Photo by Jonathan Long. *Scientists study response of Baldwin Meadow to a prescribed burn treatment, with the area burned by the Emerald Fire in the background.*

Symposium Organizers: Jonathan W. Long and Patricia Manley

NAC20 Program Topic: Managing fire regimes in a changing world (good fire/bad fire)

Description: The symposium will discuss science findings to inform management as part of the Lake Tahoe West Restoration Partnership, which involved co-production of scientific research into effects of different management strategies to promote social and ecological resilience. This symposium will include an introductory presentation on the assessment and final strategy (Gross), followed by an overview of the core modeling of social and ecological important indicators (above), results from vegetation and wildlife habitat modeling (White), results from snow modeling (Krough and Harpold), and lessons learned (DiVittorio), followed by a panel discussion. The symposium will address several conference topics.

Registration

Presentation Title: Key planning tools for the Lake Tahoe West Restoration Partnership: Resilience Assessment And Restoration Strategy

Presenters: Shana Gross and Sarah Di Vittorio

Abstract: The Lake Tahoe West Restoration Partnership (LTW) is a multi-agency, collaborative effort to increase the resilience of the forests, watersheds, recreational opportunities, and communities on Lake Tahoe's west shore. Lake Tahoe West's resilience-based approach emphasizes scaling up and accelerating restoration efforts to address a large landscape and all land ownerships, planning for a dynamic and changing future, and addressing a comprehensive set of landscape values. Through an iterative process, with manager, stakeholder and scientist input, ecological and social landscape values and services, and primary disturbances that are important to understand the current state of resilience of the west shore were identified and evaluated in a Landscape Resilience Assessment (LRA). The LRA used quantitative and spatially explicit data to compare current conditions to historic and/or contemporary reference conditions to determine which portions of the landscape and which landscape values and services are the least resilient to disturbances. The LRA results indicated that much of the Lake Tahoe Basin's west shore is likely not resilient to a variety of disturbances. The LRA, combined with computer modeling and expertise to better understand risks and likely outcomes of different treatment approaches, provided the foundation for development of a science-based Landscape Restoration Strategy (LRS). The LRS guides watershed and forest restoration approaches on the west shore over the next two decades to increase social-ecological resilience. The LRA and LRS are foundational products that support landscape level planning. They reflect an extraordinary amount of collaboration and consensus building among agencies, scientists, and stakeholders. This talk will discuss how the LRA and LRS were developed, focusing on key components of the methods, and how the results were translated into actionable management projects

Presentation Title: Modeling social-ecological systems as part of the Lake Tahoe West Restoration Partnership

Presenters: Jonathan W. Long and Patricia N. Manley

Co-authors: Charles J. Maxwell, Robert M. Scheller, Angela M. White, Stacy A. Drury, Mariana Dobre, William J. Elliot, Erin S. Brooks, Mason Bindl, Adrian A. Harpold, Sebastian A. Krogh-Navarro, Samuel G. Evans, Timothy G. Holland, Matthew D. Potts, Eric S. Abelson, Keith M. Reynolds, Brandon M. Collins, Keith M. Slauson, Becky Howard, and Alec M. Kretchum.

Abstract: Collaborations between scientists and land managers are increasingly important to guide large landscape restoration efforts. Efforts to promote social-ecological system resilience depend upon scientific frameworks for evaluating how different potential management strategies will influence ecological and social indicators across broad spatial and temporal scales. These efforts involve collectively identifying indicators and thresholds that reflect desired future outcomes and then projecting how different management strategies will perform given changes in future climates. As part of the Lake Tahoe West Restoration Partnership, a science team worked with resource managers and stakeholders to model future forest ecosystem dynamics in response to five management scenarios over 100 years across a 60,000-acre landscape in the Lake Tahoe basin of California and Nevada. Forest growth and fire dynamics were modeled using the LANDIS-II landscape platform, on which we based additional modeling to evaluate changes in wildlife habitat, water, and economics. We evaluated how the different management strategies would affect outcomes important to stakeholders, including abundance of old trees, wildlife habitat, fine sediment, water quantity, implementation costs, fire characteristics and threats, air quality, cultural resource quality, and carbon sequestration. The scenarios spanned a wide range of management inputs, from wildfire-suppression only, fuels reduction near communities, moderate and extensive restorative thinning and/or prescribed burning, all under different future climates. The team found that moderate and extensive thinning or burning treatments would promote overall objectives better than no treatment or community protection only, with the exception of carbon sequestration and treatment costs. Over the long-term, more treatment would reduce the wildfire threat to communities, the risk of unnaturally large patches of high intensity burns, and days of extreme emission of smoke into downwind communities. More extensive treatments were projected to increase water yield and promote the growth and occurrence of pine and aspen trees. The modeling considered how increased treatments, especially burning, might promote cultural resources important to the Washoe Tribe, who consider Lake Tahoe the center of their ancestral home. Ramping up the amount of prescribed burning, however, would pose risks to water and air quality, which could be mitigated with careful planning. Managers and stakeholders used the findings of this integrated modeling effort to inform the design of a landscape restoration strategy that balanced risks and benefits based on a robust scientific foundation.

