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DEVILS POSTPILE • SEQUOIA & KINGS CANYON • YOSEMITE

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Sierra Nevada Monitor

Newsletter of the Sierra Nevada Inventory & Monitoring Network

Collaborative Project Targets Five-Needle Pines

Re-surveying for non-native pathogen

Example of white pine blister rust cankers on a sugar pine tree. Photo: USGS, Sequoia-Kings Canyon Field Station.

The white pine blister rust cankers on a tree's stem or branches can girdle the conductive tissues, causing foliage wilting, loss, and mortality. A branch that has died back on this sugar pine due to blister rust cankers is highlighted above. Photo: Jonny Nesmith.

When a non-native pathogen is accidentally introduced to a new environment, it can result in tremendous impacts on local native species. In the late 1800s, the fungal pathogen *Cronartium ribicola* arrived in the U.S. on white pine seedlings imported from Europe, and it was introduced to western North America by 1910. This pathogen causes the disease white pine blister rust (WPBR) in five-needle pines.

Sequoia & Kings Canyon National Parks (SEKI) have five species of five-needled pines that are potentially threatened by WPBR: whitebark pine, foxtail pine, limber pine, western white pine, and sugar pine.

Declines of whitebark pine in large portions of its range from this pathogen and other factors have been so severe that in 2011 the U.S. Fish and Wildlife Service determined that the species warranted listing under the Endangered Species Act. While Sierra Nevada populations of whitebark pine are still much healthier than elsewhere in the species' range, WPBR has had impacts on other five-needle pine species in the parks, particularly sugar pine and western white pine.

Although WPBR was first documented in SEKI in 1969, it was not until the late 1990s that park ecologist Dan Duriscoe designed and led an extensive survey to assess the extent of WPBR in the parks. Duriscoe and his field team installed 154 long-term plots that are now enabling scientists to re-assess the status of park five-needle pine populations.

In 2013, Matt Cahill, a graduate student from the University of Vermont, re-surveyed 29% of the Duriscoe plots, focusing on those dominated by western white pine. His findings elevated concern about the local spread and impact of WPBR: After only 17 years, the number of western white pine plots with WPBR infections had more than doubled to 45 percent, and WPBR was associated with high tree mortality. His results highlighted the urgent need for information on the status of the other five-needle pine species.

Local Sierra Nevada Network, US Geological Survey (USGS), and SEKI ecologists successfully competed for funds from the US Forest Service Forest Health Protection Program and the NPS Natural Resource Preservation Program, enabling a re-survey of the remaining Duriscoe plots. This summer, a

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Sierra Nevada Network Inventory & Monitoring

As part of the National Park Service's effort to "improve park management through greater reliance on scientific knowledge," 32 networks of parks were established to conduct long-term ecological monitoring across multiple park units with similar ecological characteristics. Information from this program improves understanding of status and trends in natural resources and informs resource management decisions.

The Sierra Nevada Network parks are Devils Postpile National Monument (DEPO), Sequoia & Kings Canyon National Parks (SEKI), and Yosemite National Park (YOSE).

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Five-Needle Pines

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combined NPS and USGS field crew will visit 50 plots, and the remainder will be visited in 2016, followed up by analysis, synthesis, and sharing of data and findings in 2017.

Field crew members are: Joan Dudney (USGS Field Lead), Allyson Makuch (USGS), David Soderberg (NPS), and Douglas Cox (NPS).

Project investigators will determine the current extent, severity, and rate of spread of WPBR in SEKI. The results will be used to inform best management practices, validate current mapping products, and ground truth the accuracy of aerial detection surveys. The objectives include:

(1) Quantify current extent, severity, and rate of spread of WPBR over the past 20 years in SEKI;

(2) Develop predictive maps of WPBR prevalence and potential spread to project habitat vulnerability and possible refugia (habitats that facilitate biological persistence as environments change);

(3) Identify potential "hotspots" of genetic resistance to WPBR, which could act as sources for future management action (strategic planting of rust-resistant pines).

(4) Provide accuracy assessment tools for existing the National Insect/Disease Risk Assessment model and aerial detection surveys.

This project will not only provide valuable information for Sequoia & Kings Canyon National Parks – its results will also be applicable to Yosemite National Park and other public lands within the southern Sierra Nevada.

