Southern Sierra Science Symposium

Thursday, September 4, 2008

Visalia, California

Hosted by USDA, Forest Service-Sequoia National Forest/Giant Sequoia National Monument and Pacific Southwest Research Station; USDI, Park Service-Sequoia and Kings Canyon National Parks; and USDI United States Geological Survey-Western Ecological Research Center

REPORT

Prepared by Rebecca Reynolds Consulting

Background/Overview

The Sierra Nevada region is of vast importance to the well being of the nation, not only for its abundant recreational opportunities, but as the main source of California's thriving agriculture, energy production, and domestic water supplies. This relatively intact ecosystem provides an array of ecosystem services to the people of California, the country, and the world. Landscape change, including the effects of global climate change, shifting fire regimes, patterns of human land use, and other ecosystem stressors could have a significant influence on the natural resources associated with this area. The interaction of environmental and cultural stresses with global climate change is likely to be synergistic. Understanding these changes is vital to land managers in their efforts to make informed and sound land management decisions.

In recognition of this, four entities under three federal agencies entered into a cooperative agreement in January 2008 to jointly develop a program of research, resources management, and public education to help mitigate the impacts from and adapt to climate change effects on ecosystems of the Southern Sierra Nevada. These entities include: the USDA, Forest Service-Sequoia National Forest/Giant Sequoia National Monument (FS/GSNM) and Pacific Southwest Research Station (PSW); the USDI, Park Service-Sequoia and Kings Canyon National Parks (NPS); and the USDI United States Geological Survey-Western Ecological Research Center (USGS).

As a first step in this effort, the agencies agreed that a session would be needed to learn from science experts about the current state of science research and how it is being used in management decisions and practices. The agencies immediately saw this session as an opportunity to involve the public in learning and sharing ideas and information. It was decided to hold a science symposium open to the public that would provide a platform for scientists to share their knowledge.

The Southern Sierra Science Symposium was conceived as a starting point for all involved and a foundation for the collaborative development of a science agenda to address questions and concerns related to climate change and other ecosystem stressors. The symposium took place on September 4, 2008 and was organized around broad scale environmental "agents of change" affecting the Southern Sierra ecosystems (including Giant Sequoia groves): Climate Change, Fire, Forest Management, Pollutants and Invasives. Two scientists for each of these were invited to present: the first on the current research and the second on how the research informs land management. In addition to these ten scientists, there was a keynote speaker and two scientists invited to respond to these agents of change with regard to wild life and humans.

The thirteen presenters each used PowerPoint presentations, links to which are included below. They also provided abstracts of their talks, which follow this section.

The symposium was attended by nearly 200 attendees representing the public, land management agencies, academics, public interest groups and others. The symposium was augmented by a poster session of current science research projects and was followed the next day by a series of round table discussions between the scientists to begin to develop a broad list of information needs related to climate change and the future of the Southern Sierra Nevada ecosystem. From this work, a smaller group will develop a draft science agenda, which will be shared with the public to garner additional ideas about this important effort. The draft science agenda is anticipated to be ready for review in the spring of 2009.

Speaker Abstracts

Tony Westerling (UC Merced) We present preliminary results of the 2008 Climate Change Impact Assessment for wildfire in California, part of the second biennial science report to the California Climate Action Team organized via the California Climate Change Center by the California Energy Commission's Public Interest Energy Research Program pursuant to Executive Order S-03-05 of Governor Schwarzenegger. In order to support decision making by the State pertaining to mitigation of and adaptation to climate change and its impacts, we model wildfire occurrence monthly from 1950 to 2100 under a range of climate scenarios from the Intergovernmental Panel on Climate Change. We use six climate change models (GFDL CM2.1, NCAR PCM1, CNRM CM3, MPI ECHAM5, MIROC3.2 med, NCAR CCSM3) under two emissions scenarios--A2 (C02 850ppm max atmospheric concentration) and B1(CO2 550ppm max concentration). Climate model output has been downscaled to a 1/8 degree (~12 km) grid using two alternative methods: a Bias Correction and Spatial Downscaling (BCSD) and a Constructed Analogues (CA) downscaling. Hydrologic variables have been simulated from temperature, precipitation, wind and radiation forcing data using the Variable Infiltration Capacity (VIC) Macroscale Hydrologic Model. We model wildfire as a function of temperature, moisture deficit, and land surface characteristics using nonlinear logistic regression techniques. Previous work on wildfire climatology and seasonal forecasting has demonstrated that these variables account for much of the inter-annual and seasonal variation in wildfire. The result of this study is monthly gridded probabilities of wildfire occurrence by fire size class. In this presentation we will describe climatic drivers of wildfire in California forests and explore the range of modeled outcomes for wildfire in the Sierra Nevada Mountains.

