



Sierra Nevada Monitor

Newsletter of the Sierra Nevada Inventory & Monitoring Network

November 2013

Monitoring Birds for 24 Years in Yosemite



Hermit warbler caught in a mist net and banded in Yosemite National Park. NPS photo.



Sarah Stock shows student how to release a banded bird. NPS photo.

Nearly a quarter of a century of bird monitoring in Yosemite National Park has yielded important information on the longevity or lifespan of birds, relationships between annual weather and productivity, and migratory connectivity between different regions of the country. It has also provided outstanding educational opportunities with local community and school groups.

How Are Birds Monitored?

This bird monitoring program is called Monitoring Avian Productivity and Survivorship (or MAPS). During the main breeding season for songbirds,

mist nets are set up in the same locations each year. Birds are caught in the mist nets, and observations are recorded related to the bird's age, sex, and condition. Before being released, birds are banded so that they can be identified if recaptured in Yosemite or elsewhere. These data provide information about productivity (number of young produced per resident adult) and survivorship (estimates of adult survivorship and recruitment of young into the adult populations).

There are six bird monitoring 'stations' located in five different meadows: White Wolf, Gin Flat East, Crane Flat, Hodgdon (two stations due to its size), and Big Meadow. They are located across an elevation gradient from 1,311 meters at Big Meadow up to over 2,400 meters at White Wolf Meadow.

Program Support and Funding

The MAPS program has survived in the park this many years due to willing funding organizations and the commitment of local scientists as well

as scientists at The Institute for Bird Populations (IBP) who developed and implemented the bird monitoring protocol. It got its start in Yosemite in 1990 when IBP approached the park's Research Office to seek support for starting a set of bird banding stations in the park.

In the first eight years, the Research Office (later USGS) provided logistical support and arranged financial support for the program through the Yosemite Association. During a few early years, funding was minimal and even dropped to zero one year. IBP continued to collect data during these years, sometimes volunteering their time so that the data record would not be interrupted. By the late 1990s, the park's Wildlife Management staff began coordinating the MAPS project and funding was secured from various sources, including The Yosemite Fund, Yosemite National Park, Pacific West Region, and the Sierra Nevada Network Inventory & Monitoring Program. In recent years, the Yosemite

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Conservancy has funded the MAPS project. Sarah Stock, Wildlife Biologist in the park's Resources Management and Science Division, has managed this project since 2006, working closely with IBP to conduct the monitoring and outreach.



MacGillivray's Warbler.

Highlights: What Has Been Learned?

New Longevity Records

While the primary purpose of the mark-recapture study of birds at Yosemite is to understand population-level demographics and how they respond to weather and habitat changes, sometimes interesting information can also be gleaned from looking at the capture records of individual birds. IBP and NPS scientists recently assessed longevity records for the entire Yosemite MAPS dataset for 1990-2012, and found some amazing results. These data yielded new national longevity records for at least eight species! One example includes Mountain Chickadee (10 years, 1 month).

Yosemite Bird Recaptured in Texas
Only a very small proportion of the

world's songbirds are banded, so recaptures of banded migratory birds away from the region where they were originally banded are exceedingly rare. A recent query of the national database maintained by the USGS Breeding Bird Laboratory turned up an Orange-crowned Warbler that had been banded at Hodgdon Meadow during the 1996 breeding season, that was recaptured 2.5 years later, in January 1999, wintering near Victoria, Texas – approximately 1,500 miles away!

“Records like this provide valuable information about migratory connectivity – our understanding of where specific breeding populations spend the winter,” explained Sarah Stock, in a report to the Yosemite Conservancy.

Productivity and Snowpack

NPS and IBP scientists have examined the effects of annual weather on productivity for 20 different species. They report that for most species, there is a strong inverse relationship between spring snowpack and productivity – birds produce more young in years when there is less spring snowpack.

“Because climate change is expected to reduce spring snowpack substantially in coming years, these are important results that will be of broad interest to researchers and land managers who are struggling to assess how vulnerable the resources they manage are to impending climate change, and to incorporate climate change adaptation into their conservation planning efforts,” Sarah pointed out.

Education and Outreach

In addition to collecting valuable information about bird populations, Yosemite's MAPS program includes an education and outreach component. Park visitors, interpretive



Volunteers from the Seventh Hills School after a morning at the banding station.

rangers, local school groups, and volunteers visit the MAPS stations throughout the season. In 2013, at least 85 visitors were hosted at the stations. Biologists provide interpretive bird banding demonstrations and communicate the importance of bird conservation to a broad audience.