Collaborators on this project are: Sierra Nevada Network Ecologist Jonny Nesmith (project lead), USGS ecologists Nate Stephenson (project lead), Adrian Das, and Peggy Moore, SEKI Research Coordinator Koren Nydick, U.C. Berkeley Professor John Battles, and Vegetation Ecologist Matt Cahill with The Nature Conservancy.

Whitebark pine cones.

New Publications and Briefs

The following report, which was a collaboration between Sierra Nevada Network and Sequoia & Kings Canyon National Parks staff, is an important reference for the parks' Wilderness Stewardship Plan:

Pyrooz, N. N., J. C. B. Nesmith, C. R. Cann, E. Frenzel, S. A. Haultain, and P. Hardwick. 2015. Wet meadow and fen mapping of Sequoia and Kings Canyon National Parks: A photo interpretation mapping project of wetland resources. Natural Resource Report NPS/SIEN/NRR—2015/968. National Park Service, Fort Collins, Colorado.

See the following report for a summary of 2014 white pine monitoring results:

Nesmith, J. C. B. 2015. Sierra Nevada Network high elevation white pine monitoring: 2014 annual report. Natural Resource Data Series NPS/SIEN/NRDS—2015/761. National Park Service, Fort Collins, Colorado.

New briefs provide overviews of monitoring projects:

- High-elevation Forest Monitoring
- Lakes Monitoring
- Wetlands Monitoring
- River Hydrology Monitoring
- Climate Monitoring and Reporting

Staff Arrivals and Departures

Sylvia Haultain: New Program Manager

Sylvia Haultain, on a visit to a national park far north of the Sierra Nevada Network - Gates of the Arctic. Photo: Erika Jostad.

Sylvia joined the Sierra Nevada Network April 20th as the new program manager. Previously, she spent 18 years as a program manager in the Division of Resources Management and Science at Sequoia and Kings Canyon National Parks. As plant ecologist for the two parks, she oversaw the Stock Use and Meadow Monitoring program, provided subject matter expertise in botany and vegetation ecology, and played a lead role in the development of the recently completed Wilderness Stewardship Plan.

She worked closely with the Inventory & Monitoring Program from its inception, overseeing the rare plant inventories at Sequoia, Kings Canyon, and Devils Postpile, vegetation mapping at Sequoia and Kings Canyon, and contributing to the selection of vital signs for long term monitoring. She was closely involved in the development of the Wetland Ecological Integrity protocol. She also spent seven years as a field botanist with the Sequoia and Kings Canyon Natural Resource Inventory project, which documented the distribution and abundance of vascular plants throughout the two parks.

A three-month internship in Sequoia National Park in the early 1980s turned into a career-long love affair with the wild landscapes of the Sierra Nevada, and she has yet to tire of exploring, studying, and sharing the extraordinary biodiversity found here. She holds a B.S. in Natural Resources from Humboldt State University and a M.S. in Ecology from the University of California at Davis.

Amy Brown: On-board as Logistics Technician June 8th

Amy Brown joined the Sierra Nevada Network on June 8, 2015 as a biological science technician supporting field logistics. She is currently working as a biologist for a private consulting firm, but she is very excited to return to Sequoia & Kings Canyon National Parks (SEKI) and join the Sierra Nevada Network. This will mark her seventeenth year working in the field of ecology, and her tenth year working at SEKI.

Amy Brown hiking near Kearsarge Pass, Kings Canyon National Park.

Amy first moved to Three Rivers in 2003 to work on the USGS Forest Demography crew. In addition to spending six seasons on that crew, she participated in Giant Forest restoration, foothills exotic plant management, Italian thistle research, sugar pine research, a GIS project digitizing historic fuel-break treatments, Halstead meadow restoration, and work in the native plant nursery. Amy has also worked at several other parks and forests in California, Oregon, Washington, and Colorado. She has coordinated and led multiple crews and projects in the frontcountry and wilderness, and enjoys planning wilderness trips and staring at maps.

Amy is originally from the Bay Area and earned a B.A. in Environmental Studies from U.C. Santa Cruz in 1998. She has been visiting Yosemite and SEKI since she was in diapers and has always held the Sierra as a special place in her heart as home. She loves hiking, backpacking, staring at wildflowers, cooking, occasionally playing her musical saw and/or singing, and laughing. She lives in Three Rivers year-round, with her two very cute cats.