Nate Stephenson (USGS) In the twelve years since completion of the comprehensive Sierra Nevada Ecosystem Project (SNEP), ongoing climatic warming and its effects have become quite evident in the Sierra Nevada and across the West. Since 1979, the Sierra Nevada has warmed by roughly 2° F, with somewhat greater warming at highest elevations. Glaciers continue to melt, more precipitation is falling as rain rather than snow, and winter snowpacks are melting earlier in the spring. The consequent lengthening and deepening of the summer drought has lengthened the fire season. Plants and animals apparently also have been affected by the warming; many vertebrates have moved up in elevation, and tree mortality rates have doubled. These recent changes may foreshadow greater changes yet to come. If future warming follows current projections, over the next few decades we can expect to see profound changes in Sierra Nevada ecosystems and their services. Yet our understanding of these future changes is, at best, qualitative; we cannot predict the future with precision, and surprises are inevitable. Fortunately, this uncertainty does not mean we cannot act. Rather, it means we need to think in new ways and adopt new approaches to natural resources management.

Connie Millar, USFS PSW We offer a conceptual framework for managing forested ecosystems under an assumption that future environments will be different from present but that we cannot be certain about the specifics of change. We encourage flexible approaches that promote reversible and incremental steps, and that favor ongoing learning and capacity to modify direction as situations change. We suggest that no single solution fits all future challenges, especially in the context of changing climates, and that the best strategy is to mix different approaches for different situations. Resources managers will be challenged to integrate adaptation strategies (actions that help ecosystems accommodate changes adaptively) and mitigation strategies (actions that enable ecosystems to reduce anthropogenic influences on global climate) into overall plans. Adaptive strategies include resistance options (forestall impacts and protect highly valued resources), resilience options (improve the capacity of ecosystems to return to current conditions after disturbance), and response options (facilitate transition of ecosystems from current to new conditions). Mitigation strategies include options to sequester carbon as well as reduce overall greenhouse gas emissions. Priority-setting approaches (e.g., triage), appropriate for rapidly changing conditions and for situations where needs are greater than available capacity to respond, will become increasingly important in the future.

Jan van Wagtendonk (USGS) Over a decade has passed since the Sierra Nevada Ecosystem Project reported on the state of our knowledge about fire in the range. Additional fire history studies have added to and reinforced the information concerning the historical role of fire. Studies on the effect of season of burning have shown ramifications for invasive species, fuel reduction, and arthropod populations. The interplay multiple fires has provided insight on spatial patterns and extent of lightning fires allowed to burn under prescribed conditions. The availability of data on the location, time, and characteristics of lightning strikes enables the analysis of ignition patterns as they affect fire regimes. Perhaps the biggest advance has been made in quantifying the severity of fires using satellite imagery. This ability has led to numerous investigations on the spatial and temporal patterns of fire severity and the implications of those patterns on vegetation, animals, invasive species and fire regimes. These new frontiers in fire science allow mangers to better incorporate fire into their land management programs.