Presentation Title: Simulating wildlife habitat dynamics to inform best management strategies under a changing climate

Presenter: Angela M. White

Co-authors: Timothy Holland, Eric Abelson, Alex Kretchun, Charles Maxwell and Robert Scheller

Abstract: Many forests of the western United States have undergone over a hundred years of anthropogenic impacts that have led to increased tree density, homogenization in forest structure, and accumulation of woody material, all of which pose threats to valued social and ecological features. Forest conditions in California are particular extreme, as evidenced by recent waves of tree mortality and unprecedented large and destructive fires. Collaborative approaches to finding solutions have been identified by the US Forest Service as key to making restoration progress. In California, the US Forest Service and collaborators recently formed a science-management partnership intended to increase the pace and scale of forest restoration on a 60,000 ac landscape in Lake Tahoe. Using LANDIS-II we modeled how forest management and natural disturbance processes (such as wildfire and bark beetle outbreaks) alter habitat for terrestrial vertebrate species over the next century on the west shore of Lake Tahoe. Although wildlife populations are susceptible to many stressors, we assumed that the probability of a species' persistence over the long-term would in part be determined by the maintenance and configuration of high-quality reproductive habitat patches on the landscape. Suitable reproductive habitat for upland-associated vertebrates was interpreted at each decadal time step. Results suggested that the average number of species with high-quality habitat was expected to increase under all scenarios due to forest growth out-pacing stand replacing disturbances. Scenarios that incorporated more aggressive treatments led to the highest mean performance of biodiversity metrics including species richness, redundancy in ecological function, and diversity supported in early, mid and late seral habitat conditions. This highly collaborative effort has enhanced our understanding the effectiveness of different management actions in achieving desired outcomes, while addressing significant uncertainties, such as the impacts of climate change.

Presentation Title: Developing snowpack/forest management support tools for montane forests in the Sierra Nevada

Presenter: Sebastian Krogh

Abstract: Montane snowpack in the Sierra Nevada provides critical water resources for ecological functions and downstream communities. Understanding the effect of forest removal (e.g. forest thinning) on the snowpack in montane forests is critical to designing effective strategies that account for the co-management of several ecological services such as wildlife habitat, soil erosion, and water quality and quantity. Given the complex and heterogeneous effects that the forest canopy exerts on snow accumulation and melt, and the need to include different climates and forest structures, a multi-site, high-resolution study is required to understand how forest thinning affects snowpack over large areas. Here, we apply a high-resolution (1-m) state-of-the-art snow model to simulate the impact of forest thinning on the snowpack across a variety of sites with lidar-based forest characterization in the northern Sierra Nevada. The snow model is an ideal tool to study the influence of forest thinning on snow pack because it explicitly represents many of the physical processes affecting the snowpack mass and energy balance in the forest, such as tree shading, wind redistribution of snowfall, and canopy interception and sublimation of snowfall. The model is run with the current lidar-based forest structure (height and density), and two virtual thinning scenarios in which trees below 10 and 20-m are removed, during wet and dry years. This multi-site and-year approach allow us to quantify the impact of forest thinning on melt volumes across a gradient of climates and forests conditions, where current dry/warm places may serve as a proxy for future warmer and drier conditions in the Sierra Nevada. The wide range of snowpack conditions and forest structures represented in this study enables us to create a decision support tool that can be extrapolated to sites with different environmental conditions. This tool is expected to help guide ongoing and future forest thinning strategies in the Tahoe Basin that aim to increase melt volumes and mitigate the historically declining snowpacks in the region.

Presentation Title: Collaborative Science for Landscape Management: Lessons Learned from the Lake Tahoe West Restoration Partnership

Presenters: Sarah Di Vittorio, Shana Gross.

Co-author: Kathleen McIntyre

Abstract: As part of the Lake Tahoe West Restoration Partnership, scientists, land managers, and stakeholders undertook a collaborative modeling effort to inform comprehensive landscape restoration across more than one-third of the Lake Tahoe Basin. This presentation will discuss lessons learned for conducting collaborative, management-relevant science. The goal of the modeling effort was to understand likely outcomes of different management approaches under a changing climate up to 100years into the future to inform a collaborative landscape restoration strategy. Participants identified several key lessons that may inform future collaborative science, as follows. Collaborative modeling can help diverse interests agree on restoration goals and thresholds, understand possible futures, evaluate tradeoffs between key values, and develop a consensus-based vision and approach for restoring a complex landscape. However, collaborative modeling particularly in a large process with multiple teams and agencies involved requires a large time and resource investment. Participants should clarify expectations regarding goals, timelines, and workloads at the start of the process, and design the project to balance these needs. The need for new science should emerge from the collaborative process's participants identify key questions and uncertainties essential to resolve disagreements and inform management. Collaborative science should focus on addressing these key uncertainties and questions and avoid more peripheral topics. Choice of models should be collaborative and informed by clear understanding of the models' capacities and limitations. Highly technical content and long timelines for collaborative science will pose barriers for some participants, such as stakeholders representing local community interests; process design should factor in level, type, and timing of engagement needed for different participants. Finally, collaborative science efforts would benefit from facilitation by trained facilitators with technical competence and science training in the fields being analyzed.