Amy has long-term interests in working with the Sierra Nevada Network and she looks forward to providing much-needed support to the network field crews this summer!

Staff Arrivals and Departures

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Sandy Graban Retires

Sandy Graban played a critical role in the Sierra Nevada Network's (SIEN) monitoring program for the past seven years. Her more than 20 seasons as a backcountry ranger in Sequoia & Kings Canyon National Parks (SEKI) gave her in-depth knowledge of traveling the parks' wilderness. She excelled in planning field logistics for the network's monitoring projects and in providing GIS support.

After Sandy left wilderness rangering, she pursued GIS training on her own initiative, and gained additional expertise conducting GIS projects for SEKI. In 2006, she led an extensive survey to assess conditions of wilderness campsites. This project culminated in a published technical report that provided important information guiding the parks' Wilderness Stewardship Strategy.

At her recent retirement party, Sandy Graban shows the park photo she chose as a retirement gift - Mount Goddard from Martha Lake, Kings Canyon NP (Nick Koukoutsakis). Party Photo: Scott Martens.

Sandy was selected for a biological science technician position with SIEN in 2008 to provide field logistics, GIS, and data management support. Early on, she provided an important contribution to our lake monitoring sample design by developing a GIS travel-time analysis that used spatial data and local expertise to estimate travel times throughout park wilderness areas. Project leads greatly appreciated Sandy's wilderness expertise as they planned and implemented SIEN's monitoring projects.

Sandy had positive relationships with park staff across multiple divisions. This combined with her extensive wilderness experience made her an ideal person to coordinate field logistics, which involves working with others to ensure that food and gear caches can be distributed to wilderness locations for crews to access, and doing trip and route planning. Sandy was well-liked and respected by field crews, and she always took a special interest in them and their wilderness sampling trips.

Sandy Graban and SIEN Ecologist Jonny Nesmith at a forest monitoring site, Kings Canyon NP. Photo: Linda Mutch.

After a serious forest crew accident in 2011, Sandy played a central role in helping improve program safety by contributing to a safety plan, taking a leadership role in implementing and managing GeoPro satellite communication devices, assisting with crew training, and representing SIEN on the parks' interdivisional safety committee.

We will especially miss Sandy's generosity, independent spirit, and ability to work well with people across divisions and generations. We wish her many more wilderness journeys in her retirement.

Sandy Graban and Wilderness Ranger Cindy Wood, riding away from Bench Lake ranger station after delivering crew food and gear caches, Sequoia National Park. Photo: Isaac Chellman.

2015: What's Happening in the Field?

High-elevation Forests

The forest crew will undertake two projects this summer focusing on white pines. Sarah Hoff (crew lead), Sean Auclair, Vladamir Kovalenko, Douglas Cox, and David Soderberg will travel to high-elevation whitebark and foxtail pine forests in Sequoia & Kings Canyon (SEKI) and Yosemite (YOSE) for the fourth season of monitoring forest structure, demography, and incidence and severity of disease and insect occurrence. This is the first year that plots installed in 2011 will be re-measured. They will also work on a project to re-measure permanent plots installed in SEKI to assess the extent and severity of the introduced disease white pine blister rust on all five white pine species found within the parks. This is a collaborative project with partners from US Geological Survey, US Forest Service, and UC Berkeley (See the special feature on pages 1-2 of this newsletter for more information).

Contact: Jonny Nesmith

Wetlands

This summer is the first season the wetlands monitoring project will be implemented in YOSE and the second season in SEKI and Devils Postpile (DEPO). The project monitors wetland plant communities, groundwater levels, and invertebrates, and targets two types of wetlands: wet meadows and fens. The crew includes: Corie Cann, crew lead, and Carl Schwarz. Two additional crew members will work with the wetlands crew initially and then transition to the Lakes Crew for the second half of the field season: Roxanne Kessler and Talia Chorover. The crew will be performing a combination of remeasuring existing plots in SEKI and DEPO as well as installing new plots in SEKI and YOSE. Additional work in YOSE includes continuing accuracy assessment work to validate the map of wet meadows and fens that was completed in 2014.

