewee responses to the following question: "What was your opinion about forest health in the northern Last Chance project area after the Forest Service's fuel reduction treatments were implemented but before the fire?"

"It didn't seem quite as overgrown but still pretty high vegetation density." Agency representative

"From what I saw, everything that I saw that was treated, looked aesthetically better to me and more likely to be a sustainable forest than what I remembered in the before condition." Unaffiliated citizen

"...looking at scientific data, I would expect it to be healthier because there had been a move to make it more like a historic forest with more open areas and less competition for nutrients and water…two years' time isn't enough time to really see what's going to happen…" Unaffiliated citizen/Fire Safe Council

> "I believe they were successful...I wish we had the opportunity to do more work out there but it was money dependent. Some of the treatments required additional funding which was a challenge to begin with to get as many acres treated that we did." Forest Service

Enjoyment

Enjoyment of the forest is another barometer of participant satisfaction with the treatments. The dominant sentiments of email survey participants were perceptions of improvements or no changes in their ability to enjoy the forests after treatments. The majority of participants in all the subgroups reported that their enjoyment of the area would be improved in the long term after the treatments or at least there would be no impact from treatments on their enjoyment. In the short and long terms, only a small group of email survey participants felt their enjoyment of the forests had decreased after treatment. Of the subgroups, the Forest Service, UC Science Team, and local government participants felt there was no change in their enjoyment of the forests in the short term after the treatments (Figure F29). The environmental NGO and public participants were the most positive of the effects of treatments on their enjoyment of the forest saying their enjoyment had improved in short term. In contrast, the forest products participants saw deterioration or no change in their enjoyment of the forests after treatment in the short term.

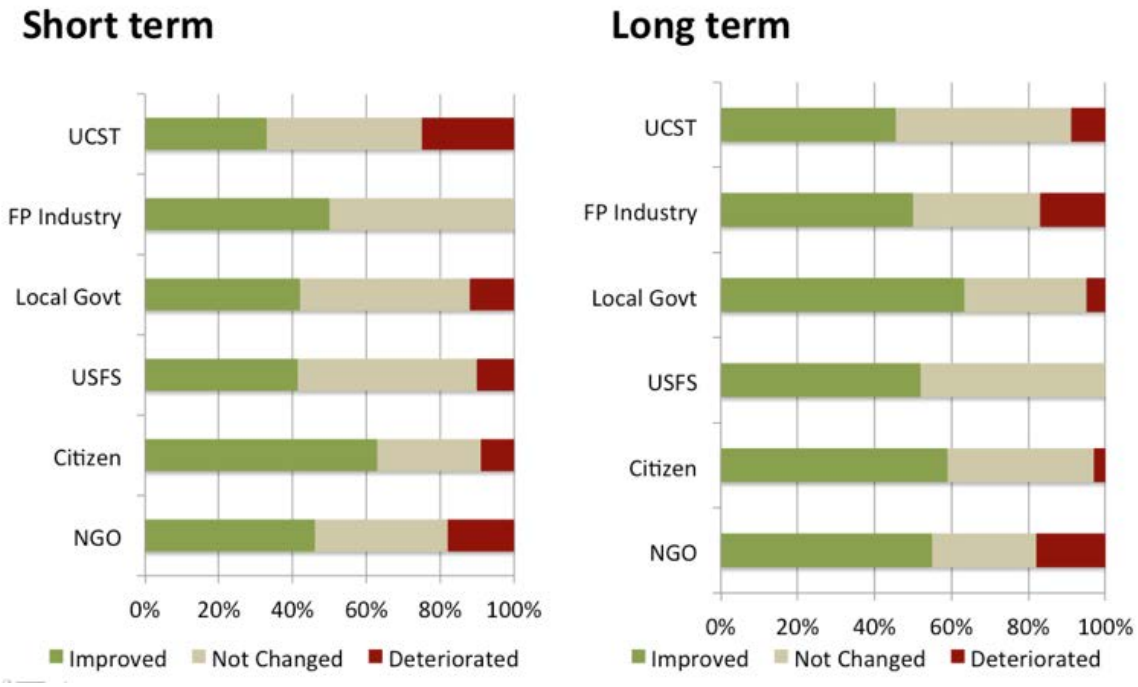


Figure F29: 2014 email survey: After treatment, my enjoyment of the area has increased in the short term (left); long term (right).

Wildlife species

The email survey respondents were not united in their opinions of the impacts of treatments on the two wildlife species in the short term – the Pacific fisher and the California spotted owl (Table F8). For both species the email survey respondents were split into thirds on the impact of the treatments in the short term – a third saw fisher and owl habitat as deteriorated, a third saw it as improved, and a third anticipated no change in the short term.

Table F8: Summary of SNAMP participant opinions of the impacts of fuels treatments on wildlife, water, and enjoyment (percents do not necessarily add to 100% due to rounding).

Fuels treatment impact on…	**Respondents' Opinions** Email survey n=258 Interviews n=26
Pacific fisher (email survey)	-Short term = 32% improved, 39% no change, 29% deteriorated -Long term = 73% improved, 15% no change, 12% deteriorated
Pacific fisher (interviews)	-Other issues may have been more important than treatments: rodenticide, road kill and predation
California spotted owl (email survey)	-Short term = 32% improved, 39% no change, 29% deteriorated -Long term = 67% improved, 20% no change, 14% deteriorated
California spotted owl (interviews)	-Will not see impact of treatments because there were too few owls in study area or treatment area too small
Water quality and quantity (email survey)	-Short term quality = 41% improved, 43% no change, 16% deteriorated -Long term quality = 63% improved, 31% no change, 5% deteriorated -Short term quantity = 56% improved, 34% no change, 10% deteriorated -Long term quantity = 57% improved, 36% no change, 8% deteriorated
Water quality and quantity (interviews)	-Treatments were positive compared to severe fire -Possibly minimal to no impact -If positive, might have increased yield

The email survey showed the detail behind the even split in opinions about the impacts of treatments especially in the short term (Figures 30 and 31). The US Forest Service and forest products groups saw no impact on the fisher or the owl in the short term. For the fisher, the UC Science Team and the environmental NGO participants felt that there could be negative impacts in the short term. For the owl, the environmental NGO participants felt the impacts would be negative whereas the UC Science Team participant answers were split between negative and no impact. The local government participants saw improvements for both species in the short term. The unaffiliated citizens felt there could be no impact on the owl and improvements for the fisher in the short term. There was much stronger support for habitat improvements in the long term for both species. In fact, a majority in all respondent subgroups groups agreed the impacts on fisher and spotted owl were likely to be positive in the long term.

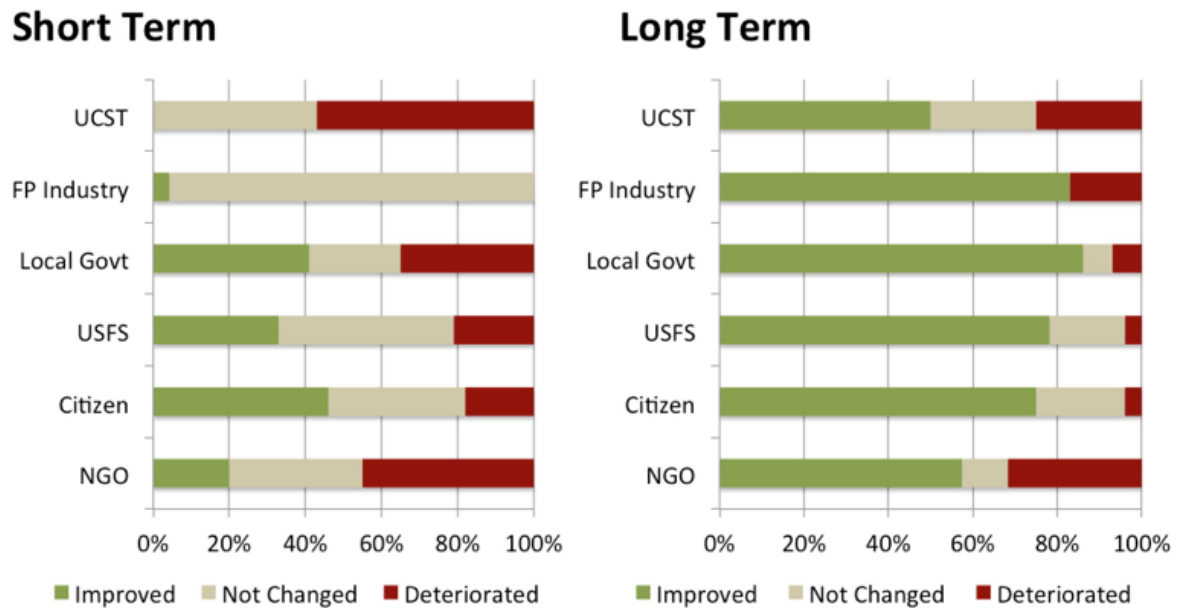


Figure F30: Perceptions of impacts on Pacific fisher habitat, 2014 email survey, short and long term.

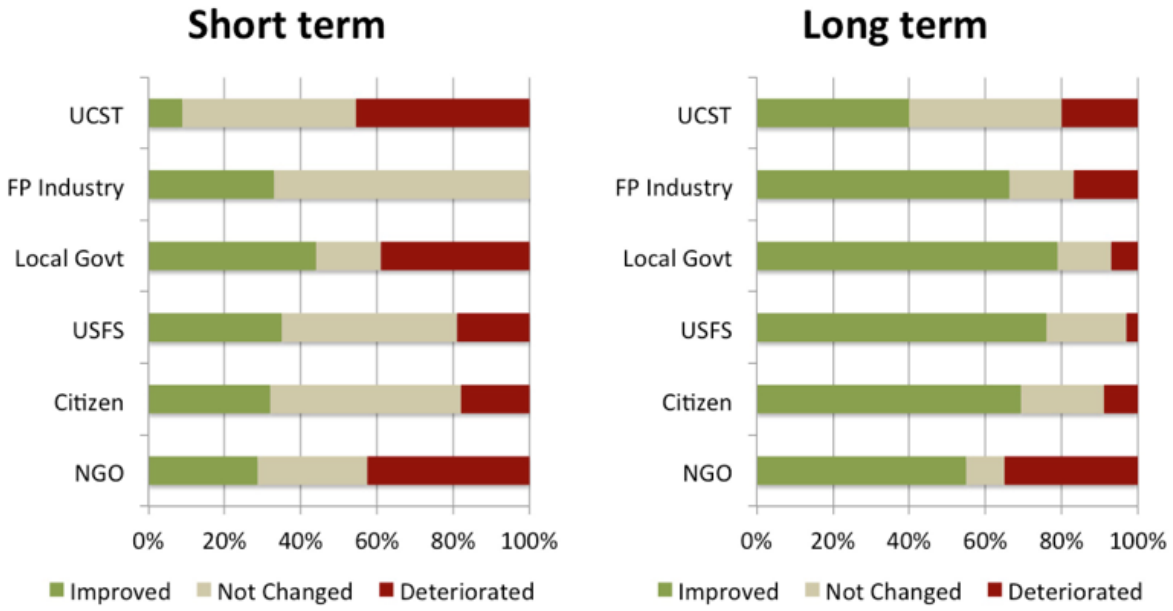


Figure F31: Perceptions of the influence of treatments on California spotted owl habitat, 2014 survey, short and long term.

Generalizing across all interviewees, for those with an opinion, there was also the perception that the treatments might have had a short term negative impact on the two wildlife

species studied in SNAMP. But some felt that treatment planning should have taken into consideration wildlife needs and so possibly the impact would be decreased. In the long term, most interviewees talked about the positive impacts from reduced risk of severe fire except one participant (UC Science Team) who felt strongly that these treatments would lead toward listing for both species.

The perception of a long term positive trend for the fisher after fuels treatment implementation was broadly supported and mentioned by at least one person in all interviewee categories. However, interviewees also mentioned other issues reported in the SNAMP findings as possibly more important than treatments. They include fisher consumption of rodenticide from illegal marijuana farms, road kill and predation. The short term negative impacts cited by interviewees were based on the views that there would likely be direct impacts of the mechanized disturbance, alterations to fisher habitat and a possibility of increases in predators due to new roads.

There was also a large group of interviewees that felt that the actual impact of treatments on the fisher is still unclear – there may be no impact detected by the monitoring, there was not enough treatment to impact the animals, and there just is not enough information yet to make a determination. There is heavy representation of UC Science Team, agency participants and Forest Service interviewees in the group who had not yet made up their minds.

Yet treatments were strongly supported across all interviewee groups when compared to an interviewee-imagined scenario of severe fire, especially for UC Science Team, agency participants and Forest Service interviewees. Interviewees felt that a severe fire could kill fisher directly and could cause longer lasting negative impacts to fisher habitat. In addition, the drought conditions that could create intense fire would also stress the fisher causing an even greater threat to their survival. This dominant opinion was tempered with sentiments such as the treatments were too light to have an impact on the spread of a severe fire and that a lighter or moderate fire could have had beneficial impacts.

The following are examples of interviewee responses to the following question: "In your opinion, do you think the SNAMP forest fuel treatments will have an effect on fisher?"