Scott Stephens (US Berkeley) Fire continues to receive great attention from policy makers, the media, land managers, and the public. The 2008 California fire season has been described at a catastrophe, disaster, and something that should never happen again. However the area burned in forests in 2008 is approximately what burned pre-historically (pre 1800) and smoky skies in the summer and fall were probably the norm before Euro-American settlement. Allowing more burning with strong considerations for public health is desirable versus inevitable wildfires. Many managers in the last decade have focused on reducing fire hazards in Sierra Nevada forests. The use of prescribed fire and fire surrogates has been applied and research has been produced in the last five years that explores the differences and similarities of common fuel reduction treatments. A great challenge is scaling up fuel treatments to landscapes scales, a recent collaborative project between the USFS, State of California, the UC system, and other partners, is underway to investigate this issue. The use of managed lightning fires in remote areas has occurred in some Sierra forests for 30 years and information from these areas can help mangers design programs in other areas; allowing more wildland fire use and appropriate management response fire management may be the only way to re-introduce fire into Sierra ecosystems at even moderate spatial scales. Changing climates necessitates forest management strategies that increase resistance and resiliency. Desired forest conditions that explicitly include spatial variation are more likely to incorporate natural disturbances and stresses of the future. Sierran ecosystems will increasingly be managed for sustainable water yields, reduced fire hazards, and carbon sequestration although exactly how to achieve these goals is not clear. Policy development will therefore need to be flexible and adapt to ever changing conditions.

Malcolm North (USFS PSW) A central challenge in managing Sierran forests has been trying to reduce fuel accumulations from decades of fire suppression without adversely impacting ecosystem attributes. In particular, fuels treatments are often slowed or stalled by concerns for maintaining or improving habitat for threatened species. Over the last decade, however, substantial ecological and silvicultural research suggests practices could be modified to reconcile some of these different objectives. Historically fire was the strongest evolutionary force shaping ecosystem processes and forest structure. Reconstruction studies suggest fire intensity and frequency topographically varied by moisture micro site within stands, and by slope position and aspect across watersheds. Managing fuels and forest structure to match these scales of variability could provide different wildlife habitats. These conditions would include areas of dense canopy cover associated with sensitive species such as the California spotted owl and Pacific fisher, and more open forest and shrub conditions favored by other species including several important small mammal prey. While fire appears essential to restoring many ecosystem processes, prescribed burns cannot be applied in some conditions. Mechanically manipulating fuels and forest structure by topography, however, may still be a cautious approach to partially mimicking historical conditions and influencing burn intensity when wildfire occurs. A silviculturist, Kevin O'Hara, is currently developing marking guidelines based on a tree's canopy strata position rather than diameter, and varying thinning treatments by species, and micro and macro topographic location. Topographically varying fuel load and forest structure may be a cautious approach to managing Sierran forest in congruence with the disturbance force that historically shaped their ecological processes.

John Battles and Rob York (UC Berkeley) The pervasive impact of human enterprise on the structure and function of ecosystems poses a fundamental challenge to environmental scientists, to resource managers, and to society. We are experiencing rapid directional change in many drivers of ecosystem dynamics (Chapin et al. 2007). A new ecological world order (sensu Hobbs et al. 2006) is emerging where few of the existing rules of stewardship and management apply. Our goal as scientists and managers is to develop strategies that do something effective - that don't just let the forests succumb to the inevitable warming climate, to the possible mass migration of species, or to the increased risks of catastrophic disturbances.

The southern Sierra Nevada, an area of approximately 30,000 km2, is a big, contiguous, forested area that is administered to a large extent by federal agencies. Given the scarcity of intervening urban or agricultural landscapes and the presence of steep environmental gradients, this ecosystem has the potential to respond resiliently to perturbations associated with global change. Species can move; disturbances can run their course; refugia can be found. In these respects, the southern Sierra Nevada ecosystem provides an ideal venue for learning.

We have no answers but we do suggest an approach. 1) The artificial boundaries between the thinkers (i.e., the basic scientists) and the doers (i.e. the forest managers) must be taken down. 2) We need to explore many alternatives simultaneously with the best available science and practice. 3) We should expect and accept some failures. 4) We must ensure that we mine failures as well as successes for insight. In this talk, we explore how such an approach might inform the specific case of conserving and managing giant sequoia groves in the southern Sierra Nevada.