Birds

The bird monitoring project will not be in the field this season. As part of a planned rotation cycle, SIEN bird monitoring is taking a one-year hiatus, and The Institute for Bird Populations is conducting analyses and synthesizing data for a comprehensive report on the project's first four years of monitoring. Field monitoring will resume in 2016.

Contact: Sylvia Haultain

Rivers

SIEN is supporting hydrologic monitoring at three river gages: Middle Fork of the San Joaquin in Devils Postpile, Tuolumne River at Tioga Bridge, and Lyell Fork of the Tuolumne below Maclure. The USGS and Devils Postpile staff will continue conducting monthly streamflow measurements at the Devils Postspile gage. SIEN and Yosemite will collaborate on the Tuolumne River sites this season with Yosemite taking the lead on field work and SIEN providing technical guidance and taking the lead on data management. The Rivers protocol is still in review as the network responds to the second round of comments.

Contact: Andi Heard

Lakes

The lakes project embarks on its eighth field season this year. Crews will sample water chemistry, record lake temperature profiles , and conduct lakeshore amphibian surveys at lakes throughout Sequoia & Kings Canyon and Yosemite. The SEKI crew will include Roxanne Kessler (crew lead), a veteran of several field crews in these parks, and Talia Chorover. The Yosemite crew, shared with the Yosemite Physical Sciences program, will be Brina Mocsny, who has worked with Yosemite Physical Sciences for six years, and Megan Mason.

Contact: Andi Heard

Where Are We?

I&M field monitoring during the next few months includes:

	June	July	August	September
Blister Rust	SEKI	SEKI	SEKI	SEKI
White Pine Forests	YOSE	YOSE	SEKI	SEKI
Lakes		YOSE	SEKI, YOSE	SEKI, YOSE
Rivers	On-going monitoring by cooperators, parks, and SIEN in DEPO, SEKI, and YOSE			
Wetlands	SEKI, YOSE	SEKI, YOSE	SEKI, DEPO	SEKI

Monarch Butterflies: International Travelers

"It's easy to get mesmerized watching the Monarchs glide overhead, with the sun shining through their wings ... They are silent, beautiful, fragile; they are harmless and clean; they are determined; they are graceful; they stalk nothing; they are ingenious chemists; they are a symbol of innocence; they are the first butterfly we learn to call by name. Like the imagination, they dart from one sunlit spot to another..." - Diane Ackerman

Epic Migration

Monarch butterflies are noted for the longest insect migration on Earth. To escape cold winters, monarchs in the east fly more than 3,000 miles to alpine forests in central Mexico. Those west of the Rocky Mountains travel to small groves of trees on the California coast.

Clustered monarchs with wings spread to gather the warming rays of the sun. Photo by Jim Lovett, MonarchWatch.org.

In Mexico, overwintering butterflies cling to fir trees in masses so dense that branches bow under their weight, and the air can sometimes be filled with butterflies cascading from the trees. The following spring, these butterflies mate, then make the journey back north, where the females will lay their eggs. Individuals only make this two-way migration once.

Monarchs can produce four generations during one summer. The first three generations will have life spans from 2 - 6 weeks and will continue moving north. During this time they will mate and have the next generation that will continue the northward migration. The fourth generation is different and can live up to nine months. These are the butterflies that will migrate south for winter to either Mexico or California.

A Killer Diet

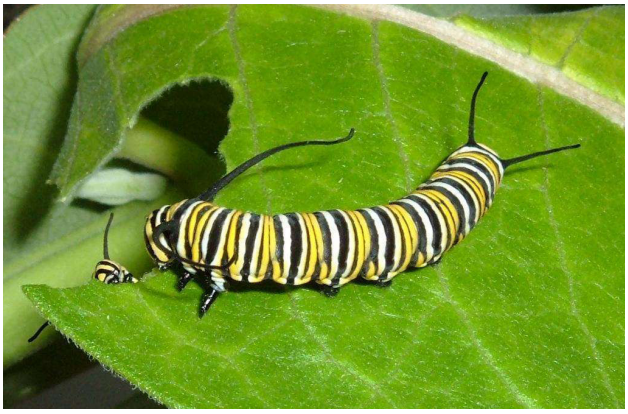
Monarch caterpillars rely on milkweed as their sole food source, while adults get their nutrients from flower nectar. Milkweed plants contain traces of cardenolides, bitter toxins monarchs store in their bodies to discourage predators, which associate the butterflies' distinctive coloration with bad taste.