"Short term I don't know. So far the monitoring has shown that it really hasn't had much of a substantive effect on the fisher... In the long term I think it will have a beneficial effect [because of] risk of catastrophic fire being reduced. Fishers don't live well in forests that have been nuked." Forest Service

"...hopefully it will give it a chance at living. There is always going to be the issue of the rodenticides due to illegal pot farms, ...and also going to be ...people, cars and so forth but I think, by taking their habitat into consideration, and how the area is treated for fires and such, if a fire goes through it may save their habitat and the people's habitat around it." Environmental NGO

"It may but from reading the reports it looks like the cause of mortality doesn't have anything to do with habitat. They were hit by cars, they were killed by bobcats and they were poisoned by rodenticide... Treatments should ensure that they had both nesting denning and foraging areas...it takes quite a while to determine the effects on an animal that may live 5 years or more." Unaffiliated citizen

"… hopefully the short term negative effects of all the treatments, you know machines being in there and their habitat kind of being ripped up in the short term, hopefully it does benefit fisher in the long term by reducing the large severe catastrophic wildfire potential which would be devastating to fisher habitat because then they would have no habitat at all." Agency representative

"…these treatments should help the fisher [in] two ways: avoid catastrophic fires which would destroy too much habitat, but also create some of that heterogeneity that is important for fisher, they can use small patches and get a different prey base and burned areas." Agency representative

"...they will be negative… it will reduce survival, reduce population size, and reduce the overall health of the fisher population and will lead toward listing." UC Science Team

"None." Interviewer asked why? "They are not modifying the forest structure hardly at all with that particular project." Forest Products

"...one of my areas of interest on the project, was the effects on the fisher. And I don't know. ... I don't know that they know the results yet or not..." Native American Tribe representative

Overall interviewee opinions about the impacts of fuels treatments on the owl were similar to those about the fisher – positive perception of treatment impact dominated, short term negative impacts were likely, low to moderate fire was beneficial, and many were waiting for more information. Differences apparent in responses focus on the perception that the study was unlikely to detect an impact of the treatment on the owl either because there were too few owls in study area or the treatment area was too small. Additionally, there are other changes that could influence the owl more than the treatments or it could be that it was the cumulative impact of many treatments over time that was most detrimental to the species. These comments were all made by agency representatives, UC Science Team or Forest Service participants. One environmental NGO representative interviewee cited studies that showed owls persisting in severely burned areas and so felt that the impact of severe fire on owls was still unclear.

The following are examples of interviewee responses to the question: "In your opinion, do you think the SNAMP forest fuel treatments will have an effect on the owl?"

> "...when I look at the data that the owl team has gathered ... teasing out treatment effects versus all those other cumulative effects at the landscape level that the owl team monitored, I think the treatments will become muddied." UC Science Team

> "I want to say that we, at minimum, maintained the requirements for managing for spotted owl and ... we hopefully improved stand conditions for them in the long term, making those stand conditions more fire resilient and so we hopefully have less risk of a catastrophic event that would harm spotted owl habitat." Forest Service

> "...I have a general perception that the owl utilizes a much larger area in the forest than where the treatments occur so would be surprised if treatments were extensive enough to change the conditions for the owl ..." Agency representative

> "The treatment units were not in a close connection with a lot of owls and so it will just be uncertain or indistinguishable." Environmental NGO

> "I think it will give the owl a better chance of surviving in that their habitat would be significantly less damaged by anything but a very high intensity fire, or severe greater than 100-year intensity fire." Unaffiliated citizen

Water

Most email survey respondents felt that that the treatments would have positive or no effects on water quality and quantity (Table F8), with long term impacts viewed the most positively (Figure F32). Looking at the email survey respondents by affiliation, the environmental NGOs, unaffiliated citizens, local governments and forest products groups actually all felt that water quality and quantity were improved post-treatment in the short and long terms. It is the Forest Service and UC Science Team that diverged from the norm. The Forest Service email survey respondents saw no change in water quality and quantity in the short term and improvements for both in the long term after treatments. The UC Science Team email survey respondents agreed with the Forest Service email survey respondents that there were likely to be no changes in water quality in the short term, but disagreed and saw water quantity improving in the short term, and in the long term they saw no changes in water quality or quantity from the treatments.

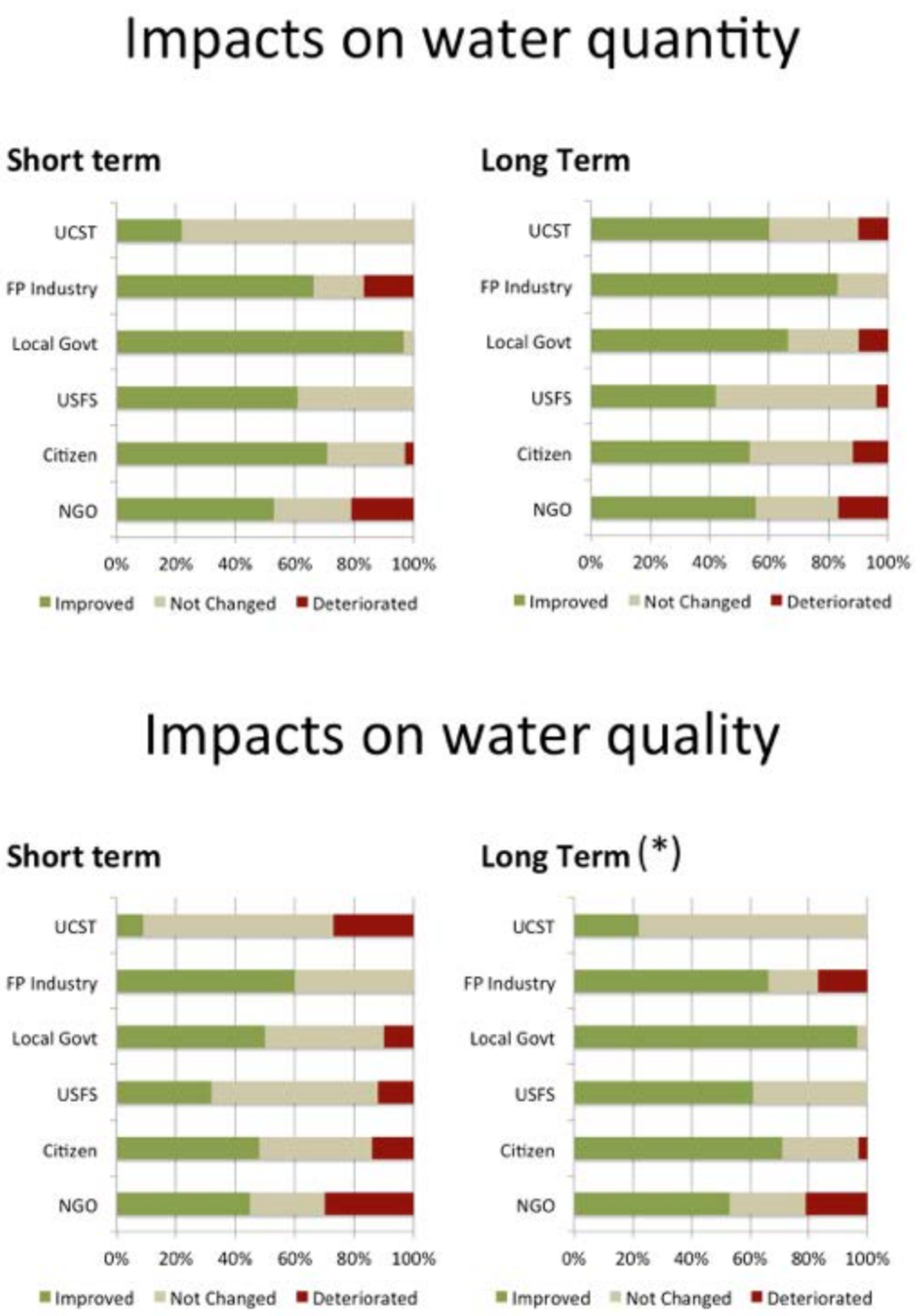


Figure F32: Perceptions of impacts of fuels treatments on water quality and quantity, 2014 email survey (* = responses differ at $p<.05$, χ^2 by affiliation).

The interviewee respondents reflected the email survey respondents' lack of agreement in terms of treatment effect on water quality and quantity. Many of the interview participants felt

the treatments would have a positive impact on water quality and quantity especially when compared to severe fire. However, there was also support within the interviewees for the likelihood of a small to nonexistent treatment impacts on water. Treatments were perceived by interviewees to have minimal to no effect on water because best management practices were used, the treatments were too light to have an effect, or the study was too short to be able to detect an effect. This view of minimal to no treatment effect on water was supported by Forest Service, UC Science Team, and agency representatives as well as a forest products and an environmental NGO representative. Those that felt there would likely be positive consequences from treatment preferred treatment over severe fire and thought that increased water yield was an advantage of treatment (but the processes that would cause increased water yield varied). These positive outcomes for water were not mentioned by any UC Science Team interview participants.

The following are examples of interviewee responses to the following question: "In your opinion, do you think the SNAMP forest fuel treatments will have an effect on water quality and quantity?"

> "Yeah, I certainly hope so... some of the early work is showing we are right. Some of the most valuable work that will come out of SNAMP will be some of the basic information about the effects of vegetation removal on water quantity." Forest Service

> "Yes, it would have a beneficial effect in my opinion; if only by reducing the risk of intense fire." Unaffiliated citizen

> "...I think that it is more that the destructive effects of the fire would be reduced and that the actual treatments themselves, by themselves, will have relatively minimal effect on either quality or quantity…the long term treatment I don't think is going to be really probably measurable, particularly in terms of water quantity." Agency representative

> "Now I think that the treatments clearly demonstrate the benefits of healthy forests on watersheds... you are going to have stronger run offs, ...you are going to have greater storage capacity from snow pack...in my world they are very important." Agency representative

> "Minimal to none...because it's not doing anything on the landscape. ...you are not doing nearly enough thinning to affect water yield." Forest products

> "Possibly at the small scale, sort of the scientific watershed level, there may be some short term water quality effects to do with sediment. " UC Science Team

Impact of treatments summary

In sum (Table F9), email survey and interview respondents felt that the fuels treatments could impact fire behavior and that the forest health of the two study areas had improved after the treatments were implemented, but there were interviewee and email survey participant results suggesting that the fuels treatments might be too light to protect the landscape from severe fire and interviewees indicated that the studies may not be able to detect treatment impact due to study design limitations. For treatment impacts on wildlife, email survey participants were more divided in their assessment of the impacts, while there was more broad support for the idea that the treatments will benefit the animals in the long term. The interviewees also mentioned short term negative impacts on the animals from the fuels treatments, but that in the long run the treatments would have a positive influence and would be beneficial, or have little impact, compared to severe fire. Email survey results showed almost no support for a negative impact on water quality or quantity from the treatments in the short or long term. Interviewees projected minimal to no impact from the treatments on water as compared to the fisher and owl.

Table F9: Summary of interviewee comments on impacts of fuels treatments.

Summary for all resources	-Treatments were likely to be positive and are preferred compared to severe fire -Treatments improved forest health -But treatments might have been too light to protect from severe fire and study may not have been able to detect impacts -Treatments might have had short term negative impacts on wildlife but long term benefits -Treatments unlikely to have had negative effects on water in short or long term -Low intensity fire would create less negative impact and would be good for resources

Influence of SNAMP on stakeholder opinions

Forest health and fire behavior

Of those who participated in the email survey, most felt their ideas about fuels treatment impacts on forest health had changed over the last 7 years (7 years of the active assessment and treatment portion of the SNAMP project to one year before final results were published in 2014) and a little over half felt that their opinions were influenced by information they learned from SNAMP (Table F10). Most of the affiliation subgroups in the email survey show a majority agreeing that their ideas about the impacts of forest fuel treatments on forest health have changed over the last 7 years, and that SNAMP did influence that change (Figure F33). Those from the forest products group and unaffiliated citizens were split with about half agreeing and half disagreeing that SNAMP influenced their opinions.

Table F10: Impact of SNAMP on participant learning and on opinions about treatments.

Fuels treatment impact on…	**Has SNAMP changed your opinion?** Email survey n=258 Interviews n=26	**Have you learned about the topic from SNAMP?** Email survey n=258 Interviews n=26
Forest health and fire behavior (email survey)	- Changed = 69% - Not changed = 31%	- From SNAMP = 54% - Elsewhere = 46%
Forest health and fire behavior (interviews)	- Changed a little - Affirmed opinions - One strong change in opinion	- Mostly learned about forest management context: decision-making, fuels management - Field trips important for learning
Pacific fisher (email survey)	- Changed = 74% - Not changed = 26%	- From SNAMP = 73% - Elsewhere = 27%
Pacific fisher (interviews)	- Affirmed previously held opinions - Two strong changes in opinion	- Incredible amount of learning about basic fisher biology
California spotted owl (email survey)	- Changed = 56% - Not changed = 44%	- From SNAMP = 56% - Elsewhere = 44%
California spotted owl (interviews)	- Changed somewhat; affirmed previously held opinions - Two strong changes in opinion	- Learning about owls and habitat use
Water quality and quantity (email survey)	- Changed = 63% - Not changed = 37%	- From SNAMP = 54% - Elsewhere = 46%
Water quality and quantity (interviews)	- Affirmed previously held opinions - Three changes in opinion	- Learned about leaf area index, techniques/equipment - Study too small to detect change

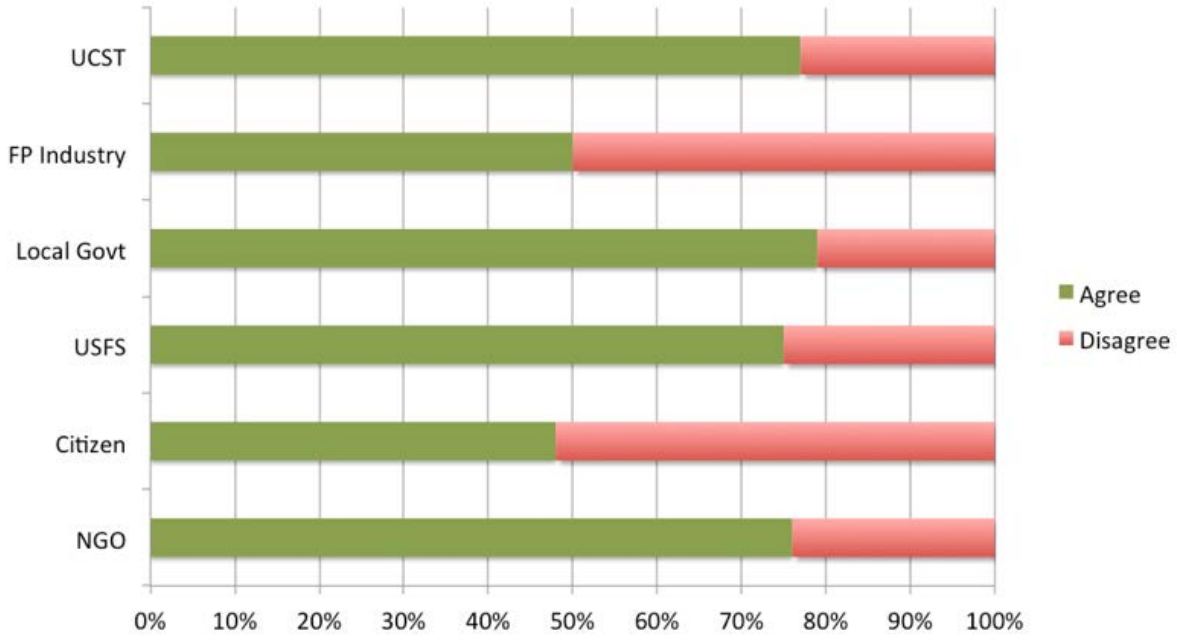


Figure F33: My opinion of the impact of fuels treatments on forest health has changed over last 7 years (responses differ at $p<.1$, χ^2 by affiliation).

