Sierra Nevada Network

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Dead giant sequoia, believed to be drought-related mortality, Grant Grove (left); giant sequoia with upper 20 percent of crown browning, 2017 (center); and base of tree shown in center showing extensive basal fire damage from 2015 Rough Fire (right). NPS photos / Tony Caprio.

Giant Sequoia Responses to Hotter Drought

Giant Sequoias are known for their resistance to insects and disease and their fire-adapted life cycle. Prior to the recent severe drought, research about giant sequoia mortality suggested that large sequoias typically died by falling or having >90-95% of their crowns scorched by fire. Standing death unrelated to crown scorch was rarely observed by scientists and managers who had spent decades working in the Sierra Nevada.

During California's 2012–2016 hotter drought, local USGS scientists and park managers observed widespread foliage dieback, most pronounced during 2014. They also documented 30 sequoias that died standing in Sequoia & Kings Canyon NP in the years during and following the drought, associated with native bark beetle activity and fire-related damage around the bases of trees.

Beetle kill in giant sequoias is a newly reported phenomenon, associated with hotter drought. Beetle-killed trees usually had recent severe basal fire scarring. Most of these trees also grew in moist locations.

Managers and scientists are gathering information to better understand responses of giant sequoia to drought and to characterize spatial patterns of vulnerability to hotter drought. The Sierra Nevada Network I&M Program is working with park staff and USGS scientists to help quantify sequoia mortality at a larger spatial scale. Forest managers may be able to enhance tree survival in the face of future hotter droughts. For example, reducing forest density by prescribed burning or mechanical thinning can reduce competition for water among the remaining trees. But prioritization will be needed, deciding where on the landscape such efforts will be best applied. Mapping vulnerability of giant sequoia groves to severe drought and warming temperatures will help managers more strategically target treatments.

August 10, 2020

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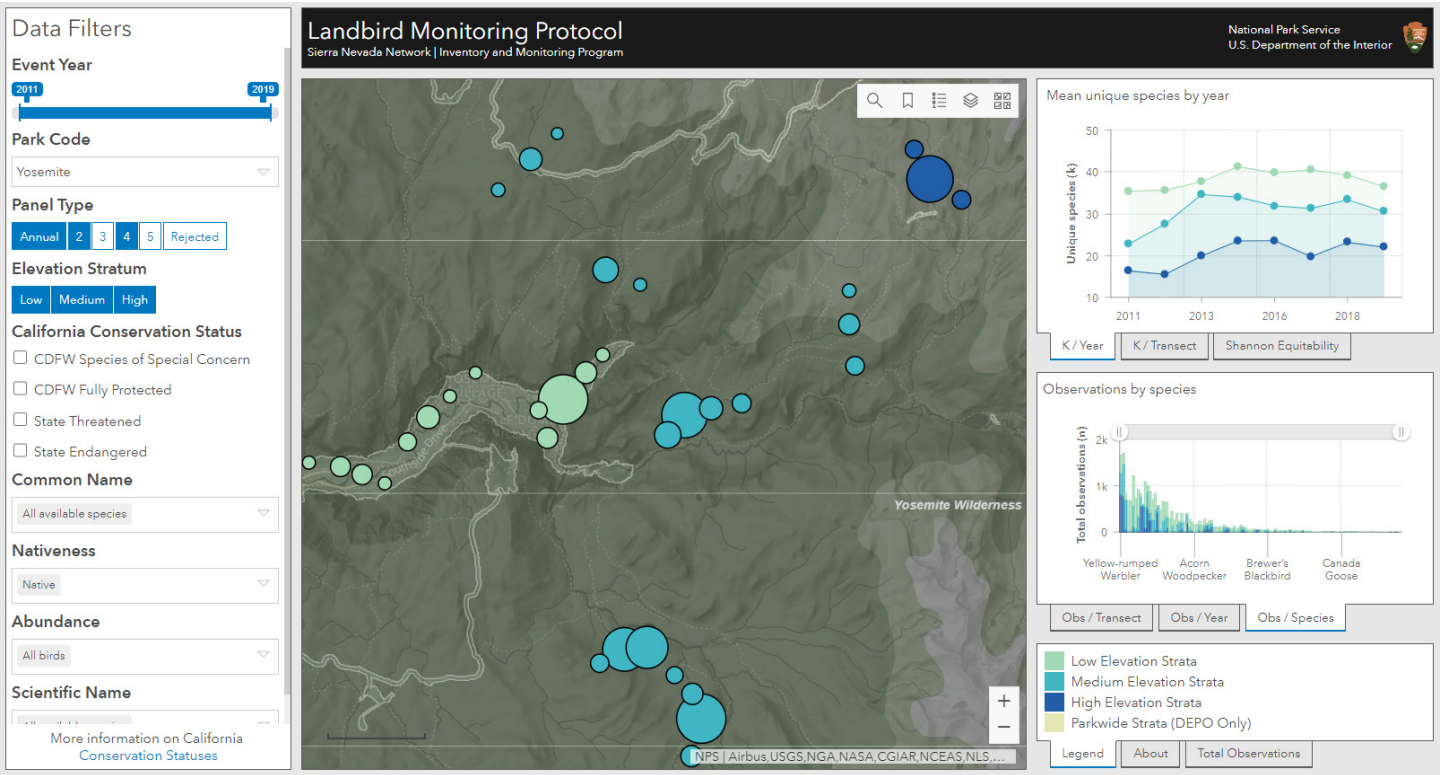
Introducing Two Data Visualization Projects



Sierra Nevada Network landbird monitoring protocol dashboard, showing point count densities in the area east of Yosemite Valley.