The protection afforded by these toxins comes at a cost. About 30 percent of the caterpillars actually don't survive ingestion of the toxin. All of the caterpillars also have to contend with the latex-type chemical in milkweed sap. It can gum up the mouth parts of small caterpillars, causing them to starve. They deal with the latex by making shallow trenches or circles in the leaves to reduce the latex flow. Older caterpillars can actually cut the main vein in the leaves, stopping the latex flow completely.

Threats

The primary threats to the monarch butterfly include the loss of milkweed—the key plant that monarch caterpillars need to survive—from agricultural and natural areas, degradation of overwintering sites, and climate change. The large-scale use of systemic insecticides within the breeding range of the monarch may pose a considerable threat. Loss of milkweed from the American Midwest is primarily due to the dramatic increase in the use of herbicides, made possible by the mass-planting of Genetically Modified Herbicide Tolerant corn and soy. Natural enemies such as diseases, predators, and parasites likely also influence the size of the monarch population.

Illegal logging has threatened overwintering sites in Mexico, and in the past decade, massive Pacific weather systems have moved into central Mexico in January and February. Each of these events resulted in heavy rain, often accompanied by hail, high winds, or freezing temperatures that devastated the monarch overwintering populations. Mortality from these events ranged from 50 % (2010) to 80% (2002). Winter is the dry season in central Mexico and storms of this severity are an unusual and recent development.



Boldly colored monarch caterpillars feed exclusively on milkweed, which restricts habitat where the butterflies can lay their eggs to areas with milkweed plants. Photo: Clay Ruth, ClayRuth.com.

Monarch Butterflies

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Status

Monarch butterfly populations have recently declined to dangerously low levels. In the 1990s, estimates of up to one billion monarchs made the flight each fall from the northern plains of the U.S. and Canada to sites in the fir forests north of Mexico City, and more than one million monarchs overwintered in forested groves on the California Coast. Now, researchers and citizen scientists estimate that only about 56.5 million monarchs remain, representing a decline of more than 80% from the 21-year average across North America. Figure 1 shows the decline in the monarch population at one California overwintering site. Extreme weather events may be negatively impacting monarchs in the eastern U.S. and low monarch populations in California are correlated with years of intense drought, in addition to habitat loss. Climate change models predict that future climate scenarios will not be suitable to support overwintering monarchs or the oyamel fir trees that they use in Mexico.

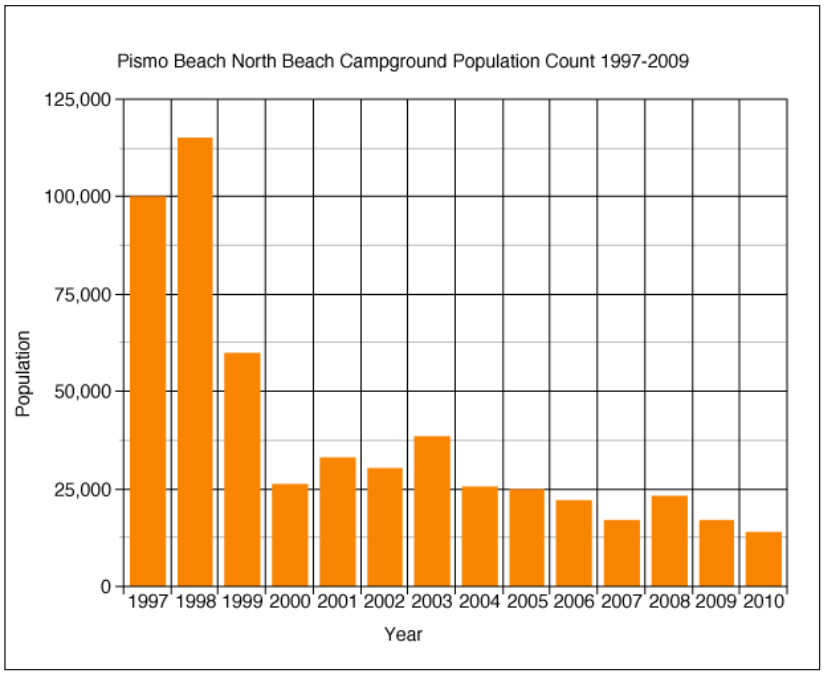

Figure 1. Population numbers for monarch butterflies at a winter roost site at Pismo Beach, California. From: www.monarchwatch.org.