Of those who answered "yes" to our interview question regarding opinion change with regard to fuels treatments and their impact on fire behavior, most felt their opinions changed only a little bit: "[SNAMP] helped me to be open to learning" or "I want to say yes but I am not sure how" and "No not really but probably just from conversations with [UC scientists] I am more confident that it is [going to have an effect] than I was before. Maybe a little." One interview participant mentioned that SNAMP did change his opinion about treatment impact on fire behavior because he did not have an opinion before SNAMP.

The following is an example of interviewee responses to the following question: "Did any information from SNAMP affect your opinions about forest fuels treatment effects on fire behavior?"

> "SNAMP has formed my opinions about fuel treatments… SNAMP has contributed enormously because I didn't have much knowledge about them before." UC Science Team

The dominant sentiment from interviewees about the influence of SNAMP on their opinions about treatment impacts on fire behavior was that participant opinions were strengthened, reinforced, validated or enhanced (Table 10). Participants learned about the context around Forest Service management, the techniques behind forest management, some were waiting for the final SNAMP report and others felt it would be a long time before there was reliable information about what happened out there. The comments below also pointed to the importance specifically of field trips as learning opportunities that helped to form or validate people's knowledge about the treatments.

The following are examples of interviewee responses to the following question: "Has your opinion of forest fuels treatment effect on fire behavior changed over the course of SNAMP?"

> "...it has solidified it because I knew things had to change… and just leaving things to nature, can't always be that way, we have learned that fire is necessary but also kind of directing it ourselves but clearing it and so forth is necessary too." Environmental NGO

> "I think it is very similar to what I thought would happen. The Forest Service did a nice job of implementing them." UC Science Team

> "...it is still really theoretical and I still think there needs to be more evidence and data collected to show that the fire models are performing the way they are assumed to be performing." UC Science Team

> "Didn't change the opinion but informed it about what the treatments were and how they looked on the ground. I saw the forest before the treatments and after – it looks pretty darn different … there is a lot less fuel to burn. I do know more about what that looks like now." Agency representative

> "I have followed other treatments in the area so I am not surprised by the results, most SNAMP results I am not surprised by." Forest products

> "...I would have probably advocated from my background that 'fuels treatments make sense and need to be moderate to heavy to have a significant impact on wildfire' but my sensitivity about public and land managers is higher… My bias as a forester would say heavier is better but maybe not." UC Science Team

> "I ... have a better understanding of how the different treatments are determined by the Forest Service based on the data the Science Team collected… I knew about in a general way but now I have a much more specific understanding of how they went about deciding what to do." Unaffiliated citizen

The following are examples of interviewee responses to the following question: "Did any information from SNAMP affect your opinions about SNAMP forest fuels treatment effect on fire behavior?"

> "It strengthened it, yeah. Well I think the main thing is the density, managing the density of the stocking levels... I believe on that trip they showed a couple of different treatments of surface fuels and that was educational too… it reinforced some of the things I had thought." Native American Tribe representative

> "Yes. Going on the field trips and listening to the UC Science Team and Forest Service talk about what they were doing and looking at what they were treating and post treatment areas and having an understating of why they were doing what they were doing and what outcomes they expected." Unaffiliated citizen

> "I think SNAMP probably taught me the most… it was SNAMP that opened my eyes to all of this [learning about fuels management]. Which was important for me as a state worker. We don't get much money to travel and get extra training." Agency

Wildlife species

Email survey participants changed their opinions about SNAMP forest fuels treatment impacts on both wildlife species and learned information from SNAMP that influenced their opinions (Table F10 and Figure F34). These sentiments were stronger for the Pacific fisher portion of SNAMP than they were for the California spotted owl. For all of the email survey affiliation subgroups, the majority agreed that their opinion about fuels treatment effects on the Pacific fisher had changed, and changed due to SNAMP, except those who were associated with the forest products industry. The industry email survey participants disagreed that their ideas had changed and disagreed that SNAMP affected them. The same lack of change was true for the forest product participant opinions and SNAMP influence with regard to the owl. For the owl, the unaffiliated citizen participants also reported no change in opinion and a lack of influence from SNAMP.

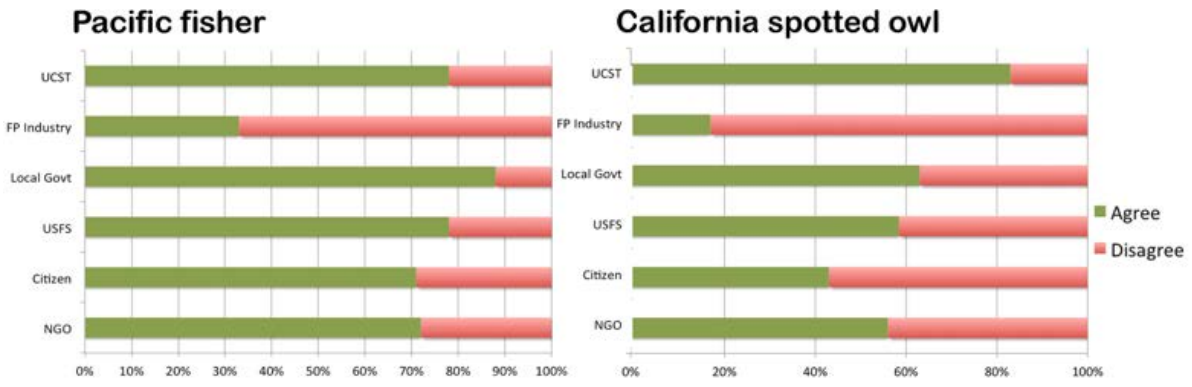


Figure F34: My opinion of the impact of fuels treatments on Pacific fisher and California spotted owl has been influenced over last 7 years by what I learned from SNAMP, 2014 email survey (responses differ at $p<.1$, χ^2 by affiliation).

Interviewees reported that the basic biological studies of fisher and spotted owl produced novel and interesting information that strongly influenced participant learning about the species (Table F10). The interviewees who attended to the fisher portion of the project mentioned that they learned about rodenticide issues, basic fisher biology, den trees, home ranges, and the impacts of fire on fisher. A Forest Service participant said that the "big news is...about the rodenticide and predation. That came out of SNAMP and we weren't thinking about that before." A forest products participant reflected the same sentiment when she said "...the fisher site is the most interesting…" One person felt that what he learned in SNAMP increased his concern about fisher vulnerability to fire. Another felt that she learned that light treatments are more spatially, politically and legally acceptable. Four interview participants admitted that they knew very little about the fisher before SNAMP and so learned quite a bit from the project. Two full changes in opinion about the impacts of forest treatments on the fisher were expressed by interviewees.

The following is an example of interviewee response to the following question: "In your opinion, do you think the SNAMP forest fuel treatments will have an effect on fisher?"

> "...before I was in SNAMP I would have said yes, what one thinks of as an old growth-associated species would be affected … probably negatively. Based on what I have learned as a participant in SNAMP I would now say that it's not clear – not sure there would be strong immediate effects." UC Science Team

The following is an example of interviewee response to the question: “Has your opinion of this [the effects of forest fuels treatments on the fisher] changed over the course of SNAMP?”

> “When SNAMP first started I thought we would see more of an impact on the fisher and now I think they have a wider variety of habitat that they choose to use than I initially thought.” Forest Service

For those interviewees who did not feel their opinion changed about forest treatment impact on fisher, they commonly felt that what they learned in SNAMP affirmed, bolstered and reinforced previously held opinions or they were waiting for the final conclusions and recommendations.

The following are examples of interviewee responses to the question: “Did any information from SNAMP affect your opinions about this [the effects of SNAMP forest fuels treatment on the fisher]?”

> “SNAMP is helping me understand that the way I saw it is correct, that there won’t be an effect. Helped solidify opinion that it won’t affect the fisher.” Forest Service

> “We have more information about the fisher but not how the fisher responds to disturbance.” Environmental NGO

> “...active monitoring was a good thing and it showed the movement of the fisher under certain circumstances and good to have that ongoing. Fisher team did a great job on field trips and presentations. Interesting to see so many of the public attend those meetings....” Forest products

At the time of this project, the California spotted owl had been studied for decades and there were many sources outside of SNAMP for information on the species. Yet, for the owl portion of the project, many email survey participants and interviewees still felt that they learned about the owl from SNAMP and felt their opinion had changed during the 7 years of the project. Similar to the fisher, some interviewees knew little of the owl before SNAMP and so learned significantly from the project. Based on what they learned in SNAMP, some interview participants felt they now know more about owl habitat use and so feel more comfortable with conclusions that are the opposite of their preconceived opinions.

The following are examples of interviewee responses to the following question: “Has your opinion of the effects of forest fuels treatments on the owl changed over the course of SNAMP?”

> “...with both the fisher and the owl, ... now that I have had access to the science I think that the treatments probably are a wise idea compared to the risk of high severity fire.” UC Science Team

> “Because this was an area that I didn’t know a lot about when I went in, during the presentations I was reassured that the design was to protect the owl so yes I was significantly affected by SNAMP.” Unaffiliated citizen

> “...once the final data come out because I feel like this has been a much more complete large study of owls, but currently I don’t know that it has changed drastically but it may once we have the final data.” UC Science Team

Of interviewees who mentioned information sources outside of SNAMP affecting their opinions about the owl, some saw that information coming into SNAMP, some felt that SNAMP provided the context for learning about the owl, and others based their opinions on their own observations or other publications about the impacts of fire on the owl. Similar to the other resources studied in SNAMP, many interviewees felt that SNAMP studies of the owl supported the opinions they brought to the project.

The following is an example of interviewee response to the question: “Has your opinion of the effects of fuels treatments on the owl changed over the course of SNAMP?”

> “Before this it was a hypothesis more and now it is more “this should happen because I know” not just because “I think.” Learning in SNAMP solidified my concerns and what needs to happen.” Environmental NGO

Water

Email survey participant opinions of forest fuels treatments impacts on water quality and quantity changed during SNAMP and just over half reported an influence of SNAMP on their opinions (Table F10 and Figure F35). The two subgroups that did not fit this trend are, again, the forest products and unaffiliated participants. Few interviewees felt that they had changed their

opinions about the impact of forest treatments on water quality or quantity over the last 7 years but many did feel they learned from the project and their preconceived opinions were supported. Interviewees mentioned learning from SNAMP about water assessment techniques and equipment, learning about the interactions of leaf area index and water, or, like the other subjects, some participants knew little of the topic before SNAMP and so the learning in SNAMP was significant for them.

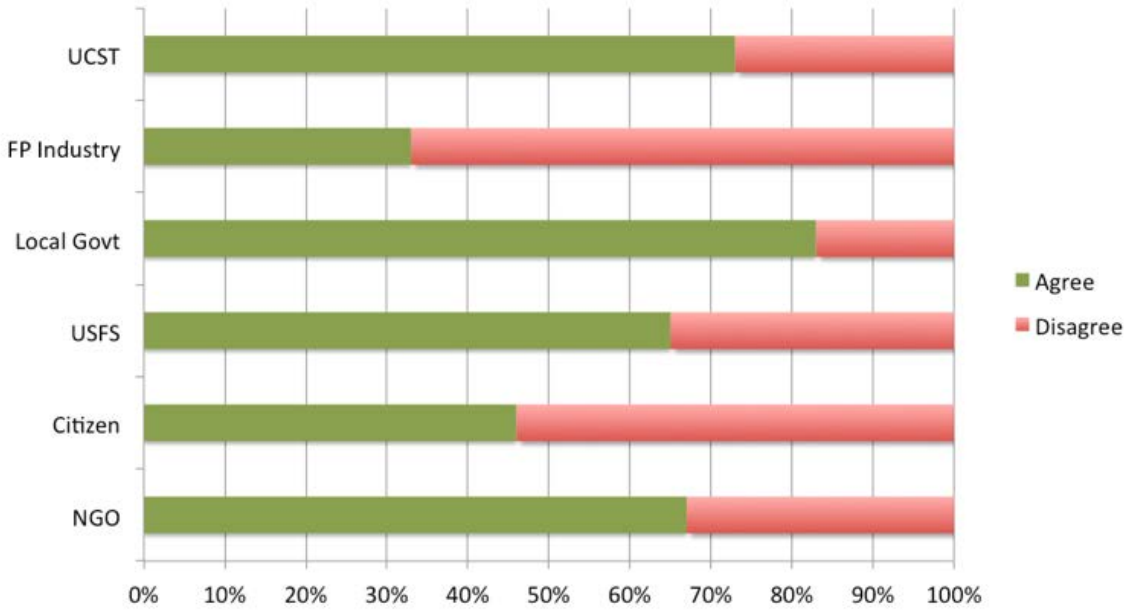


Figure F35: My opinion of the impact of fuels treatments on water quality and quantity has been influenced over last 7 years by what I learned from SNAMP, 2014 email survey (responses differ at $p<.1$, χ^2 by affiliation).

The following is an example of an interviewee response to the following question: "Has your opinion of forest fuels treatments on water quality and quantity changed over the course of SNAMP?"