Those who visit the banding stations are sometimes given the opportunity to release a bird after it has been banded. One visitor to a banding station in 2012 was moved to write about this experience:

“I am offered the opportunity to release an Anna's Hummingbird, and suddenly a breath of feathers is slipped into my hand. I'm hardly aware of its physical presence, except for the warmth that concentrates and spreads across my open palm underneath its fragile body. I am coached to gently rock it back and forth onto its stomach, and with a few shallow bobs of my palm the sprightly bird elevates up into the air. The flash of movement and sudden pulse of wing beats against my hand cause me to gasp. I remember in that moment that it is possible to hear your soul shout for joy...”

Yosemite's MAPS program collects, analyzes, and interprets high-quality data about bird populations and also succeeds in engaging the public in the rewarding challenges of improving understanding of bird populations and working for their conservation. This project is currently funded through 2014 by the Yosemite Conservancy, and Sarah is working hard to secure further funding for the project.

Recent Publications

Chung-MacCoubrey, A. 2013. [Appendix 16 – Bats. A natural resource condition assessment for Sequoia and Kings Canyon National Parks](#): Natural Resource Report NPS/SEKI/NRR—2013/665.16. National Park Service, Fort Collins, Colorado.

Heard, A. M. 2013. [Global Change and Mountain Lakes: Establishing nutrient criteria and critical loads for Sierra Nevada lakes](#). Doctoral dissertation. 160 pp. University of California, Riverside.

Hilimire, K., J.C.B. Nesmith, A.C. Caprio, and R. Milne. 2013. [Field Note: Attributes of windthrown trees in a Sierra Nevada mixed-conifer forest](#). *Western Journal of Applied Forestry* 28(2): 85-88.

Rice, R. and R. C. Bales. 2013. [An assessment of snowcover in major river basins of Sierra Nevada Network parks and potential approaches for long-term monitoring](#). Natural Resource Technical Report NPS/SIEN/NRTR—2013/300. National Park Service, Fort Collins, Colorado.

van Mantgem, P., J. C. B. Nesmith, M. Keifer, E. E. Knapp, A. Flint, and L. Flint. 2013. Climatic stress increases forest fire severity across the western United States. *Ecology Letters* 2013. doi: 10.1111/ele.12151.

vanMantgem, P., J. Nesmith, M. Keifer, and M. Brooks. 2013. Tree mortality patterns following prescribed fire for Pinus and Abies across the southwestern United States. *Forest Ecology and Management* 289: 463-469. doi: 10.1016/j.foreco.2012.09.029.

Resource Briefs:

Climate Change Resource Brief – Describes recent changes in the Sierra Nevada that are likely linked to climate change and provides information about how SIEN vital signs may be sensitive to climate change.
http://science.nature.nps.gov/im/units/sien/assets/docs/briefs/ClimateChangeBrief_sien_20130314.pdf

Program Brief – provides an overview of SIEN I&M Program
http://science.nature.nps.gov/im/units/sien/assets/docs/briefs/ProgramBrief_sien_2012.pdf

Windstorm effects on conifer forests of Devils Postpile National Monument
http://science.nature.nps.gov/im/units/sien/assets/docs/briefs/DEPOWindEvent_brief_20121031.pdf

Highlights...

SEKI Geology Map

In April 2013, a digital geologic map was completed for Sequoia and Kings Canyon National Parks (SEKI). The map and associated data were completed as a component of the Geologic Resources Inventory program, which is funded by the National Park Service Inventory and Monitoring Division and administered by the NPS Geologic Resources Division. Source geologic maps and data used to complete this digital dataset were provided by the US Geological Survey. The GIS layers and other associated data and information are available on-line at: <https://irma.nps.gov/App/Reference/Profile/2194511/>.

New River Gage

USGS and NPS staff worked together to select and establish a new Hydrologic Benchmark Network (HBN) river monitoring site on the Marble Fork of the Kaweah River in Sequoia National Park. SEKI Hydrologist Don Seale coordinated the project for the parks. This site was established to replace a more remote existing site with one that is more accessible. SIEN will provide some support for sampling at the site, and will report on the HBN data as part of our river hydrology monitoring protocol. HBN sites, located in watersheds less affected by human activities, serve as a benchmark against which to compare changes in streamflow and chemistry in developed watersheds.