Helpful Information Sources

http://www.monarchwatch.org/

http://www.xerces.org/monarchs/

Sierra Nevada Network staff monitor invertebrates in park wetlands. Here, Alexa Armstrong uses a sweep-net to sample invertebrates in a Kings Canyon NP meadow. NPS photo by Corie Cann.

Local Monarchs

There are over 300 overwintering sites from south of Ensenada, Baja California, to north of San Francisco, in Sonoma County where monarchs concentrate in fall and into winter, if temperatures are mild. Monarchs are found in the Sierra Nevada from the foothills up to 7,000 feet, frequenting montane meadows and other habitats with milkweed. Butterflies are one of the many families of insects monitored by the Sierra Nevada Network as part of our wetlands project (see photo above). Yosemite National Park has an annual butterfly count coordinated by the North American Butterfly Association. Visit this web page to learn more: http://www.nps.gov/yose/learn/nature/butterflycount.htm.

Conservation

Planting native milkweed in yards and along roadways, riparian areas, and various migration corridors is recommended as a way to begin to counteract the loss of milkweed habitat elsewhere. It is critical, however, to plant native milkweed. Tropical milkweed is sometimes planted, but because it does not dieback in winter, the monarchs are attracted to stay instead of migrate. This makes them more prone to dying from a parasite that is otherwise kept in check by the movement of migration.

You can learn more about milkweed restoration efforts and what milkweek species are native to California and other regions of the U.S. at this webpage:

http://www.xerces.org/milkweed/

Special thanks to Jeff Holmquist, University of California White Mountain Research Center, for some of the information in this article.

Eliza Goode, taking video footage along the Madison River near Bozeman, Montana.

First Video Project

Eliza Goode, who has recently completed her Master's Degree of Fine Arts in Science & Natural History Filmmaking at Montana State University, will come on-board as a Geoscientist-in-the-Parks intern in late July to help us embark on our first video project. Eliza will work closely with the network's physical scientist, science communication specialist, and lake monitoring crew members to make a video about our lake monitoring project.

She will accompany the crew on several wilderness lake sampling trips in Sequoia & Kings Canyon and Yosemite and will work in Sequoia National Park on the process of editing and finalizing the film. Previously, Eliza has done films in Olympic and Glacier National Parks, and has a film on fire ecology targeting middle school student audiences.

Sharing What We Learn

In addition to sharing information locally with park staff at meetings, brown bag lunch talks, and other venues, network staff also attended regional and national meetings to share information more broadly with peers and managers in other parks and organizations. This past winter, staff presented monitoring information at the following meetings:

Poster presented at California Native Plant Society conference, San Jose, CA: ***Mapping Fens and Wet Meadows in Sierra Nevada National Parks*** (Presenter: Sylvia Haultain; Lead Author: Jonny Nesmith)

Talk presented at Science for Parks, Parks for Science conference, Berkeley, CA: ***Assessing the Severity and Rate of Spread of an Invasive Forest Pathogen in Sequoia & Kings Canyon National Parks: A Case Study in Collaboration*** (Jonny Nesmith)

Posters presented at George Wright Society conference, Oakland, CA:

- ***Status and Trends of Sierra Nevada Lakes*** (Andi Heard)
- ***Long-term Monitoring of High-elevation White Pine Communities in Pacific West Region National Parks*** (Jonny Nesmith)
- ***Mapping Fens and Wet Meadows in Sierra Nevada National Parks*** (Jonny Nesmith)

Andi Heard participated in the Air Quality and Ecosystem Services Workshop in Thousand Oaks, CA, February 24-26, 2015. The purpose of the workshop was to identify linkages between the effects of air pollution on natural resources and ecosystem services (i.e., services provided by nature that are valued by society) with the broader goal of informing environmental policy and management decisions. The workshop was a collaborative multi-organization effort. A workshop report is in-progress.