> "Yes, that was ... where I learned the most from SNAMP." Unaffiliated citizen

> "I didn't know much about it beforehand so I got a lot of learning from the SNAMP project." UC Science Team

The following are examples of interviewee responses to the following question: “In your opinion, do you think the forest fuel treatments will have an effect on water quality and quantity?”

> “...I think they are on to something with the straight-line relationship between LAI (leaf area index) and water production... as you take photosynthetic capacity out of the forest more water results and it is more predictable than we would have thought.” Forest Service

> “...the presentations indicated to me that silt and debris and the water results of fire will be greatly reduced … if the intensity of the future fire that goes through that area is reduced.” Unaffiliated citizen

> “.... the effects were not anticipated to be that long on the landscape. But every little bit helps. To avoid catastrophic fires, which would really affect water quality, then some treatment is better than none.” Agency representative

For those who did not change their opinion, some felt their opinions were affirmed or refined through SNAMP but a large group felt that the study was too small to see an impact or that similar information already exists outside of SNAMP.

The following is an example of an interviewee response to the following question: “Has your opinion of the effects of forest fuels treatments on water quality and quantity changed over the course of SNAMP?”

> “For water quality it hasn’t changed too much, for water quantity what I learned was that the basics of spacing (where trees are removed, are they clumped together) really matter but where they are taken out on the landscape; there might be other things we learn too. I think that through the treatments, we may not see physical effects, with the modeling we will definitely be able to learn from it.” UC Science Team

The following are examples of interviewee responses to the question: “Did any information from SNAMP affect your opinions about the effects of SNAMP forest fuels treatment on water quality or quantity?”

"They are going to see that this does help. They will reinforce what I already know from the college of hard knocks. Doing the science will make it significant and educate the public and the decision makers." Local government

"Found it fascinating all the little monitors etc. Website field trips and meetings learned it. Especially from the field trip that I went on – I think I went on almost all hydrological team field trips." Unaffiliated citizen

SNAMP influence on opinions summary

Overall, during the lifetime of the SNAMP project, most email survey respondents reported changes in their opinions during SNAMP (Table F11). Just over half the email survey respondents felt that SNAMP influenced their opinions on forest health, water and the owl, but nearly three-quarters felt SNAMP impacted their opinions on the fisher. Interviewees reported a few significant changes in opinions about the subjects of SNAMP, with SNAMP playing a role in those changes. The dominant impact of the scientific portion of SNAMP is the vast amount of learning by participants about forest management, species biology and hydrology. This learning was novel for many and reaffirmed, confirmed and strengthened participant opinions. The completed SNAMP report is what many participants say they will base their opinions on.

Table F11: Summation of respondent responses on learning and changes in opinions.

	Has SNAMP changed your opinion?	**Have you learned about the topic from SNAMP?**
Summary	- SNAMP learning did alter some opinions, shows up more in email survey than interviews - Reaffirmed/ confirmed/ strengthened opinions - Need to wait and see with time and SNAMP results	- New subjects for some who then learned a considerable amount - Basic learning for most on forest management, species biology, hydrology

Opinions and change by affiliation

Our email survey affiliation analysis showed no statistical differences between affiliation group response about treatment impacts to the fisher and the owl; the majority of people in each group responded the same way. Most participant affiliations also had similar distributions of responses about the impacts on water quality and quantity but the UC scientist responses differed and tended to report an opinion of no impact on water quality in the long term whereas the local government participants were more likely to predict a positive impact on water quality in the long term. The forest products participants separated themselves from the group because they more often reported an opinion that, in the long term, forest health would not be improved—comments indicated that most felt that the treatments did not remove enough material to improve forest health over the long term.

The forest products email survey participants were also less likely to report they had learned or changed their opinions about any topic studied in SNAMP. Interviews revealed that forest products participants often referred to their own observations from working in the forest in preference to SNAMP information. Likewise, unaffiliated citizens in the email survey less frequently reported a change in opinion with regard to the impacts of the treatments on forest health and reported that SNAMP bolstered and reinforced their opinions on the impacts of treatments on forest health without changing them. The unaffiliated group from the email survey was in step with the group as a whole in terms of how frequently they reported experiencing a strong amount of learning about the fisher but was less likely to report that SNAMP had influenced their opinions about the owl or water quality or quantity. The unaffiliated citizens who participated in the email survey frequently selected "I do not know enough to have an opinion" about the impacts of the treatments and this could be why they were less likely to respond that they experienced a change in opinions and influence of SNAMP on their opinions. In contrast, the unaffiliated citizen interviewees who focused on the owl and the water portions of SNAMP, did report learning from SNAMP.

SNAMP fostered shared understandings

SNAMP's outreach program created an array of participation options to promote learning through in-person events and information sharing at a distance. Evaluation information showed

that in-person events, most importantly field trips and management workshops were best for science learning. Overall, results demonstrated public endorsement of the fuels treatments by participants, showed that participants learned from SNAMP, and revealed that most participants thought that long-term treatment impacts would be positive. For all SNAMP focal areas, some participants changed opinions and most learned from the project. This was the case most strongly with forest health, fire behavior and fisher.

A focus on learning dominated every aspect of the SNAMP process from the original title of the work plan ("Learning how to apply adaptive management…") to the final public meeting and creation of the final report. The extensive outreach effort allowed participants to learn from the scientists and change or support their opinions. Shared understandings evolved around the impacts of treatments on the studied resources, as well as around the underlying assumptions of the project: what constitutes forest health and adaptive management process itself (Sulak and Huntsinger 2012; Sulak et al 2015).

VIII. Participation Team Conclusions

SNAMP fits into the category of top-down, rather than bottom-up or "grassroots", participatory processes. A top-down approach generally means a less organic set of relationships to begin with, making it harder to build and strengthen connections among participants, and a less democratic governance structure (Arnold et al. 2012). There are two major kinds of decision-making within SNAMP, decisions about scientific study made by the Science Team, and decisions about management made by the Forest Service. Both groups have strong constraints on sharing decision-making with stakeholders. Stringer et al. (2006) state that power sharing can remain elusive in settings dominated by scientists and managers. These limitations were made clear at the outset of the project, avoiding some of the misunderstandings that have been a problem in other participatory management efforts (Wagner and Fernandez-Gimenez 2009). The majority of respondents valued the learning opportunities, open discussions, and face-to-face interactions with scientists. Respondents felt "part of the project" (Figure F18).

Working with Cooperative Extension, the Science Team sought public and agency feedback on science decisions, and respondents agreed that the Science Team showed interest in

stakeholder input. However, scientists held that they must keep to the scientific standards set by their peers, limiting their ability to use all suggestions. At the behest of the Participation Team, they agreed to make decisions transparent, and to provide a clear explanation when stakeholder input was not used. For example, there was an online discussion board post from a public participant who suggested study of a nearby severely burned area. A UC scientist explained that this could not fit the timeframe, budget, and objectives of SNAMP, or result in better management information, because there was no pre-fire data available from the site and it had a high severity burn, which is not comparable to the prescribed fires used in SNAMP. A Science Team principle was that public input leads to better science as well as management, but in fact a consultative approach is used, rather than the shared decision-making of a full collaboration.

As to the Forest Service, it has been argued that full decision-making authority cannot be devolved or abdicated outside of Congress's reach (Moote and McClaran 1997; Coggins 1999). This was raised at the beginning of the project in 2005, and again in April of 2008 by participants in SNAMP workshops because of the aspiration of many to have power sharing - based co-management, including shared decision-making, with the Forest Service. Some participants were concerned that their contribution over the many years of SNAMP might ultimately be "a waste of time" if they could not have more assurance that project results will be used by the agency. The perception that participants risk wasting resources and time is not specific to SNAMP, but has been expressed numerous times during agency-led participatory projects. Again, the Forest Service approach remains fundamentally consultative, with intention expressed to adhere to the results of the collaborative project.

However, different aspects of an adaptive management program may have different levels of public involvement (Stringer et al. 2006), and the diverse SNAMP formats allowed a more collaborative approach when possible. The SNAMP project emphasized transparency, created diverse and inclusive opportunities over several years for participants to join and to build relationships, and, using the adaptive management model of experimentation, provided material for shared learning. There was indication of the development of shared norms and values. Participants tended to agree that conflict was reduced, at least for those who participated in the project. Toward the end of UC's participation, in 2014, more than 80% of respondents felt that

participation in SNAMP was worth their time.

The third party role

UC was strongly seen as neutral and unbiased in its third party role and most interviewees and survey respondents supported using the SNAMP model in other collaborative adaptive management situations, but cost and "scalability" are concerns. The SNAMP model is costly in time and money. In fact, the annual appropriations cycle of the Forest Service is not a good fit to the length to time needed to carry out an adaptive management project like SNAMP. Insecurities about funding, from time to time, cut into scientist commitment and upset stakeholders. The gradual but steady reduction in funding throughout the term of the project was also distressing, as pieces of the project were jettisoned along the way. In addition, changes in personnel in the agencies hampered long term learning and communication at times.

In fact there are gradations possible in a third party model, from stakeholder participation or implementation in monitoring, through bringing in another agency to do some of the monitoring and outreach, to collaborating with an entity like UC that conducts science and outreach as full partner to the public and the agency. One example is the role of the Natural Resources Conservation Service, an advisory service, in developing Ecological Site Descriptions for monitoring on BLM lands. These are the kinds of arrangements, conducted with utmost transparency, that engender what seems to be meant by hundreds of authors as "trust." The feeling that nothing is being ignored or kept secret, that parties are working together in good faith, and that the biases of each party are given an equitable chance at expression and then balanced using scientific information that all parties feel is credible. It is what a member of the public once characterized as "trust, but verify."

Closing the loop

To gauge participant thoughts on SNAMP's impact on future forest management in the Sierra, we collected participant assessments of SNAMP as a successful adaptive management project. Many answers included the phrase "time will tell…" because the final part of the process, the incorporation of final results into future management, as we have called it in this project, cannot occur during the project. The UC role ended in 2015, with the publication of the

final report and results. What the Forest Service will do with that information was not able to be tracked as part of the project so the ultimate adaption will go unrecorded by the UC Science Team. For some this was less of an issue because they could point to adaptations that had already occurred and for others this was a sticking point.

The SNAMP legacy

Participants had many examples of why SNAMP was important and how it will impact forest management into the future. A few participants saw SNAMP as reaching past the local level to decision makers in the Forest Service Regional office (Region 5) and influencing the Forest Service's future collaboration intentions at a larger scale, whereas others did not. Other comments described SNAMP as a demonstration of better agency interaction with stakeholders that could be continued by the Forest Service. There were many hopeful remarks that the relationships built in SNAMP, with the public as well as between the agencies, would facilitate productive interactions in the future, but it is a question, it is not something participants are sure about. At the outset, a major goal was to create a group of knowledgeable stakeholders to work with the Forest Service--this has been accomplished, but the future hinges on the agency's ability to build on the relationships created thus far--to literally "keep stakeholders in the loop."

For the long term, participants hoped that SNAMP's scientific legacy would continue in improvements management of the study areas based in SNAMP's scientific findings – the list of SNAMP publications is extensive already (for a list of Participation Team journal articles see Appendix F7). Some of the scientific projects that have continued after the formal SNAMP project ended will continue outside the SNAMP framework. And, since the community of interest sampled by the email methodology is active in forest management issues, former SNAMP participants can continue to support using the lessons learned in future projects. Nearly 2/3rds of 2014 email survey respondents had attended other Forest Service NEPA-related meetings. About 70% reported participating in other collaborative projects. Survey respondents reported participation in the Sierra Cascade Dialog, Dinkey Creek CFLRP, fire safe councils and fuel management groups, and numerous other programs. About 42% of respondents said they knew that SNAMP had had an influence on other projects, and about a quarter reported that they knew of SNAMP results being used elsewhere. One typical comment volunteered on the email

survey was that the "SNAMP collaborative process is being used for forest planning in Oregon and California. The facilitation workshops run by SNAMP have been attended by people from many different organizations so I imagine that is having an influence on collaborative projects." Another comment was that "it has provided a model for cross-disciplinary collaboration and for modeling the importance of reaching stakeholders. I have been reaching out to community groups to explain our research at a level that I have not done beforehand."

At the outset, the Forest Service expressed a desire to create a group of informed, committed stakeholders with which to work. We believe this has been accomplished, and hope that the relationships created will carry this constructive, learning based effort into the future. In fact, the creation of this group is a highly resilient way to continue what has been learned in SNAMP, as the group can work with the Forest Service to adapt the lessons learned to future conditions.

IX. Lessons Learned

Transparency, inclusiveness, learning, relationship building and effectiveness are the five main goals established for the SNAMP Participation Team. In their pursuit, we found value in the following:

1) **Transparency**:

Emphasize project openness and transparency. Communicate clearly and thoroughly. Report directly to the public.

- Maintain an up to date and accessible website with project document archive and meeting information. Make outreach staff contact information easily accessible.
- Maintain contact information for all participants for outreach purposes.
- Specifically address how decision making for the project will happen from the very beginning.

- Identify and record clear project boundaries and key agreements in shared notes. Clarify expectations at the start, and throughout the project, about what can and cannot be done especially with regard to funding.
- Use webinars to transfer information, increase access and enhance transparency.
- Evaluate project transparency on an ongoing basis through evaluation, conversations at meetings, or use of self-organizing map methods to help see sustained engagement between scientists, managers and stakeholders over time.
- Have a plan for bringing new participants up to speed on project progress, constraints and communication protocols in order to weather staff turnover while maintaining transparency.

2) **Inclusiveness**:

Maintain an atmosphere of inclusivity in all aspects of the project.

- Provide notice 6 weeks ahead (minimum) of gatherings and send reminders closer to the date.
- Design events for participants with varying levels of interest, availability and knowledge; provide background information for those who want more.
- Provide a variety of times for events.
- Hold events in the regional capital to draw agency and regional representatives and in the local area to connect with local stakeholders.
- Keep local communities and the broader communities of interest, including under-represented groups, updated on the project through notices to an email list and local outreach events. Do not expect them to come to the project, outreach must go to them.
- Use web technology, such as webinars, to complement face-to-face interactions and public meetings, allowing distant participants to be involved.
- Use multiple forms of electronic media including websites, emails, blogs and social media to extend awareness beyond the local and regional scale.
- Monitor the flow of information products through their production, transport, and use so that process corrections can be made if needed. Powerful new information monitoring tools may

be useful for monitoring.