USGS Hydrologists Louis Cannarozzi and Jason Koenig installing new stream gage on the Marble Fork of the Kaweah River, September 2013. Photo: Andi Heard.

Monitoring Project Updates

Birds

This was the third season that SIEN worked with The Institute for Bird Populations to monitor abundance and distribution of birds across the parks' elevational gradient. The SIEN bird crew members (Jade Ajani, Tyler Stuart, Martin Frye, and Sarah Hendrickson) completed 27 point count transects in both SEKI and YOSE and 40 point counts along a grid in DEPO. New safety training and check-in procedures were implemented and field-tested by bird monitoring crews, using GeoPro Satellite Devices and park radios. The annual report for the 2012 bird monitoring season was drafted (Chung-MacCoubrey et al. 2013).



Tyler Stuart monitoring birds in Sequoia National Park. Photo: Jade Ajani.

Climate Reporting

The network has acquired and processed a portion of the 2012 climate data and is awaiting additional data that are being processed by the Desert Research Institute in Reno, NV. The first annual climate report is planned for this summer. A snowpack assessment for Sierra Nevada Network parks done by the University of California, Merced, was published in September (Rice and Bales 2013). The authors used existing data and techniques to assess the trends and current status of snowpack for six watersheds within SIEN parks and to recommend approaches for monitoring and modeling snowpack changes.

High-Elevation Forests



Forest monitoring crew near a white-bark pine plot in the Helen Lake area of Yosemite National Park. NPS photo.

During the second season of monitoring whitebark pine and foxtail pine forests in SEKI and YOSE, forest crew members Pete Del Zotto, Tressa Gibbard, Sienna Hiebert, and Patrick Rizzo visited a total of 29 plots and completed installation on 21 of them. Four plots were rejected due to safety or lack of target species. Plot corners are marked with rebar, and trees are identified with numeric metal tags. All trees are measured and assessed for incidence of insects or disease. Project lead Jonny Nesmith met with other forest monitoring leads from Klamath and Upper Columbia Basin networks to discuss shared analysis opportunities and potential protocol refinements.

Lakes

The lake monitoring was scaled back to sampling just the annually sampled set of lakes in order to allow time to finalize and address any remaining issues in the river protocol. Other SIEN field crews and long-term staff sampled the eight lake sites in SEKI and YOSE. Project lead Andi Heard completed her doctoral dissertation which incorporated SIEN lake monitoring data. It also included research on the effectiveness of current environmental policy in protecting Sierra Nevada lakes and informing future environmental policy through the development of critical loads and nutrient criteria for Sierra Nevada lakes (Heard 2013).

Rivers

Activities this past summer have focused on responding to peer-review comments in order to finalize the Rivers Hydrology Monitoring Protocol and evaluating SIEN-operated sites in preparation for protocol implementation in 2014.

- In August we had a Water Resources Division technical assistance visit by hydrologist Gwen Gerber at two Tuolumne River stations. Gwen provided guidance on streamflow methods, station equipment and survey upgrades, data management, and Aequus streamflow data storage and analysis software.
- The SIEN Physical Scientist visited the Devils Postpile stream gage and met with USGS and DEPO staff. The visit included taking a streamflow measurement, reviewing methods and safety procedures to ensure consistency between SIEN, USGS, and DEPO, and planning for improvements to the gaging station.
- A new gage was installed on the Marble Fork of the Kaweah near Lodgepole in Sequoia NP. This site is the new Hydrologic Benchmark Network site, replacing the site just upstream, above Tokopah falls.
- Substantial progress has been made on responding to peer-review comments. The revised protocol will be submitted in November.



Andi Heard (l) and Gwen Gerber (r) taking streamflow measurements on the Lyell Fork of the Tuolumne River. Photo: Harrison Forrester.

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David Graber, Inventory & Monitoring Pioneer, Retiring

David Graber, Chief Scientist for the Pacific West Region, is retiring on January 11, 2014. Dave has worked 32+ years for the National Park Service and three years for National Biological Survey/US Geological Survey.



David Graber.

Among his many accomplishments, Dave has made significant contributions to the National Park Service Inventory & Monitoring (I&M) Program.