Ricardo Cisneros (USFS) Air pollution generated from urban and agricultural areas have pronounced effects on forests and other ecosystems of the Sierra Nevada. Air quality is also very important for the health of people who live in the foothill and mountain communities and the people that visit and recreate in the southern Sierra Nevada national parks and forests. Recently, air quality in the southern Sierra Nevada has seriously deteriorated, increasing risks to of negative impacts on public health and forest ecosystems.

High levels of photochemical air pollutants have been measured in southern Sierra Nevada since the early 1970s. Recently, the San Joaquin Valley of California has become of the most polluted by photochemical smog areas in the United States, resulting in a significant deterioration of air quality of the downwind southern Sierra Nevada Mountains. It has also been established that air pollution originating in the San Francisco Bay Area and even Los Angeles Basin affect air quality of southern Sierra Nevada. Elevated concentrations of ozone (O3) and nitrogenous (N) air pollutants are the main hazards to forests. Ozone is a powerful oxidant, causing visible injury to plant foliage and decline of sensitive ponderosa and Jeffrey pines. Elevated concentrations of ammonia (NH3), nitrogen oxides (NOx), nitric acid vapor (HNO3), particulate nitrate (NO3-) and ammonium (NH4+) increase N deposition affecting ecosystems in many different ways. Both elevated O3 concentrations and N deposition result in impairment of carbon (C) and N cycling, stand densification, weakening of trees, increased depth of litter, enhanced flammability of forests and higher risk of fires and toxic smoke emissions, increased nitrate runoff, etc. Integrated effects of O3 and N deposition seriously damage structure and function of native ecosystems and increase their susceptibility to other factors such as drought, insect attacks, catastrophic fires, and extreme weather. In addition, elevated concentrations of O3, NOx and particulate pollutants (PM) have pronounced effects on health of residents and visitors to the southern Sierra Nevada.

In the last ten years, extensive use of passive samplers for monitoring O3 and N pollutants ambient concentrations as well as application of portable O3 monitors, have allowed for a much better understanding of air pollution status and distribution in the southern Sierra Nevada. Results of these monitoring efforts will be presented.

Southern Sierra Nevada is perhaps one of the regions most susceptible to air pollution impact from fires. Fires can significantly increase the already existing air quality problem in this region and affect possibility of using prescribed fires. Thus, potential effect of fires on air quality in the San Joaquin Valley Air Basin and southern Sierra Nevada is a serious air quality management issue.

Nancy Grulke (USFS PSW) Air pollution is an increasing stressor in Sequoia National Park. Globally, ozone has already doubled since pre-industrial times and is expected to increase an additional 50% by 2020. Ozone concentrations once associated with southern California will become typical throughout the Sierra Nevada. Low to moderate levels of ozone reduce carbon uptake and transpiration in tandem, thus conserving water at the landscape level. There is increasing evidence that moderately high and higher levels of ozone further decrease carbon uptake, but result in increased transpirational losses to the atmosphere, and less stream outflow. As ozone (and nitrogen deposition) increases, individual trees will experience more drought stress, will require a greater soil volume per tree, and translates to greater need for thinned stands. Typical visible symptoms of ozone exposure will be presented for conifers and oaks, as well as how altered physiological traits have led to ecosystem-level changes. Recommendations for mitigative forest management that will protect against both increased pollutant deposition and increased drought stress are proposed.