Web-based GIS: Sierra Nevada Network

Web-based applications such as ArcGIS dashboards lower the threshold of accessibility to otherwise complex datasets. Last winter, Sierra Nevada Network (SIEN) staff undertook two major web data visualization projects: a summary dashboard for the SIEN landbird monitoring protocol and modernization of the legacy wildlife observation database. These products were the result of a unique collaboration of sharing a GIS and Data Management Assistant between the parks and SIEN.

Landbird Monitoring Dashboard

We developed the SIEN landbird monitoring dashboard as an interactive companion to the written reports prepared by SIEN and The Institute for Bird Populations staff (partners in SIEN's landbird monitoring project) for consumption by park staff and cooperators. The dashboard comes configured with several exploratory charts which respond to parameters selected by the user. Using the dashboard, stakeholders can interact with the data without the need to understand the underlying dataset structure or maintain a local GIS environment.

Wildlife Observations

Observations of wildlife collected within the SIEN parks were previously submitted via paper slips and hand-entered by park staff into a tabular database. The new suite of tools was built using the ArcGIS Online framework and allows users to submit their own observations using a smartphone. These geotagged observations can then be vetted by subject matter experts prior to being incorporated into the master dataset, which park managers rely on for understanding the distribution of park wildlife. Submitted observations are combined with open-source data gleaned from citizen science platforms such as eBird and iNaturalist, and displayed side by side in an interactive web map. Users can export selected data in an open format from this web map for further analysis in their platform of choice.

Interested in submitting a wildlife observation? The internal form is currently being beta-tested and is available by request. However, observations submitted to iNaturalist with a photograph (which allows them to be considered for research grade status) will automatically be displayed in the interactive wildlife observations web map. Bird observations submitted to eBird, which do not require a photograph to pass their review process, will also be added. Both apps are easy to install and use, and they connect your observations to a global audience.

Exploring the Tools

The Wildlife observations and Landbird Monitoring web tools are available to NPS staff by request. For more information, please contact alex_eddy@nps.gov.

– by Erik De Silva and Alex Eddy

A Season Like No Other

In early March, I&M colleagues from all over the country gathered to craft our vision for the next 20 years of our program (link available to NPS only). We imagined a culture of shared leadership and committed partnership that facilitates exceptional science and empowers decision makers. We renewed our focus and came away energized and excited about the future. What we didn't realize? That after we returned home, the world would change, dramatically, as we entered what we now know is a global pandemic.

We're used to challenges. We've adapted to record snowpack and raging rivers, crippling drought, wildfires, and outbreaks of hanta-virus and plague. But we've never faced a global pandemic, and that caused us to pause and re-think virtually all aspects of how we live and work.

We stood down. On phone calls and video chats, from our living rooms and kitchens, we assessed the risks associated with both office and wilderness fieldwork. We realized that staying safe is an extraordinary undertaking; that outside is best, that inside is challenging. We reconsidered where we live between tours, how we access the research center, share vehicles, travel and collect our data; all while protecting our families, colleagues, and communities.

"Should we go?" For forest and bird monitoring, the answer was easy: no. Bird monitoring is on a scheduled rest year, and we'd just completed a three-year cycle of forest measurements. For lakes and wetlands, we scaled back to the subset of sites we prioritize visiting every year. Collecting outlet samples from eight lakes allows us to maintain the unbroken 12-year data record from our longest running protocol, and by relying on existing staff in the parks (and a team from our sister network in the Mojave Desert), we can do this without hiring additional staff. In Yosemite, the physical sciences staff will maintain the two gages on the Tuolumne River, while USGS tends the gage on the middle fork of the San Joaquin at Devils Postpile.

Wetland botanists Wes Meyers and Keven Griffen are operating as a family unit, or 'quaranteam.' Based out of park housing at SEKI, this requires tremendous trust and communication, as they share a home, vehicle, and equipment. By visiting the instrumented well sites, they will ensure that not only are the past years data preserved, but that the loggers are able to capture groundwater changes during the next water year. Deep thanks to Steven Lee and his team at the USGS Yosemite Field Station for helping cover sites we can't get to.

None of this is easy. Everything takes longer and is more challenging. Standing down a field season that would have brought a truly remarkable team of field biologists to our network was a hard but necessary decision, and one we did not make lightly. We're taking it one well, one lake at a time—because we are in this for the long term, and what we learn from this season will inform how we face an uncertain future. We're looking forward to coming back stronger, more resilient, and with new approaches to living and working in the coming year.