3) **Learning**:

Learning together is critical for shared understandings and building relationships.

- Learning cannot occur without transparency and inclusivity.
- Design a variety of participation events that accommodate diverse backgrounds and knowledge levels – overview large meetings, technical detailed smaller meetings, hands-on workshops, field trips, and webinars or conference calls as needed.
- Conduct as many field trips as possible to draw the broadest audience of participants and clarify discussions in realities on the ground.
- Build in informal time at meetings, as it is important for people to network. Always include question and answer sessions to allow participants to get to know what others think.

4) **Relationship building**:

Put time and effort into allowing participants to build relationships between each other.

- Relationships cannot be built or improved without transparency and inclusivity. Learning together is also essential.
- Provide face-to-face meetings (large and small), especially field trips.
- Webinars are most effective after in-person relationships have been built.
- Monitor the status of participant relationships to ensure success of the project. This can be done through questions on event evaluations, group discussion or other more advanced tools such as affiliation network analysis.
- Continually brief new agency leaders in order to maintain agency commitment despite leadership turnover.

5) **Effectiveness**:

Structure the process for success. Specify roles, relationships, and responsibilities in the project's steering committee.

- Bring all partners at all relevant levels into the project as early as possible.
- Assign project staff and clarify roles and responsibilities for outreach and communication.
- Ensure that all participants, scientists, and agency staff understand expectations for communication throughout the project.
- Provide training for participating in collaborative efforts. Include facilitation skills and tools to deal with difficult behaviors.
- Use trained outreach professionals. Use a trained facilitator when difficult topics are anticipated.
- Provide many opportunities for feedback throughout the process including using on-going evaluation techniques.
- Be flexible. Continually adapt methods to match participant needs.
- Use in-person outreach methods for learning and relationships; at a distance methods for awareness and information transfers.
- Leadership is important – consistency and engagement are crucial. Choose leaders held in high esteem by project participants and with authority within their affiliated agency or organization.
- Develop the capacity to transfer leadership, as people change positions often in a long term project (agency contacts, managers, and scientists).
- Attend to project team relationships. Emphasize internal agency communication between field levels and management or administrative levels.
- Agency partnerships need to be fostered for effective collaboration.
- Secure long term funding for long-term projects.
- Develop the project at the time and spatial scale appropriate to the funding source.

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Appendix F1: Participation Team Evaluation Tables

CORE ELEMENT: Transparency - "Public understands decision-making (in the SNAMP) process. Information about issues and process is available" (Laurian & Shaw 2009). "Open, accessible, and transparent process" (Conley and Moote 2003).

Evaluation Criterion	Measures	Type of data	Analysis method	Accomplished?
Meetings are held in places/at times convenient for stakeholders (Smith & McDonough 2001).	SNAMP gives adequate notification of meetings and events: Number of days between first notification and event. Locations and times with most attendance. Choose a minimum attendance as acceptable.	Event records, interview results, compare to literature best practices, matrices, evaluations, observer notes	Quantitative	Yes
Presence of an effective facilitator and/or coordinator (Leach 2006, Reed 2008). Training for participants in collaborative skills (Leach 2006). Presence of a strong leader (Leach 2006). "External facilitator" (Twarkins et al 2001).	Presence/absence of facilitators at meetings and impact of that presence on participant experiences. Evidence of trainings and requests for trainings. Impressions of participants about leadership.	Event records, interview notes	Quantitative and qualitative	Yes
SNAMP meeting and engagement methods are "selected and tailored to the decision-making context" (Reed 2008 and Glicken 2000). Varied in time and place to encourage broad attendance; also structure as well as flexibility important (Twarkins et al 2001).	Meeting methods are appropriate for the meeting purpose.	Meeting evaluations, interview notes, internal evaluation of meetings	Qualitative	Yes
SNAMP makes current and relevant project and scientific information accessible and available to the public (Rowe & Fewer 2000). Information is "documented and communicated in a manner understandable to all stakeholders" (Gregory et al 2006; Beckley et al 2006). The process uses good science, science that is trusted by participants (Interview #2) "high quality information" (Innes 1999; Leach 2006). Scientists "employ clear language" and don't talk down to participants (Walker and Daniels 2001).	Plans, maps and other documents are updated, understandable and widely available to interested parties (Cote & Bouthillier 2002). Presentations are accessible to all levels and efforts are made to clarify definitions for the audience. Number of questions requesting explanation of meeting information. Currency of data used. Date documents uploaded to website prior or post meetings/events. Evaluation of SNAMP written documents for accessibility and timeliness. No jargon.	Interview results, meeting notes, website data, evaluations, meeting observation notes	Quantitative and qualitative	Yes except some critique of UCST communication with public
SNAMP promotes early and continued involvement - all participants are included in all phases of project. (Interviews #9, #13, #14, #19, #30; Reed 2008)	Percent of SNAMP meetings open to the public. Evidence of SNAMP encouragement of public attendance. Categories of people invited to events. Use of website for sharing of decisions/decision making events. Evidence of "sustained quality stakeholder interactions" (Bales et al 2004). Participants included as early as possible in design and implementation of project (Bales et al 2004; Sheppard 2005) - dates attendees first become involved. Website launch dates. Participants agree to ground rules for the process (Sheppard 2005). Evidence of stakeholder complaints about lack of transparency.	Invitee lists for events, attendance lists, interview results, website data, individual communications	Quantitative and qualitative	Yes except some critique that managers were not included as early as possible in design and implementation of project
SNAMP clearly defines and articulates reasons for public involvement.	There is clear and timely documentation of purpose, results and degree of public influence (Sheppard 2005). SNAMP includes rules and expectations for participants in meetings and publications (Leach 2006; Shindler & Neburka 1997). SNAMP meetings and the project overall have a clear purpose and endpoint and next steps are clear (Shindler & Neburka 1997). Mention of these topics in documents, publications, meeting agendas and notes.	SNAMP documents, publications, and meeting notes, matrices, evaluations, interview results, observer notes	Quantitative and qualitative	Yes - at beginning had to spend extra time on expectation; next steps were not always clear

CORE ELEMENT: Inclusiveness - SNAMP incorporates a wide range of public values (Beckley et al 2006; Rowe & Fewer 2000).

Evaluation Criterion	Measures	Type of data	Analysis method
SNAMP reaches a large number of people (Interview #9), "inclusiveness" (Conley & Moote 2003; Laurian & Shaw 2009; Leach 2006; Twarkins et al 2001) "accessibility" (Beckley et al 2006)	Number of contacts on outreach email list, attendance at SNAMP events, attendance at events where SNAMP was presented, numbers who comment on website, individual outreach contacts, affiliations for these people.	Names of participants, affiliations, for each event with type of event, interview results about who is missing, evaluation results, website data	Quantitative
SNAMP reaches a broad and diverse audience (Interviews #13, #14, #19, #30; Conley & Moote 2003; Leach 2006; Plummer and Armitage et al 2008; Wondolleck & Yaffee 2000)	Number of contacts from different affiliations: on outreach email list, attendance at SNAMP events, attendance at events where SNAMP was presented, who comment on website, individual outreach contacts. Connections to those beyond primary participants (Conley & Moote 2003)/ SNAMP engages more than the "usual suspects" who are already engaged in policy and research debates (Stringer et al 2006). Relevant stakeholders are analyzed and represented systematically (Reed 2008).	Names of participants, affiliations, for each event with type of event, interview results about who is missing, evaluation results, website data	Quantitative
SNAMP reaches all relevant and significant groups (Armitage et al 2007; Glicken 2000; Innes and Booher 1999, Innes 1999) including major NGOs from all sides. "Representation" (Moote & McClaran 1997)	All groups that are normally involved in forest management are participating in SNAMP. Those what are determined via stakeholder analysis and participant suggestions to have a stake in SNAMP are contacted and invited to join. All relevant and significant NGO groups from all sides participate in SNAMP regardless of size or influence (Keough & Blahna 2005). Those who frequently object and/or sue the USFS over management are involved in SNAMP. SNAMP is not missing any crucial groups/people.	Names of participants, affiliations, for each event with type of event, interview results about who is crucial to the process or missing, evaluation results, website data, lawsuit authors from USFS.	Quantitative and qualitative
SNAMP reaches local people (Moore 1996); specifically local government (Conley & Moote 2003). SNAMP reaches all scales - local, regional, watershed, etc (Armitage et al 2007; Plummer and Armitage et al 2008)	Local people and groups are participating in SNAMP. Numbers and kinds of events held in local study areas. Attendance at SNAMP events as well as outreach talks. [But at policy level collaboratives it is common to have organizations rather than individuals participate due to travel distance - two table problem - Margerum 2008.]	Names of participants, affiliations, for each event with type of event, interview results about who is crucial to the process or missing, evaluation results, website data	Quantitative
SNAMP incorporates a wide range of public values (Plummer and Armitage et al 2008; Rowe & Fewer 2000)	Number of contacts on outreach email list, attendance at SNAMP events, attendance at events where SNAMP was presented, numbers who comment on website, individual outreach contacts, affiliations for these people, number and diversity of comments received at meetings, outreach talks and on the website.	Names of participants, affiliations, for each event with type of event, interview results about diversity of views in SNAMP, evaluation results, website data	Quantitative and qualitative
SNAMP's attendance reflects renewal as well as consistency in participation (Interviews #9, #13, #14, #19, #30; Beckley et al 2006; Moote & McClaran 1997). Different groups are allowed to participate at different stages (Stringer et al 2006). The process "keeps participants at the table, interested and learning" (Innes 1999). "Comprehensive and sustained public involvement" and "continuity in participants" (Leach 2006).	"Evidence of sustained quality stakeholder interactions" (Bales et al 2004): SNAMP participant change and stability over time in both numbers, affiliations, and individuals. No major faction that has gone away mad and is litigating (Interview #20). The SNAMP participation process is flexible allowing people to change the way they participate (Stringer et al 2006). "New opportunities for interaction" (Wondolleck & Yaffee 2000). Accessible to all (Moote & McClaran 1997).	Event records and attendance, interview results to explain changes, meeting evaluation results	Quantitative and qualitative
SNAMP's website augments participation for existing participants and brings in new participants.	Number of people who use the website, comparison of those people to those who attend/are vocal at meetings.	Total number of website hits, reasons or timing for those hits, number of people using web, who using the web and how.	Quantitative and qualitative

CORE ELEMENT: Learning - Communication is ongoing and two way in SNAMP (Beckley et al 2006; Laurian & Shaw 2009); SNAMP "contributes to all participants' knowledge" (Beckley et al 2006)

Evaluation Criterion	Measures	Type of data	Analysis method	Accomplished?
SNAMP increases public awareness/increases agency awareness of public views (Laurian & Shaw 2009). "Joint or reciprocal learning" (Twarkins et al 2001)	Number of people aware of SNAMP, issues at stake, and decision making process (Laurian & Shaw 2009): number of contacts on outreach email list, attendance at SNAMP events, attendance at events where SNAMP was presented, numbers who comment on website, individual outreach contacts, diversity in affiliations for these people. Number of USFS people involved with SNAMP: on outreach email list, attendance at meetings, individual contacts between USFS and public, comments on their environmental docs, comments at their USFS NEPA events. UCST & USFS are aware of public views, concerns and preferences (Laurian & Shaw 2009): number of UCST and USFS attendance at meetings, face-to-face interactions with the public.	Names of participants, affiliations, for each event with type of event, interview results about interactions with the USFS and the public, comments on USFS documents.	Quantitative and qualitative	Yes for participants; unknown for non participants
SNAMP participants feel ownership of the process/plan (Moore 1996; Wondolleck & Yaffee 2000; Interview #2). Participants feel heard (Interview #9). SNAMP is learning from its participants.	SNAMP collects feedback from participants (Chess & Purcell 1999). Evidence that the participants' comments appear in meeting notes (Tuler & Webler 1999) or in environmental documents (McCool & Guthrie 2001). Or that they are clearly addressed in website interactions or emails. Evidence that changes are made in SNAMP in response to public input (Interview #9). If comments are not used, participants know why (Interview #9). SNAMP decision maker available to the public - generally and at meetings (Shindler & Neburka 1997). Number of participants who had face to face interaction with scientists/decision makers. Number of meetings that promoted individual conversations with PIs. Email/web interactions between participants and PIs. SNAMP participants feel that the events get more meaningful as time goes on in the project (Interview #9). "Active open minded listening" by scientists, scientists take notes on participant comments (Walkers and Daniels 2001).	Meeting notes, website data, archival data, environmental documents/publications, interview results, evaluations, observer notes, email interactions	Quantitative and qualitative	Yes but constrained by scientific method
Participants learn from SNAMP (Interview #21)/gain knowledge and understanding (Conley & Moote 2003, Innes 1999; Moote & McClaran 1997). The SNAMP process produces information that stakeholders can understand and accept (Innes and Booher 1999).	Availability of facilitator and UCCE representatives (Bales et al 2004) as well as UCST project scientists for translation of science (Glicken 2001). Structure promotes learning - room layout, agenda organization, facilitation. Researchers and agency people take participant knowledge seriously. The process engages participants in learning through discussion, drama, humor and informal interaction (Innes and Booher 1999). Educational aids provided where needed (Sheppard 2005). Evidence of "agreed upon data or scientific information"/mutual understanding (Innes & Booher 1999; Laurian & Shaw 2009).	Attendance, room evaluation and agenda analysis, evaluations, interview notes, observer notes	Quantitative and qualitative	Yes
SNAMP meetings are structured to promote full group interaction (Shindler & Neburka 1997) and deliberative dialogue (Beckley et al 2006; Interview #6). "Perspectives are exchanged and modified via discursive communication" (Plummer and Armitage 2007)	Room layouts, meeting goals, facilitation, interview comments, all crucial people in attendance. Participant discussions are frank and open (Beckley et al 2006).	Attendance, room evaluation and agenda analysis, interview data, observer notes	Quantitative and qualitative	Yes
Participants have power to influence the process and outcomes (Cote & Bouthillier 2002; Tuler & Webler 1999) Or they are able to share in collective decision making (Fiorino 1990, formal or informal - Keough & Blahna 2005). Process "encourages participants to challenge assumptions" (Innes 1999). "Equitable distribution of power and influence" (Leach 2006).	Analysis of participant legal or organizational structural power. Meeting notes that reflect sharing in decision making, and equitable interactions with PIs. Participants participate equitably with the experts and agency reps (Fiorino 1990). Evidence that meetings and meeting discussions focus on participants' interests/concerns (Cote & Bouthillier 2002); altered based on participant suggestion or request. Science is responsive to user needs and interests (Bales et al 2004).	Legal/structural analysis, meeting notes, email or website logs, meeting planning discussions, website data	Quantitative and qualitative	No - shared decision making not possible for UCST or USFS
Technology transfer - SNAMP/UC educates USFS and the public about the most current uses of technology used by the UCST teams. UCST is an active communicator of research (Gibbons et al 2008).	The SNAMP process incorporates high quality information for many types/levels of participant and assures agreement on meaning (Innes and Booher 1999). Variety of meeting and presentation types. Descriptions in meetings notes, meeting agendas, website.	Meeting notes, agendas and matrices, evaluations	Quantitative and qualitative	Yes
Data sharing - UCST shares research results/data to the best of their ability and in a clear and useful manner to the public and MOUP.	Amount of UCST data on data sharing site and speed of sharing, use of data sharing site by stakeholders, information shared at meetings, other methods of data sharing.	Data sharing website access log and uploading log, meeting notes	Quantitative and qualitative	Yes but data sharing website underutilized and eventually abandoned
Involving a third party increases vertical learning integration up to higher institutional levels (Stringer et al 2006).	Evidence that learning occurs at high levels within participating institutions - attendance of high level reps, appearance in environmental docs. Connections to UCST facilitation ("achieving such a feedback across institutional levels requires an agent or institution acceptable to all groups who can ensure that this sort of dialog does take place" Stringer et al 2006)	Interview notes, meeting notes, meeting attendance, individual communications	Qualitative	Yes to some extent
The public has a common understanding of the tradeoffs of implementing the studied fuels treatments (Interview #24).	Evidence that there is general agreement on the effects of SPLATs.	Interview notes, meeting notes, observer meeting notes, individual communications, web postings, key agreements	Qualitative	Yes
Shared understanding develops (Ansell and Gash 2007; Armitage et al 2007; Plummer and Armitage 2007)	Evidence that there is general agreement on the issues at stake in SNAMP - forest health? Adaptive management? State of Sierra forests? Strategies to manage forests?	Interview notes, meeting notes, observer meeting notes, individual communications, web postings, key agreements	Qualitative	Yes