Rob Klinger (USGS) Invasive animals, plants and pathogens, especially non-native species, have had a range of undesirable effects throughout California. The Sierra Nevada has certainly not been immune to these effects, but overall their magnitude and extent have generally been less severe than in other bioregions in the state. This has likely been due to three factors; historical legacies, increasing extremes of temperature and precipitation associated with strong gradients in elevation, and reduced propagule pressure because of low and patchy human population density. Nevertheless, severe effects by invasive non-native species on particular taxa or specific ecosystems in the Sierra Nevada have been documented. For example, predation by non-native fish has suppressed populations of native amphibians, with cascading effects on the structure of aquatic vegetation communities. Non-native herbivores have facilitated colonization, establishment, and dominance of non-native plants in grasslands and oak savannas, and there is an increasing pattern of non-native grasses such as Bromus tectorum altering fire regimes in some mixed conifer forests. Moreover, as large scale agents of landscape-level change in the Sierra Nevada become more pronounced (e.g. climatic shifts) and human population density in the region increases, it is likely that rates of colonization and establishment by "new" non-native species as well as spread from existing local populations (e.g. lag effects from species such as feral pigs) will increase. In all probability this will lead to novel effects or exacerbate existing ones that humans find undesirable. However, while effects from invasive non-native species are widely regarded as being negative ("impacts"), they are actually characterized by considerable complexity. This complexity presents challenges, complications, and contradictions for developing polices and planning and implementing actions to manage invasive species. Examples from ecosystems around the world indicate that this complexity increases substantially when multiple non-native species interact, especially over long periods of time, making management outcomes difficult to predict. Faced with the likelihood of more extensive and severe effects from invasive non-native species in the Sierra Nevada, scientists and managers will need to jointly develop coordinated research strategies explicitly linked to the different phases of biological invasions (colonization, establishment, spread, and equilibrium). Key components of these strategies will include prioritizing non-native species and/or communities to focus on, predicting patterns of invasion for high priority species and/or communities, developing long-term studies that integrate observational, experimental, and modeling approaches, and comprehensively and objectively evaluating outcomes from management programs. This will lead to a better understanding of the temporal and spatial aspects of invasions in the Sierra Nevada, and provide insight into the implications for their management.

Matt Brooks (USGS) Invasive species are a top priority for the effective management of public lands, but their vast numbers can make this a daunting task. Decision-support tools have been recently developed to help guide land managers in the efficient allocation of limited resources. These tools are based on the life history traits of individual species, their ecological impacts, basic ecological principles, and newly applied statistical methods. These tools are also beginning to be tailored for the colonization, spread, and equilibrium phases of biological invasions. The ultimate purposes of these efforts is to help land managers implement early detection monitoring programs, determine which species to focus management efforts on given specific situations, decide which control methods to use, and evaluate the need to integrate these efforts with other land management programs.

Dave Graber (NPS) All five of the agents of change: forest management, fire, pollutants, invasive species, and climate change; working individually are in concert, are known to or may be reasonably surmised to affect many of the terrestrial and aquatic vertebrate wildlife species native to the southern Sierra Nevada of California. For example, forest management, fire regime, and climate change all may affect stream temperatures that both directly control the viability of fish and amphibian species, and indirectly through the trophic chain. Similarly, those same three agents, and sometimes invasive plant species, affect forest structure and function that provides feeding, resting, and reproductive habitat for a broad suite of native vertebrates. Invasive animal species may compete directly with natives, or occasionally prey upon or parasitize them. The number and distribution of known biologically-active contaminants in the southern Sierra continues to increase. While most effects on vertebrates remain speculative, specific contaminants are implicated in eggshell thinning and amphibian pathologies. In the long run, climate change is likely to lead to landscape-scale changes in vegetation structure and composition, water availability and quality, and temperature that will greatly alter the potential distribution and density of most wildlife species in the region.

Mark Nechodom (USFS PSW) Southern Sierra ecosystems provide a number of ecosystem goods and services, many of which face significant change over the coming decades. Moreover, the capacity for social, institutional and policy responses will be important as increasing population and resource use puts pressure on the larger system. This presentation will synthesize some of the human systems responses that are likely under coming changes in the system, and assess the institutional capacities and policy frameworks that lead to different future outcomes in the region.

Public Comment/Questions

After the speakers in each segment of the symposium agenda, public comments and questions were welcome. The following is a record of them. Participant's questions/comments are immediately followed by the speaker's response; each new participant's question/comment is indicated by a space.