“When I was working in Yosemite in the 1970s, I was shocked at the lack of good baseline information on plants, animals, geology, and other natural resources, which made any kind of ecological research like my bear work much harder to do,” Dave observed.

After Dave transferred to Sequoia and Kings Canyon in 1980 for a Research Scientist job, he began working with Jan van Wagendonk, Research Scientist in Yosemite, to develop a floristic inventory for the parks they worked in and to integrate it with the Geographic Information System technology that was just getting started.

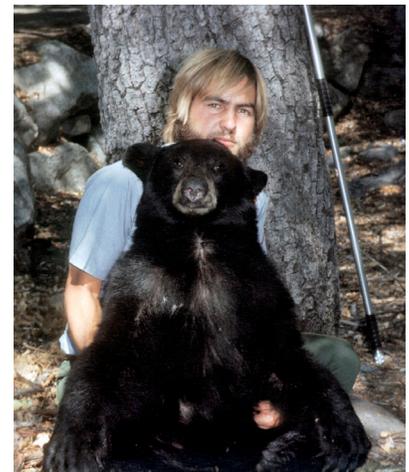
“At about the same time, Gary Davis (NPS Marine Biologist) was developing his ideas about the importance of monitoring from his work in the reefs off Everglades and then the kelp forests of Channel Islands,” Dave said.

While Dave and Jan were starting a systematic Natural Resources Inventory in their Sierra Nevada parks, Gary Davis and Dave shared their vision for a Servicewide inventory and monitoring program with then Superintendent of Sequoia & Kings Canyon, Boyd Evison, and this conversation continued when Evison became Regional Director in Alaska.

“We created a larger working group and met in Washington, D. C. as well as Channel Islands National Park to develop what became NPS-75,” Dave explained. This 1992 document laid the foundation for establishing the NPS I&M Program, although it took until the Natural Resource Challenge

in 1999 to get I&M institutionalized and funded.

Dave supervised the Sierra Nevada Network (SIEN) I&M Program between 2003-2006 and has served on the Board of Directors, the Science Committee that guided early planning, and currently, the Steering Committee. His extensive experience with research, inventory, and monitoring projects in the Sierra Nevada enabled Dave to provide valuable insights and guidance throughout the development of our program. SIEN staff will greatly miss Dave’s wealth of knowledge, great stories, sense of humor, and gourmet coffee!



David Graber in 1974, conducting research for his PhD dissertation on black bear ecology in Yosemite NP.

Monitoring Project Updates (*continued*)



SEKI Plant Ecology Program crew members conduct field accuracy assessments for the wetland mapping project. NPS photo.

Wetlands

The wetlands protocol is under revision: Major changes include an improved sample design and a reduction in sample size to accommodate a smaller project budget. The collaborative project between SIEN and SEKI Resource Management & Science staff to map all wet meadows and fens in the parks provided the spatial information about park wetlands needed to develop a new sample design. A similar mapping effort is planned for Yosemite and Devils Postpile wetlands. Jonny Nesmith is finalizing protocol changes this fall and will submit the protocol for peer review by January 2014.

Fire Regimes in the Southern Sierra

The Rim Fire in the Stanislaus National Forest and Yosemite National Park this past summer, and numerous other large fires in the western U.S in the past two decades, suggest that fire regimes have changed. Many places that historically had predominantly low to moderate severity fire are now experiencing large, catastrophic, high severity fires.

Fire regimes are defined by the following characteristics:

1. **Frequency** - how often fire burns
2. **Magnitude** - *intensity*, or amount of heat a fire produces; and *severity*, or amount of organic matter below and above ground consumed by fire.
3. **Size**
4. **Season** - time of year fire typically occurs
5. **Spatial distribution** - patchy vs. continuous
6. **Type of fire** - surface fire burning mostly in the understory; crown fire burning in crowns of trees and shrubs; or a mix of crown and understory fire.

Fire regime characteristics may vary through time, and across the landscape, in response to climatic variation, number of ignitions, topography, vegetation, specific historic events, and human cultural practices.



Example of low severity surface fire in a ponderosa pine forest. Tony Caprio.