CORE ELEMENT: Effectiveness - SNAMP improves the quality of decisions (Beckley et al 2006). SNAMP completes its contractual obligations.

Evaluation Criterion	Measures	Type of data	Analysis method	Accomplished?
The SNAMP process produces UC and USFS plans that are implemented. (McCool & Guthrie 2001; Moore 1996; Plummer and Armitage 2007; and Interviews #6, #11, #16, #19, #20, #24).	Implementation of individual parts of SNAMP - both UC research and USFS mgmt. All UCST team experiments conducted. USFS SP and LC treatments happen. Numbers of acres treated/studied.	Research completion, peer reviewed published papers and environmental docs, USFS records	Quantitative	Treatments were implemented but delayed and some experiments truncated
SNAMP generates acceptance of agency, legitimacy, (of USFS and UCST) and its actions (Moore 1996; Laurian & Shaw 2009; Plummer and Armitage 2007). There is broad support among the stakeholders for SNAMP (Interviews #3, #19). Stakeholder satisfaction is key (Interview #26). There are mutually beneficial outcomes (Moore 1996, Wondolleck & Yaffee 1994). SNAMP creates the basis for new agreements regarding forest management (Cote & Bouthillier 2002).	The USFS is an active participant; it listens to the public and UCST's findings (Interview #2). Number of meetings with USFS leadership present and actively participating. Participant attitudes towards agency actions and attitudes, either USFS or UCST. Participant understanding. The final plan/product agrees with public input (Interview #28, #30, #31). The agreement is supported through to implementation by stakeholders (Moore 1996). Stakeholders appear to be moving towards more collaboration post-SNAMP.	Conversations with participants, meeting notes, interview notes, observer meeting notes, web postings, email conversations	Qualitative	Somewhat accomplished and after SNAMP ends
SNAMP research results inform USFS management (Interview #23; Conley & Moote 2003). SNAMP and UCST research change the way USFS manages and studies forests in the future (Interviews #5, #13, #14) The USFS monitors after SNAMP is complete (Interview #10).	Examples of changes in Last Chance and Sugar Pine and future management plans for those forests and others in the Sierra (Interview #4). Examples of changes in USFS research or monitoring based on SNAMP. Should research show changes are needed in USFS, examples of everyone working together to change management (Interview #20).	Conversations with USFS, meeting notes, USFS environmental documents, interview notes, mention in any new Sierra Framework.	Qualitative	Some evidence of USFS use of SNAMP data, after SNAMP ends
SNAMP's AM framework/ parts of the AM framework are adopted by USFS. Quality of USFS decisions is improved (Laurian & Shaw 2009)	Examples of changes in future management plans or planning docs for forests in the Sierra. UCST monitors how SNAMP affects future management (Interview #6). Quality of decisions improved because based in broad knowledge base and public support (Laurian & Shaw 2009).	Conversations with USFS, meeting notes, environmental documents, interview notes.	Qualitative	After SNAMP ends
SNAMP creates new practices within participating institutions (Conley & Moote 2003). SNAMP results in flexible and networked institutions allowing more creativity in response to change and conflict/build institutional capacity and resilience (Laurian & Shaw 2009). New collaborations come out of SNAMP (Innes and Booher 1999). Improved capacity for dispute resolution (Conely & Moote 2003). "Second order effects" (Innes 1999).	Examples of changes within the USFS, changes in relationships with other MOUP based on SNAMP. New partnerships with stakeholders and within stakeholders. UCST and USFS are more efficient, effective, able to respond to input better (Interview #1). USFS and UCST relationships with stakeholders are improved. New collaborations are created out of SNAMP.	Conversations with USFS, meeting notes, environmental documents, interview notes	Qualitative	Some evidence of USFS use of SNAMP public participation methods, after SNAMP ends
SNAMP is successful and useful in the eyes of both the USFS and the participants (Interviews #7, #8). SNAMP was a good investment of time and energy (Interview #8). Participants satisfied (Laurian & Shaw 2009). SNAMP produces information that stakeholders accept as accurate (Innes 1999).	Discussions with USFS and other participants from interviews and meetings notes. Continued attendance at meetings and positive evaluations.	Interview notes, meeting notes, meeting evaluations, future survey?	Quantitative	Yes
A lasting data network is created and SNAMP measurements are continued (Interview #12).	Continuation of SNAMP study projects by USFS or UCST or a portion there of.	Future data collection protocols and data, environmental docs	Quantitative and qualitative	For some parts - fisher and water
The UCST completes its workplan and sees the research through to completion (Interview #13, #16). UCST produces a final report to the USFS.	Number of published peer reviewed papers (Interview #4, Gibbons et al 2008). Each team in SNAMP reaches its scientific research goals (Interview #11) and integrates research across disciplines - joint papers, collaborative field work, sustained participation in SNAMP meetings (Bales et al 2004). The UCST completes its contractual obligations. Factors that facilitated or hindered UCST's process. Specific team's progress and successes. The UCST remains a fully integrated team through the end of the project (Interview #13). All data is collected and the fisher are tracked (Interview #16). Final document reviewed by public and published.	SNAMP data records and documents, meeting notes, matrices	Quantitative and qualitative	Yes
SNAMP reaches consensus and answers the question of how to minimize fire danger and still have owls and fisher around (Interview #17; Laurian & Shaw 2009). Eventually SNAMP produces a real reduction in vulnerability to fire without environmental degradation (based on Bales et al 2004). SNAMP facilitates implementation of a solution (Laurian & Shaw 2009).	UCST makes useful recommendations to USFS that allow for fire danger mitigation as well as protection of environmental values. There is stakeholder and USFS agreement about next steps. Future research shows SNAMP research produced improved environmental conditions. Improved habitat and water quality; biological diversity preserved (Conely & Moote 2003).	SNAMP documents and meeting notes, matrices, peer reviewed research on Sierra forests	Quantitative and qualitative	After SNAMP ends
SNAMP compares favorably with other similar processes in terms of costs and benefits (Innes and Booher 1999).	Total cost of SNAMP compared to other AM processes of similar scale. Total benefits of SNAMP compared as well.	SNAMP records	Quantitative and qualitative	Unknown
SNAMP culminates in a written document of some sort that is acceptable to stakeholders and agencies. A "clear written plan" (Conely & Moote 2003) or a "high quality agreement" (Innes 1999).	The document has clear goals, expectations; is based in sound consensus science; integrated with socioeconomic considerations; approved by a consensus based process (all from Mandarano 2008).	SNAMP records, UCST workplan, meeting notes, final document review comments, final document	Quantitative and qualitative	Yes
SNAMP develops a clear 3rd party adaptive management process that can be applied elsewhere. It produces learning and change in and beyond this group (Innes and Booher 1999). SNAMP's results and conclusions are available to other groups and not lost in bureaucracy (Interview #18 and Innes 1999).	Review of SNAMP meeting information, processes and data, final documentation of SNAMP. Other projects that use SNAMP's lessons learned or are based on SNAMP in any way. SNAMP is able to be scaled up to regional or national level policies (Stringer et al 2006).	Meeting notes, agendas and matrices, evaluations, interview data, literature search	Quantitative and qualitative	Yes but after SNAMP ends
SNAMP produces a [mutually agreed upon] definition of adaptive management (Interview #2).	Mention of an agreement on a definition in any SNAMP documents or meeting notes in addition to the UCST workplan.	SNAMP records, UCST workplan, interview notes, meeting notes	Qualitative	Yes

CORE ELEMENT: Adaptive management components - Comparison to adaptive management criteria from literature

Evaluation Criterion	Measures	Type of data	Analysis method	Accomplished?
The AM circle is fully completed (Interviews #2, 4). SNAMP completes its legal requirements? (Laurian & Shaw 2009)	Explanation of the USFS constraints; its flexibility to adapt management based on UCST research (Interview #23). Information from public and USFS about implementation of next projects - the final step in SNAMP (the left hand side), check each step (Reever Morghan et al 2006). Delegation of power - Margerum 2008.	Conversations with USFS, future meeting notes, USFS environmental documents, interview results, meeting evaluations, key agreements.	Quantitative and qualitative	After SNAMP ends, USFS responsible, public to monitor
SNAMP "improves USFS managers' knowledge about a set of well defined ecological objectives through implementation of carefully designed quasi-experimental management interventions and monitoring programs" (Gregory et al 2006). UCST provides appropriate information at the level of detail needed for management (Interview #23). Does the UCST "recognize the need to provide information that can be directly used by decision makers"? (Gregory et al 2006)	USFS knowledge is improved. "The adaptive management design is paired down to focus on only those uncertainties most likely to influence management decisions" (Gregory et al 2006; Reever Morghan et al 2006) "Project timeline to obtain verified results is compatible with management decision making requirements" (Gregory et al 2006; Reever Morghan et al 2006). UCST provided enough information that the USFS can go forward with a science based plan for wildfire management (Interview #12). SNAMP experiments are designed to test managers' hypotheses about the effect of treatments on the ecosystem (Gregory et al 2006). How early were USFS managers included in SNAMP planning? Do SNAMP experiments change over time to increase or decrease the ability of the research to answer management questions? How does the UCST share information with MOUP? Does the MOUP agree with both the quantity and type of information shared? "The information collected through adaptive management has sufficient predictive ability to make a difference to managers" (Gregory et al 2006). The USFS uses UCST information in future wildfire management plans.	Interview data, meeting notes, communications between teams and USFS, appearance in USFS environmental documents, SNAMP final document, use of data sharing website, attendance at IT meetings where data/results are shared, communication between UCST and MOUP	Quantitative and qualitative	UCST aimed report at managers; managers were not included early enough and do not feel they had input. Use of SNAMP results occurred somewhat already, full use yet to be determined
SNAMP's "design and assessment of adaptive management plans explicitly address the multiple goals of stakeholders (rather than only scientists)" (Gregory et al 2006).	Description of who was involved in determining SNAMP research designs. Analysis of whether the science addresses the managers' and stakeholders' main questions or concerns.	Meeting attendance lists, email conversations, interview notes, meeting notes, observation notes	Quantitative and qualitative	Somewhat
The MOUP's responsibilities for implementing the adaptive management cycle are clear and acted upon (Gregory et al 2006). There is explicit policy guidance and leadership support for adaptive management.	Funding (Leach 2006), technological and coordination support are adequate (Keough & Blahna 2005; Habron 2003). MOUP professional support is adequate. MOUP time dedicated to SNAMP is adequate. Funding from a variety of sources (Wondolleck & Yaffee 2000).	Public, MOUP and internal UCST meeting notes, funding scares and improvements, interview notes	Quantitative and qualitative	No
Adequate attention is paid to stakeholder shared understanding and decision making for SNAMP over all and for each team (Gregory et al 2006).	Stakeholders are satisfied with SNAMP; participation is worthwhile. Stakeholders feel empowered. There are no lawsuits from within the active stakeholder group or from others/less management through the judiciary (Moore 1996; Interview #29).	Interview notes, legal proceedings of study areas or other entities post-SNAMP, meeting observation notes	Qualitative	Yes
SNAMP addresses "potential issues related to background trends and cumulative effects of management actions in the adaptive management design for SNAMP overall and for each team" (Gregory et al 2006).	Review of the workplan overall and for each team. Reviewed in both public meetings and internal meetings.	UCST and team workplans, public and internal meeting notes	Qualitative	Yes
SNAMP uses "stopping rules and clear thresholds [to] identify and/or minimize the perceived risks of failures to species and institutions for SNAMP overall and for each team" (Gregory et al 2006; Plummer and Armitage 2007)	Indicators and thresholds are jointly agreed upon for each team. How is agreement determined? The agreed upon thresholds are used by the USFS. The thresholds have clear meanings and implications to avoid misinterpretation.	Meeting notes (esp annual, internal UCST, and IT), USFS environmental docs	Qualitative	No - specifically not included
SNAMP and the USFS have "sufficient management flexibility and continuity to incorporate new information in revised experimental designs for SNAMP overall and for each team" (Gregory et al 2006)	Analysis of whether the USFS is able to change later prescriptions based on SNAMP lessons learned - Legally as well as procedurally. Can UCST incorporate new information during the project?	USFS environmental docs, SNAMP internal and external meeting notes	Qualitative	Somewhat for UCST and to be determined for USFS
The "proposed AM design does not involve any trade-offs that might be considered taboo by some stakeholders" (Gregory et al 2006).	Do stakeholders have lines already drawn in the sand? Are those who do (have lines drawn) participating or not participating in SNAMP? What are those taboos? Will this cause some groups/individuals to sue?	Interview notes, meeting notes, evaluations	Qualitative	No - specifically not included
Sufficient analytical skills are available (staff or contractors) to design, evaluate, and monitor adaptive management plans" (Gregory et al 2006).	Annual sufficient funding to have the personnel in place to complete workplan and monitoring. Peer review comments and approval of plans, final recommendations and interim publications.	Numbers of UCST employees, change over time, reasons for those changes, funding requests and actual funding levels	Qualitative	To occur after SNAMP ends
SNAMP researchers (ideally familiar with AM) and managers are engaged in the process from the planning stages. They worked together to create adaptive management plan (Reever Morghan et al 2006). SNAMP incorporates the right people and resources to achieve its goals (McGuire 2006).	When were researchers involved and when did managers become involved? How much did they work together to plan the project? Was the project adequately funded all the way through? Were the right people involved from the MOUP and UC to allow the project to move forward? Do the MOUP all bring critical components to the project?	Dates of meetings, attendance lists, meeting notes, interview notes	Quantitative and qualitative	No
Monitoring occurs either during SNAMP (UCST) or after (USFS)? (Keough & Blahna 2005).	Does UCST conduct final monitoring after the treatments are implemented? Does the USFS continue to monitor after SNAMP is complete?	SNAMP records, USFS records	Quantitative	After SNAMP ends, USFS responsible, public to monitor
"Ecological, social, and economic variables are included during data collection, analysis and monitoring" (Keough & Blahna 2005).	Confirmation that these components are included in workplan and occur throughout the project. If not why not?	SNAMP records, meeting notes, interview notes	Quantitative and qualitative	Yes but not economic
"Stakeholders see adaptive management as an effective way to deal with uncertainty" (Gregory et al 2006) .	Stakeholders support SNAMP and its conclusions via comments on final documents and lack of lawsuits.	Meeting notes, interview notes, USFS records, comments on final SNAMP docs	Qualitative	Yes
Decisions are reached through dialogue and diverse inputs are present in decision-making (Plummer and Armitage 2007).	Decisions are made transparent - either during or after deliberations. Diverse opinions are taken into consideration during decision making. Diverse interests are present during decision-making.	Meeting notes, interview notes, USFS records, comments on final SNAMP docs	Qualitative	Yes