Key Note Speaker (9:20 am)

Tony Westerling (UC Merced)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/westerling.pdf

1. No questions or comments.

Climate Change (9:45 am)

Nate Stephenson (USGS) and Connie Millar, USFS PSW

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/stephenson.pdf

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/millar.pdf

Q: Could we look at other species like steelhead that can live in warmer water to reintroduce, rather than salmon?
A: Could be a good idea to look into.

Q: There are two issues: temperature and moisture. Temperature is worldwide so should we try to focus on moisture and manage the moisture by watershed?
A: Working at a watershed level makes good sense.

C: Connie presented on the movement of Sugar Pine—I am glad we are showing that plants do move.

Q: What would your management approach be to these novel ecosystems? And how do we model them?
A: That's a good question. For one thing, we need to look to the past: we have non-analog situation so we need to examine possible 'Toolbox' solutions. We cannot be certain about which types of management approaches will be best. Another thing to be concerned about is the speed at which change happens. If we can ease the transition of species into new ecosystems, this could enable things to solve themselves.

Fire (10:50 am)

Jan van Wagtendonk (USGS) and Scott Stephens (US Berkeley)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/van_wagtendonk.pdf

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/stephens.pdf

Q: What are the specific mechanisms of treatment with fire not incurring endemics?
A: Opening up the stands—this is a trend that could increase over time.

Q: I would like to clarify something about the San Pedro Martir fire: you said that 50% of the largest and smallest trees burned?
A: The fire took place in a 50 acre watershed and about half of the small trees died but also half of large trees—probably due to the previous four years of drought and increase in beetles. The drought and insects made the trees more susceptible to fire.

Q: I was wondering why water and soils are not prominent on the agenda, so thanks to Scott for bringing them up. At Kings Canyon we've had research experiments blocked by the public for three years. I am concerned with the public not allowing experiments to take place, and I hope that symposiums like this one will help introduce the public to the issues at hand.

C: One point I want to make is that it is clear that we have to do fires. Native Americans burned lands before seasonal migration up to the 1970s. Also, there is a connection between fire and rain: by having fire rainfall increased. No fire; no rain. And has anyone done a study on taking the trees out?
A: We have to think of yield and how they affect fire behavior. We need to get dead trees out to create more effective fire. We need to think about what is left in the future. What is taken out may be less important than what remains.

Q: For nine years or less there has been good maintenance burning—were these fires done in stands of low, moderate or high severity?

A: It was a mix of all three. We would be oversimplifying the issue to talk about severity alone, because there's a vegetation component to consider as well. There is a very complex relationship between fire, fire severity, and the vegetative response.

Q: Regarding the Miller paper that you cited: how far back in time did Miller look?
A: Miller looked back to 1984.
Q: Any thoughts about going back to turn of the century to look at that data?
A: The data/imagery only goes back to 1972; we did not have the satellites before that time.

Forest Management (11:40 am)

Malcolm North (USFS PSW) and John Battles and Rob York (UC Berkeley)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/north.pdf

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/york_battles.pdf

Q: Regarding the lack of regeneration in the last century—I question this and wonder what data was used? We have found in distribution of seedling and saplings in open canopy and also in closed that it is not necessary to create gaps for regeneration.
A: Yes, you can find such cases but this tends to be the trend.
Q: The surveys were random. We did not find a lack of regeneration.
A: Did you age the trees as well as size them?
Q: No.
A: Small doesn't necessarily mean young. Age structure versus size cohort is important to consider in this.
Q: Does the fact that you're seeing very small yet old Sequoias mean that there is a negative correlation between germination and growth rate?
A: We did not see a correlation. The lesson learned was that the practical way of artificial seed sowing did not work.

Q: Is anybody working on analysis of previous failures as a learning tool? Learning *how* we failed before?
A: I don't know in general. It's a big adaptive management project. There have been other adaptive management projects. We need to look at how it worked? Several studies in Pacific NW tried to say that clear cutting is analogous to fire practices, but that belief is built on faulty premises of historical paradigms. There are numerous practices based on faulty notions but it takes a long time to chisel away at these.