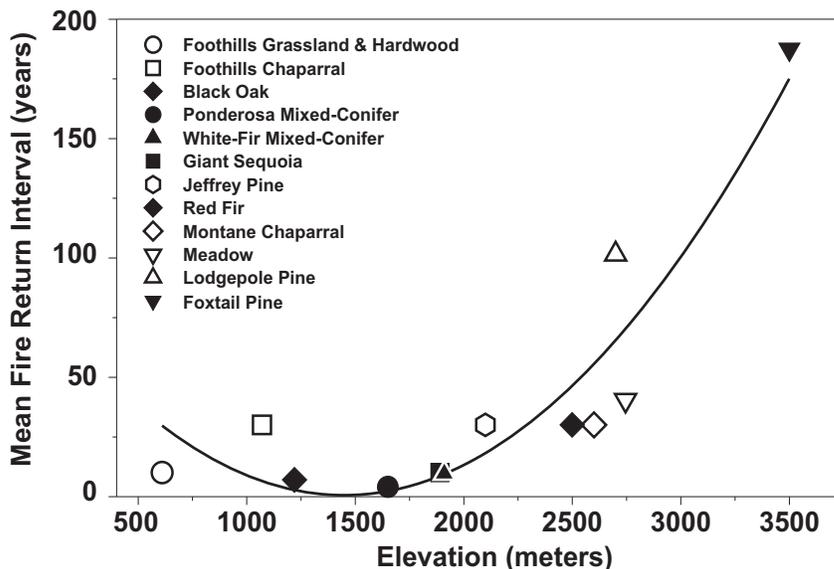


Figure 1. A strong relationship exists between elevation and the mean fire return interval (or average number of years between fires). Low elevation areas have smaller average intervals of time between fires while at the highest elevations, the average interval between fires is close to 200 years. From Caprio and Lineback 1997.

Substantial work has been done to define fire regimes across elevation gradients and different types of vegetation in the southern Sierra Nevada. Tree-ring records of fire scars clearly show shorter intervals between fires in low elevation conifer forests and longer fire intervals at higher elevations where fuels have higher moisture levels and are sparser (Figure 1). Less frequent, higher elevation fires are often more severe, while areas with frequent fire typically have lower severity fire. In giant sequoia-mixed conifer forests,

fire severity is mixed: patches of high severity fire help open the canopy, enabling giant sequoia seedlings to establish and get enough sunlight to survive.

Recent research on western United States wildfire activity (Westerling et al. 2006) showed that large wildfire activity increased suddenly and markedly in the mid-1980s, with higher large-wildfire frequency, longer wildfire durations, and longer wildfire seasons. The greatest increases occurred at mid-elevation, Northern Rockies forests, and are strongly associated with increased spring and summer temperatures and an earlier spring snowmelt.



Rim Fire, August 22, 2013 - burning as a high severity crown fire. NASA Earth Observatory.

The Rim Fire is the largest fire in the Sierra Nevada in recorded history, and is the sixth largest for the state of California. Research in the coming years will provide information about the varied effects of this fire over the landscape, and how factors such as prior land-use, management practices, fuel characteristics, and climate affected the size and severity of this fire.

Dissertation Completed!



Andi Heard, with the Great Western Divide in the background, Sequoia National Park.

Congratulations to SIEN Physical Scientist Andi Heard on completing her doctoral dissertation through UC Riverside in July 2013 - *Global Change and Mountain Lakes: Establishing Nutrient Criteria and Critical Loads for Sierra Nevada Lakes*. Her dissertation facilitates interpretation of lakes monitoring data and informs environmental policy and management related to atmospheric deposition of air pollutants and impacts on water quality.

Sierra Nevada Network (SIEN) Inventory & Monitoring Program

As part of the National Park Service's effort to "improve park management through greater reliance on scientific knowledge," a primary role of the Inventory and Monitoring (I&M) Program is to collect, organize, and make available natural resource data and to contribute to the Service's institutional knowledge by facilitating the transformation of data into information through analysis, synthesis, and modeling.

Parks in the network are: Devils Postpile National Monument (DEPO), Sequoia & Kings Canyon National Parks (SEKI), and Yosemite National Park (YOSE).

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The *Sierra Nevada Monitor* is published twice a year for Sierra Nevada Network park staff, our partners, and others interested in resources management and science in Sierra Nevada national parks.

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Pete Del Zotto, high-elevation forest field crew lead, hikes toward the rugged Sierra Crest across Boreal Plateau, enroute to a sampling site in Sequoia National Park. Photo: Tressa Gibbard.