Literature in SNAMP Evaluation Table

The table also includes input from participants via interviews conducted from 2008-2010.

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Appendix F2: Affiliation of stakeholders contacted through SNAMP

Affiliation of stakeholders attending SNAMP events:

Federal Agencies

US Fish and Wildlife Service
United States Forest Service, Region 5
United States Forest Service, El Dorado National Forest
United States Forest Service, Sequoia National Forest
United States Forest Service, Sierra National Forest
United States Forest Service, Stanislaus National Forest
United States Forest Service, Tahoe National Forest
United States Forest Service, Pacific Southwest Research Station
United States Geological Survey
Natural Resources Conservation Service
National Park Service, Yosemite National Park
National Park Service, Sequoia/Kings Canyon National Park
Americorps (part of the Corporation for National and Community Service)

State Agencies:

California Air Resources Board
California Department of Fish and Wildlife
California Department of Food and Agriculture
California Department of Transportation
California Department of Water Resources
California Energy Commission
CalFire
California Regional Water Quality Board
California Resources Agency
California State Parks
California Tahoe Conservancy
Lahontan Regional Water Quality Board
San Francisco Regional Water Quality Board
Sierra Nevada Conservancy

Local Government/Collaboratives

Camptonville Community Partnership
Foresthill Forum
Fresno County Agricultural Commission
Madera County Board of Supervisors
Placer County
Placer County Agricultural Commission
Placer County Board of Supervisors
Sutter Yuba Mental Health
Trinity Collaborative
Yuba County Office of Education

Local Water Districts/Councils

Calaveras County Water District
Central Sierra Watershed Committee
El Dorado Water Agency
Fresno and Chowchilla Rivers Watershed Council
Mountain Counties Water Association
Placer County Water Agency
Plumas County Flood Control District
San Francisco Power and Water
Upper Merced River Watershed Council

Local Resource Conservation Districts

California Association of Resource Conservation Districts
Nevada County Resource Conservation District
Placer County Resource Conservation District
Tahoe Resource Conservation District
Tehama County Resource Conservation District

Local Fire Safe Councils/Fire Districts

Amador Fire Safe Council
Camptonville Valley Fire
Foresthill Fire Department
Georgetown Fire Department
Nevada County Fire Safe Council
Mariposa County Fire
Mariposa Fire Safe Council
North Lake Tahoe Fire Protection District
Plumas County Fire Safe Council

Tribes

Mono Rancheria
Tule River Tribe

Industry

California Forestry Association
Pacific Gas and Electric
Sierra Forest Products
Sierra Pacific Industries
Southern California Edison
TSS Consultants
WM Beaty and Associates

Universities/Research

University of California Berkeley
University of California Cooperative Extension
University of California Davis
University of California Merced
University of Minnesota
University of Wisconsin
University of California San Francisco
California Academy of Sciences
Conservation Biology Institute
Prescott College

Conservation organizations

American River Watershed Institute

Bear Yuba Land Trust
California Native Plant Society
Central Sierra Environmental Resource Center
Defenders of Wildlife
Ebbetts Pass Forest Watch
Environment Now
Environmental Defense Fund
Mariposans for Environment and Responsible Government
National Forest Foundation
Quincy Library Group
Pacific Rivers Council
Resources Legacy Fund
Sequoia Forest Keepers
Sierra Club
Sierra Forest Legacy
The Wilderness Society

Other

Bridges to Housing
Calvin Crest Outdoor Education School
Harmony Health
Indian Peak Ranch
Jim Nelson Facilitation
Sierra Business Council
Sierra Institute for Community and Environment
Sound Watershed Consulting
Salvation Army Yuba Sutter
Wildscape Engineering Services
Yosemite Mountain Ranch
Yuba Sutter Corporation

Additional organizations reached through outreach presentations at their events:

State Agencies

California Environmental Protection Agency

Local Government

Amador County Board of Supervisors
El Dorado County Board of Supervisors
Fresno County Board of Supervisors
Kern County Board of Supervisors
Madera County Board of Supervisors
Mariposa County Board of Supervisors
Nevada City Mayor
Placer County Board of Supervisors
Tuolumne County Board of Supervisors

Local Water Districts/Councils

Sierra County Watershed Council
Placer Watershed Forum
Statewide Watershed Forum
Yuba Watershed Protection Council

Local Resource Conservation Districts

Central Sierra Regional Resource Conservation District
Coarsegold Resource Conservation District
Mariposa Resource Conservation District

Tuolumne Resource Conservation District
Yosemite/Sequoia Resource Conservation and Development Council

Local Fire Safe Councils

Butte County Fire Safe Council
El Dorado County Fire Safe Council
Foresthill/Iowa Hill Fire Safe Council
NorCal Prescribed Fire Council
Prather Fire Safe Council
Sierra County Fire Safe Council
Yuba Fire Safe Council
Yuba Watershed Protection & Fire Safe Council

Industry/Business groups

Bass Lake Chamber of Commerce
The Divide Home & Business Show
Mariposa Chamber of Commerce
Oakhurst Board of Realtors
Yosemite Alpine Village Association

Civic groups

49er Rotary Club
Auburn Host Lions Club
Foresthill Lions Club
Oakhurst Rotary Club
Oakhurst Soroptomist Club

Civic /Political Forums

Amador-El Dorado Forest Forum
California Rangeland Conservation Coalition
Oakhurst Democratic Club
Fish Camp Advisory Council
Mountain Community Women
Sierra Dialog
Sierra Day at the Capital Reception
Yosemite Alpine Village Association
Yosemite Stanislaus Solutions Collaborative

Universities/Research

Association for Fire Ecology
Association of Natural Resource Extension Professionals

Conservation Organizations

Audubon Society, Sacramento, Sierra Foothills
California Native Plant Society, Sacramento and El Dorado Chapters
California Rangeland Conservation Association
Sierra Club, Tehipite Chapter
Sierra Foothills Conservancy
Sierra Nevada Alliance
Stewards of the Sierra
The Nature Conservancy
Trout Unlimited, Sac-Sierra chapter
Wilderness Society

Professional Societies

Ecological Society of America

Society of American Foresters Sac-Tahoe, High Sierra, San Joaquin chapters

Society of Range Management

Wildlife Society

Arts/Recreation Groups

Road Scholars

Tenaya Lodge Greenpath

Trailbike Sportsman Association

Yosemite Artists

Youth

Children's Museum of the Sierra

Foresthill High School

Mariposa 4H camp

Minarets High School

Mountain Home School

North Fork Elementary

Oakcreek Elementary School

Oakhurst Elementary School

Rio Americano High School

Yosemite High School

Other

Jack Boyd's Outdoor Education School

High Sierra Volunteer Trail Crew

IDRS Inc.

California Indian Partnership Fair

Appendix F3: SNAMP Newsletters

Fall 2007 - Welcome to SNAMP – The SNAMP project involves resource agencies, the public, and scientists to assess how vegetation treatments to prevent wildfire will affect fire risk, wildlife, forest health, and water quantity and quality. The Forest Service will plan and implement the treatments, while the Science team will independently monitor and study the effects of the projects. The public is invited to provide feedback on the entire process.

Spring 2008 - Forest and Fire Team - The Forest Team will investigate effects of fuel treatments on fire behavior and forest health. Crews are collecting pre-treatment data on forest structure and composition, shrubs and fuels in the 1st 2 years.

Summer 2008 - Water Team - Water Team members will investigate impacts of strategic fuel treatments on water quality and quantity across SNAMP treatment and control catchments prior to and after treatments.

Fall 2008 - Fisher Team - The Pacific Fisher is a State and Federal Species of Special Concern. The fisher study will determine whether the population in the southern study area is stable or decreasing, which vital rate is most important in population change, and which environmental factors are correlated with these changes.

Fall 2008 - Spotted Owl Team - The California Spotted Owl is an uncommon resident in the mixed conifer belt of the west slope of the Sierra Nevada, and a State and Federal Species of Special Concern. This team will assess the impacts of forest fuel treatments on owl territory, occupancy rates and reproductive output.

Fall 2008 - Spatial Team - Geospatial data, or data linked to a place on the surface of the earth, is increasingly a part of our everyday lives and an important resource for environmental study. We are mapping the forest and forest habitat before and after treatments across our treatment and control sites.

Spring 2009 - Participation Team - The Participation Team is studying the Forest Service public participation processes and working to increase stakeholder involvement in SNAMP through regular public meetings and reporting, public outreach, and an interactive website. The Participation Team coordinates and facilitates all SNAMP meetings, field trips, and events. In addition, the Participation Team seeks to facilitate an open dialogue amongst scientists and interested members of the public.

Fall 2009 - Water Team - The Water Team is investigating impacts of strategic fuel treatments in SNAMP study areas on both water quantity and quality in headwater catchments of treatment and control firesheds. The goal is to better understand the water storage in and movement through the catchments: how the water begins as snow or rain, interacts with the landscape, and eventually exits the system as stream discharge.

Spring 2010 - Fire Integration Project- This study compares the performance of fuel management strategies currently being implemented on Forest Service lands in the Sierra Nevada using fire behavior modeling to better understand how fuel management treatments are implemented in real landscapes, and if these treatments perform as theory predicts.

Fall 2010 - Fisher Team - The Fisher Team goals include: (1) determining the population parameters and limiting factors for the Pacific fisher; and (2) evaluating the effects of fuel reduction treatments on resource use, survival, and population persistence of Pacific fisher. The fisher team has captured and radio collared 66 individual fishers since the start.

Spring 2011 - Owl Team - The Owl Team is studying the effects of treatments on spotted owl site occupancy, survival and reproduction. The owl team is collecting pre- and post-treatment data on vegetative structure within owl territories to estimate the effects of treatments on owl habitat. The owl team just finished their 4th field season and are currently analyzing the data.

Spring 2011 - Spatial Team - The Spatial Team is using Lidar data to map forests before and after vegetation treatments and measuring forest habitat characteristics across treatment and

control sites. Airborne Lidar (light detection and ranging) works by bouncing light against a target in a similar way to sonar or radar.

Winter 2011- Forest Fuels Treatment Field Trip - The October 2011 SNAMP field trip to the Last Chance study site showed fuels treatment on the ground. Here we retrace our steps, review the stops of the field trip, and highlight some of the significant conversations and realizations made by participants. This field trip provided the opportunity to examine the fuel treatments for the first time and provide a forum for learning through discussion and dialogue.

Fall 2012 - Water Team - The Water Team is exploring: (1) What are the timing and amount of water storage and routing in forested Sierra Nevada catchments? (2) What effects do forest treatments have on water quality, quantity (yield), storage and routing through the catchments? And (3) What is the transferability of information from four intensively measured headwater streams to a larger area fireshed response?