Q: The current Forest Service forest planning process does not accommodate adaptive management very well. How can we incorporate adaptive management?
A: I know the Forest Service is aware of this and is working on it. Timing is crucial and resources are limited. How quickly do results from the field filter back for changes in management?   This kind of process can be a real challenge. How do you make it work in a practical sense when we need to learn on the go?

Q: Has any study been done on undergrowth that would impact the growth of the Giant Sequoia?

A: We have done some studies at Blodgett and have seen Giant Sequoias overgrown with brush that could persist under low light and low resource conditions. The Sequoias that we are referring to were planted, so that may have had something to do with it. There have been studies where brush was removed and the Giant Sequoias responded well to removal and the pressure release.

Pollutants (2:00 pm)

Ricardo Cisneros (USFS) and Nancy Grulke (USFS PSW)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/cisneros.pdf

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/grulke.pdf

C: (Member of the San Joaquin Air District Governing Board): I am curious about what are you finding in the forest relative to levels of pollutants and ozone concentrations. We are showing that air quality has improved by 60%.
A: Valley ozone hasn't improved—it depends on how you look at it.
Q: Perhaps ozone is not related to vehicle emissions? If it is better in the city but not in the mountains then maybe we need to study why.
A: The air quality districts are good at controlling emissions so people don't drive as much during most sensitive times when we could generate more ozone. But we need to look at the total dose over a 24-hour period.
A: There is also the scavenging effect which is different in the mountains than the valley.
A: In Sequoia National Park: 69 ppb per 12 hour period over a 5 month growing season.

Q: The San Joaquin is the biggest agricultural producer in the nation. Will this stomata issue have an impact on water use?
A: We're good at growing species that use less water.

Q: Are there any people saying that it would be a good idea to limit population growth in San Joaquin? [Scientists could not comment on this question.]

Q: In the transport study you identified the San Joaquin Valley Basin. Did you consider other transport? Or, did you focus just on the San Joaquin valley?
A: I focused mainly on transport from Valley through the canyon.

Q: Is there any evidence of development of resistance or tolerance of tree species?
A: Yes, there is some evidence for genetic shifts.

Invasives (2:50 pm)

Rob Klinger (USGS) and Matt Brooks (USGS)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/klinger.pdf

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/brooks.pdf

Q: In the earlier discussion of a management 'Toolbox'---translocation was one example of management which included the example of Steelhead reintroduction? What will our good-willed tampering do in regards to the translocation of propagules?
A: The question is: Should we translocate anything? Every time you move something, it has hitchhikers. Any translocation process that we use will never be free of hitchhikers.
A: There is something in human nature that wants to manage, but sometimes it may be best to sit back and let them change. There are things we can't understand or predict, so we may cause more problems.

Q: I urge everyone to read Peter Schuft's "Prescribed Burning Plan in Sequoia and Kings Canyon National Parks" – he brings in the early observations of Muir and ranchers of the period. Also, wouldn't it be less expensive to do prescribed burning in December and January rather than in the spring or summer? Have Rob's studies looked at invasive species since the 1930s when the ranchers' burning stopped?
A: The short answer is no. Those types of studies are almost non-existent. Studies have shown that the season of burning 80% of variation in species composite determined by rainfall and aspect. It's more wishful thinking than anything else.

Q: Has Matt looked at burning in winter versus other times of year?
A: Seasonal timing huge—not only for targeting species you want to manage but also for how species react to fire as well as how the landscape reacts.

Q: Migration of plants and animals is happening as result to climate change. How do we factor that in with regard to invasive species?
A: It is inevitable that plants and animals move and non-native and native species move. It is a huge challenge. The issue of when species becomes native or non-native is very unclear. This is a really tough issue.

Response to these Stressors: Wildlife (4:00 pm)

Dave Graber (NPS)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/graber.pdf

1. No questions or comments.

Response to these Stressors: Human Communities (4:30 pm)

Mark Nechodom (USFS PSW)

See PPT: http://www.fs.fed.us/psw/southernsierrascience/speakers/pdf/nechodom.pdf

Q: Don't we need to spend time training our kids and grandkids to appreciate what we have? We need to stimulate human interest and activity.
A: I couldn't agree more. Connecting people is very important. One example of a program trying to achieve this is the FS "Kids in the Woods." It is very important to reach people who are still capable of being fascinated: young people. We must make this investment.