Spring 2014 – Integration - The Public Participation team discusses the SNAMP integration effort, which will provide a comparative framework that examines the resources we are evaluating: water, wildlife, and forest health, and the role of public participation in collaborative adaptive management (CAM). The goal is to enable managers and other stakeholders to compare the effects of SPLATs across resources.

Fall 2014 - IT Meeting Wrap up - We are in the midst of a very busy final year as each team continues to work on data analysis, integration and final report writing. Part of our SNAMP commitment is to provide opportunities for all stakeholders to participate in meetings where information is shared and ideas exchanged. In this vein, each Science Team participated in either an in-person meeting or webinar to inform SNAMP participants of their current results and integration metrics. This newsletter is intended to provide one more link to the study and results, as well as to help better prepare participants for the Annual Meeting webinar on November 6, 2014.

Appendix F4: SNAMP Videos

Fisher Wildlife Team Webinar (October 2013): Dr. Craig Thompson of the SNAMP Pacific Fisher Team participated in a webinar today in which he presented an overview of the team's camera survey, reproduction, survival, and dispersal data for 2013. He also gave details about the metrics that will be used to integrate fisher data with the other SNAMP teams, including occupancy, intensity of use, and reproductive habitat quality, as well as the priorities for the Fisher Team in 2014

Pacific Fisher Survival vs. Predation (date): In our recent field trip with the Fisher Team, Dr. Rick Sweitzer shared some of the interesting findings regarding the survival and predation of Pacific Fishers in the Sierra Nevada forests. This field trip was organized by SNAMP.

Pacific Fisher Kits (date): In this video, Dr. Rick Sweitzer gives an explanation to why fishers would move their kits to different den trees?

California's Water Tower (date): This episode of Onward California follows Roger Bales, director of the Sierra Nevada Research Institute at UC Merced, into the mountains to measure the water and geochemical balance of the landscape. The impact of climate change on California's water supply is more than an environmental concern -- it's at the forefront of economic sustainability.

California Spotted Owl Science in the Sierra Nevada (March 2012): This video gives updates on the studies on California Spotted Owl done by the SNAMP Owl team and created by Participation Team.

Science on Forest Health (date): This video describes the science on forest health being done by the SNAMP Fire and Forest Ecosystem Health team.

SNAMP Picture Series - "What is SNAMP?" (March 2011): This short video created by Participation Team offers a brief introduction to SNAMP through a series of pictures and text.

Public Participation in Collaborative Adaptive Management (July 2010): This video created by Participation Team discusses the role of public participation in SNAMP and features SNAMP scientists / participants.

Spotted Owl Video (July 2010): This short video features SNAMPs Kim Ingram talking about a spotted Owl fieldtrip. It was created by Jeannette Warnert with UC Ag and Natural Resources.

Fisher Video (October 2008)**:** This video about the pacific Fisher features SNAMP scientist Rick Sweitzer. It was created by Jeannette Warnert with UC Ag and Natural Resources.

The Sierra Nevada Adaptive Management Project (October 2008): This overview video about SNAMP features several SNAMP scientists. It was created by Jeannette Warnert.

Appendix F5: SNAMP UCANR Green Blog Stories

Can be found at http://ucanr.edu/blogs/Green/

7/9/2010	Scientists track the California spotted owl
10/8/2010	Pacific fisher kits returned to the wild
12/15/2010	Wireless networks could improve state water forecasting
2/23/2011	Do CA Spotted Owls prefer to nest near forest edges? SNAMP scientists say No
6/15/2011	Scientists complete eventful fisher monitoring season
9/28/2011	US Forest Service and UC study ways to reduce wildfire
12/14/2011	UC Wildlife team looking for single socks
1/18/2012	You socked it to us!
2/29/2012	Using Lidar to map forest structure and characterize wildlife habitat
6/13/2012	Visualizing the forest
9/26/2012	Web-based tools' contribution to public participation and natural resource management
12/18/2012	Evidence of rodenticide poisoning of wildlife found in the Sierra
4/15/2013	Fire ecology - a "hot" career to attract students to science
7/25/2013	Roadkill is a serious threat to rare wildlife populations
11/8/2013	Generating energy from forest products
2/27/2014	What happens when a wildfire sweeps through your study area?
6/4/2014	Taming Sierra flames
9/19/2014	Calendar with rare Pacific fisher photos available from UC Cooperative Extension
11/13/2014	The effects of density and high severity fire on tree and forest health

Appendix F6: SNAMP Collaborative Adaptive Management Curriculum

Facilitation Skills for a Collaborative Adaptive Management Process: A workbook to train natural resource managers and stakeholders in facilitation of collaborative projects

By the University of California Cooperative Extension
January 2014

Collaborative Adaptive Management (CAM) is many things to different people. It is based on the premise that ecosystems are complex, dynamic and unpredictable. It involves deliberate experimentation that provides information to resource managers on appropriate spatial and temporal scales. CAM is a participatory process that engages scientists, stakeholders and managers in a relationship based on shared understanding and learning that assesses and evaluates the values and implicit assumptions that underline management goals.

A team of University of California Cooperative Extension (UCCE) professionals based on their experiences facilitating civic engagement in agriculture, natural resources, nutrition and youth development has developed a series of curriculum modules and workshops to help engage people with the CAM process.

The curriculum was refined through a series of workshops offered by UCCE to SNAMP scientists, managers and stakeholders in Winter, Spring and Summer 2013. Their CAM curriculum is available here as a download.

http://snamp.cnr.berkeley.edu/documents/574/

Appendix F7: Participation Team Paper Abstracts

Huntsinger, L. and A. Sulak. (in preparation) Third party monitoring and the evolution of National Forest Management

In 1905 Gifford Pinchot took the Division of Forestry and created the US Forest Service with his vision of conservation: “the greatest good for the greatest number for the longest time." His goal was to create a cadre of professional forest managers able to make the best decisions and develop the science needed to manage a resource crucial to the nation. Since then, and as vehement controversy persists, the management models for forests and rangelands have evolved to include multiple use, public participation, and now, adaptive management. Relationships between the land management agencies, and the public, are considered key to making decisions and even conducting science for resource management. But is there a third step on the horizon? The Sierra Nevada Adaptive Management Project can be seen as a case study for exploring the potential evolution of a three way model for natural resource management that includes the agency, the public, and a monitoring or science participant. Three historical periods can be used to represent three major phases in the development of the public role in Forest Service decision-making: the early 20th century, the post-war period, and beyond the 80’s.

Kelly, M., S. Ferranto, S. Lei, K. Ueda, and L. Huntsinger. 2012.. Expanding the table: the web as a tool for participatory adaptive management in California: a case study in the Sierra Nevada. Journal of Environmental Management 109:1 - 11. [http://dx.doi.org/10.1016/j.jenvman.2012.04.035]

Participatory adaptive management is widely promoted as the new paradigm in public lands management. It is grounded in two underlying principles e that management experiments and diverse sources of information should be used to continually refine management in complex ecological systems, and that the public must be included throughout the adaptive management process. Access to scientific results and exchange of information is at the core of both of these principles. The recent proliferation of Internet communities and web-based participation tools raises the question of how the Internet might help facilitate information exchange in participatory

adaptive management. Using a case study approach, the role of web technologies in facilitating the flow of transparent and useful information was examined in a participatory adaptive management project focused on Forest Service vegetation management treatments in California's Sierra Nevada. Three evaluation methods were used: analysis of web usage and content, a survey of active participants, and a review of comments posted to the project website. Results suggest that the web played an important role throughout the adaptive management cycle by supporting communication through disseminating information to the public and increasing the transparency of the scientific process. The web played a small, but important role in public consultation, by providing a forum for targeted questions and feedback from the public. Internet technology did not actively support the two-way flow of information necessary for mutual learning. Web technology complements face-to-face interactions and public meetings, rather than replacing them.

Kocher, S., Lombardo, A., and R.A. Sweitzer. 2012. Using Social Media to Involve the Public in Wildlife Research—the SNAMP Fisher Sock Collection Drive, February 2013. Volume 51(1).

The University of California Cooperative Extension used social media to solicit donations to support studies on the Pacific fisher, a rare forest-dwelling weasel, conducted by UC scientists. The social media campaign included blog and Facebook postings, news releases, and tweets requesting donations of single socks. Socks were donated from around the state and nation, with 82% coming from urban areas. The drive was successful at securing resources to support wildlife studies while at the same time extending outreach to new non-local audiences. The major challenge was developing the local logistical support to deal with the overwhelming influx of donations.

Lei, Shufei , A. Iles, and M. Kelly. (2015) Characterizing the networks of digital information that support collaborative adaptive forest management in Sierra Nevada forests. Environmental Management 56(1): 94-109.

Some of the factors that can contribute to the success of adaptive co-management – such as social learning, open communication, and trust - are built upon a foundation of the open exchange of information about science and management between participants and the public. Despite the importance of information transparency, the use and flow of information in adaptive co-management is rarely characterized in detail in the literature, and there are opportunities to develop strategies for increasing the exchange of science and management information in such contexts. As digital information channels and networks have increased over the last decade, powerful new information monitoring tools have also evolved allowing for the complete characterization of information products through production, transport, use, and monitoring. This study uses these tools to characterize the use of various science and management information products in a case study - the Sierra Nevada Adaptive Management Project (SNAMP) - using a mixed methods (citation analysis, web analytics, and content analysis) approach borrowed from the information processing and management field. The results from our case study show that information technologies and systems greatly facilitate the flow and use of digital information, leading to multiparty collaborations such as knowledge transfer and public participation in science. We conclude with recommendations for increasing information exchange in ACM by taking advantage of available information technologies, systems and networks.

Lei, S. and M. Kelly. (2015) Evaluating adaptive collaborative management in Sierra Nevada forests by exploring public meeting dialogues using Self-Organizing Maps. Society and Natural Resources. DOI:10.1080/08941920.2015.1045645

Self-organizing maps (SOM) were used to explore multi-year public discussions associated with a forest management case study in the Sierra Nevada in order to understand whether and how adaptive co-management has facilitated discussion in a contentious environmental management setting. Input textual data consisted of the questions and responses from public meetings (2005-2012) in which scientific results, project progress, and other issues were discussed. We found that public discussion remained focused on the project content, yet the more contentious and critical issues dominated the discussions through time. Integration across topics could be improved. These results suggest that adaptive co-management in SNAMP has been successful in

sustaining engagement and facilitating focused discussions among the contentious participants in the project. The SOM was an effective and efficient unsupervised machine-learning tool for organizing, distilling and making sense of unstructured and unorganized meeting notes, and might be explored more often for this kind of analysis.

Lei, S., and M. Kelly. (in preparation). Mapping the dynamics of social resilience in a forest management setting: Use of affiliation network analysis of public meetings and participants in the Sierra Nevada Adaptive Management Project. Environmental Management

Adaptive co-management is widely seen as the appropriate management regime for dealing with complex social-ecological systems, and to ensure ecological and social resiliency in these systems. More work has been devoted to understanding the ecological resilience of social-ecological systems; in this paper, we concentrated on the social resilience of a forest management system and modeled its social resilience framework using social network analysis. Our objectives were: 1) to quantitatively characterize aspects of social resiliency of adaptive co-management for a social-ecological system through affiliation network analysis of attendance data; and 2) to understand which factors in our project contributed to its social resilience. Our participants included managers from federal and state natural resource agencies and the public. We examined 7 years of attendance data at all public meetings associated with the Sierra Nevada Adaptive Management Project (SNAMP) and constructed a 2-mode affiliation social network that allowed us to ask questions about project cohesiveness, participation, and overall social resilience. Affiliation network analysis helped us evaluate critical aspects of the SNAMP social network, for example, the geographic and core-periphery patterns, the importance of individuals and particular public meetings were highlighted, and the dynamics of the network and its ability to withstand external perturbations were evaluated. In this case study, the SNAMP program showed aspects of social resiliency in the face of exogenous stressors. Important to the success of the SNAMP network were: 1) the ability of members of the management and public groups to become leaders; 2) the project norms of transparency and science integration; and 3) a flexible governance structure.

Sulak, A., Huntsinger, L. and S. Kocher. (2015). UC plays a crucial facilitating role in the Sierra Nevada Adaptive Management Project. California Agriculture. 69(1):43-49.

The Forest Service's 2004 Sierra Nevada Forest Plan Amendment calls for using participatory adaptive management to carry out treatments to improve forest health and reduce fire severity. The Sierra Nevada Adaptive Management Project began in 2005 and includes the University of California as a third party science and outreach provider in two Sierran national forests as part of a seven-year adaptive management project. University of California Cooperative Extension expertise in facilitating stakeholder participation is a crucial part of the project. Respondents to a 2010 email survey sent to an Extension outreach list valued the learning opportunities of the project, especially appreciating the open discussions, public input, and face-to-face contact with scientists. Despite the institutional and technical limits to power-sharing, an environment conducive to the social learning characteristic of democratic collaborative projects was created, and may lead to long term relationships that support use of project findings well after the University role in conducting the project has ended.

Sulak, A., and L. Huntsinger. 2012. Perceptions of forest health among stakeholders in an adaptive management project in the Sierra Nevada of California. Journal of Forestry 110:312-317.

"Forest health," a term broadly used in US forest management, has been described as a normative term that implies one ecological state is better than another and as a positive goal for forests that stakeholders can rally around. The definitions stakeholders brought to a participatory adaptive management program in central California may be thought of as reflective of mental models shaped by experience and culture. Perceptions of forest health and the potential link to ideas about management were assessed through 42 in-depth interviews of individuals concerned about forests in the study area. Four views of forest health emerged, characterized here as oriented to biodiversity, ecological processes, history, and management. These were not clearly linked to divergent opinions of what participants consider appropriate forest management tools. Definitions were not mutually exclusive or rigid, revealing opportunities for reconciliation and social learning. Working to establish unified ecological goals has been suggested as a first step

for collaborative and participatory projects. Longer-term participants tended to espouse the process-oriented view of forest health, perhaps reflecting the development of a hybrid culture of shared meanings, norms, and expectations about team processes fostered through the social learning that is key to adaptive management.