Q: How do we get people to care and to trust us in the face of uncertainty?

A: We will not regain trust by saying “trust me.” We will regain trust by saying “come out here with me and see what needs done.” Collaboration takes more money – it’s a measure of last resort. Pain needs to be distributed equally before people will collaborate. A huge part of how to get people to care is as crass as messages: we have to get them information they can understand and they must have and perceive their stake in it. If they don’t see their stake in it, forget it.

Q: Do you consider the Quincy Library Group to be a success in that way?
A: QLG was one way to put NGOs in the saddle. It’s a powerful example and a sincere effort to do adaptive management. The politics of how it unfolded were hard.

Adjourn 5:00 pm

Written Comments

The option of submitting written comments was given to all symposium participants. The following represents those comments that were written during the symposium.

1) Marti Phipps, Sequoia Middle school
(559) 359-2409 sciphi2001.mp@gmail.com
Please put me on the stay in touch list.

2) John Monsen
johnmonsen@sierraclub.org
7032 Floramorgan Tr., Tujunga, CA 91042
(For mailing list)

3) Anonymous
Are private companies (i.e., Weyerhaser's) doing any research and is there any coordination with government agencies (USFS, etc.)?

4) Pam Canby
pampvc@aol.com or pcanby@lindsay.k12.ca.us
(559)805-0281
Please keep me informed.

5) Shawn Ferreira
San Joaquin Valley APCD
Shawn.ferreria@valleyair.org
(559) 230-5823

6) Dwight Chaddock
So. Tulare Co. Sportsman's Association
dchadd@outdrs.net
Keep me informed.

7) Mark Price
President Roger's Camp Homeowners
559) 732-4400
The science is good. We have good ideas/methods to solve our problems. I have not heard how this solution will be implemented. Where are the funds to implement these solutions going to come from? I don't think public money will cover these costs. You need to have a way to involve private sector/foundations in the process.

8) David Laughing Horse Robinson
Kawaiisu Tribe
(661) 378-1090
Horse.robinson@gmail.com
I felt relieved for the first time in my life that the science community is starting to get it. From fire science to climate change, my elders are starting to be heard. Thank you for that! POGMATOGMAGOT (Creator knows).
Do it again in 2010!

9) Natalie Bursztyn
nburszty@bakersfieldcollege.edu
Professor of Geology & Earth Science
This is the most efficiently run symposium that I have ever been to. Also, it had a remarkable number of phenomenal speakers. Thank you, and thank you for giving my students a terrific educational experience!

10) Kate DeVries
Researcher
Kate.devries@gmail.com
Please incorporate Peter H. Schuft 1973 “A Prescribed Burning Program for Sequoia and Kings Canyon National Parks” report in your management plan. Its historical extracts from the early 1900s (Ben Lowerin and Sudworth) best describe the Pre-Columbian prescribed burning done by California Native Americans. The John Muir descriptions of groves and their biodiverse makeup are also important history to use to achieve the Leopold Report conclusions.

11) Jim Davis
POB 3936
Wofford Heights, CA 93285
davistalodge@aol.com
760 379-2844
Citizen
Interest fisher, shrub habitat, fire science.
I am interested in finding out information about the fisher throughout its entire S.N. Range and the work being done to monitor the species. My current efforts are on the Kern Plateau.

12) Anonymous
Now I know where my taxes go! – For research. What is the relationship between private enterprise and taxes that perpetuate our fear of death and anxiety to control and understand everything the eye sees. Suggestion: start “doing” – get out of the offices and computer labs and start managing – not controlling – or we won’t have forests in the future.

13) Joe Fontaine
fontaine@lightspeed.net
661 821-2055
Please make a hard copy of the PPTs the presenters used along with an abstract of each talk as soon as possible.