Farewell, and welcome. We said farewell to valued colleagues this year; in addition to Deanna Dulen, who retired in May (page 6), we thank Woody Smeck and Mike Reynolds, who left superintendent roles in our network to serve in regional offices, for their continued leadership and inspiration. We wish Erik De Silva all the best as he heads to Grand Canyon and the next chapter in his career. We welcome Cicely Muldoon (YOSE), Lee Taylor (SEKI), and Kevin Killian (DEPO) as they each have graciously left their homes to step in as acting superintendents during these incredibly challenging times.

– by Sylvia Haultain

California Condor Comeback

California Condors, once widespread in the western U.S., are returning to their historic range, after years of restoration efforts. This range included the Sierra Nevada, where they once nested on cliffs and in large trees. While they are not nesting locally, confirmed sightings and radio transmitter records indicate condors have been near or just inside Sequoia & Kings Canyon. In late May, an employee observed four condors flying over Giant Forest and touching down on Moro Rock in Sequoia National Park. This part of the Sierra is unique for condor recovery because the central and southern California populations seem to be converging here: the Moro Rock (and recent Mt. Whitney) condors were from southern CA and a 2014 group at Buck Rock Lookout in nearby Sequoia National Forest from central CA. For more information, see the new park web page on these iconic birds.

Two California Condors visit Moro Rock in Sequoia National Park, May 2020. NPS / Wilson Garver.

Check Out Our Recent Products

River Hydrology Monitoring: Annual Brief for Water Year 2018

This brief summarizes data collected from the three SIEN-managed river hydrology monitoring sites for water year 2018 (October 2017 - September 2018): San Joaquin gage at DEPO and Tuolumne gages at Lyell Fork and at Tioga in YOSE. This monitoring brief was developed to meet park manager needs for annual summaries of SIEN monitoring projects.

Bessem, K., A. Eddy, and A. Heard. 2019. River Hydrology Monitoring: Water Year 2018. Annual Resource Brief. National Park Service, Inventory & Monitoring Division, Sierra Nevada Network.

White Pines in Decline: What Can Managers Do? (Resource Brief)

This brief summarizes information about white pine decline in the Sierra Nevada, from recent research and an in-press publication. It provides key summary points from the paper, and identifies potential management actions for consideration across Sierra Nevada public lands.

Sierra Nevada Network. 2020. White pines in decline: what can managers do? Resource Brief, National Park Service, Inventory & Monitoring Division, Sierra Nevada Network.

Vegetation Map for Sequoia and Kings Canyon National Parks (SEKI)

This report documents the SEKI vegetation mapping products, which have been in use by park staff since 2007. Products include digital layers, descriptions of each vegetation type, a key to the types, source data, ecological field data, and all related data and metadata files. Products are available at the NPS Vegetation Mapping Inventory Products webpage and through the NPS Integrated Resource Management Applications (IRMA) system.

Haultain, S. A., E. T. Reyes, J. M. Menke, D. N. Johnson, and D. L. Karavidas (Cline). 2020. Sequoia and Kings Canyon National Parks vegetation classification and mapping project report. Natural Resource Report NPS/SIEN/NRR—2020/2101. National Park Service, Fort Collins, Colorado.

Wet Meadow and Fen Mapping of Yosemite National Park (YOSE)

The Yosemite Wetland Mapping Project identifies and maps all fens and wet meadows >0.5 ha within Yosemite National Park. These products will allow managers to better understand the distribution and current status of fens and wet meadows within YOSE. This information is being used to aid several NPS planning and monitoring efforts including the SIEN Wetland Ecological Monitoring Protocol.

Pyrooz, N. N., A.W. Dickenson, J. C. B. Nesmith, C. R. Cann, E. A. Frenzel, S. A. Haultain, and P. E. Hardwick. 2020. Wet meadow and fen mapping of Yosemite National Park: A photo interpretation mapping project of wetland resources. Natural Resource Report. NPS/SIEN/NRR—2020/2145. National Park Service, Fort Collins, Colorado.

Climate Change Scenario Planning Report

Three I&M networks and scientists from the Oregon Institute of Technology conducted scenario planning workshops focused on two species – whitebark pine and American pika. The authors: a) initiated climate change scenario planning for the two species, b) provided insight into the process beyond "how to" guides for climate adaptation, and c) synthesized results to inform future scenario planning and implementation of recommended actions.

Kellermann, J. L., T. J. Rodhouse, J. C. B. Nesmith, and A. Chung-MacCoubrey. 2019. Setting the stage for climate change scenario planning: Whitebark pine and American pika in the Sierra Nevada, Klamath, and Upper Columbia Basin Inventory and Monitoring Networks. Natural Resource Report NPS/KLMN/NRR—2019/1960. Nat. Park Serv., Fort Collins, Colorado.

Whitebark Pine in the Klamath Network

This paper is a recent product from a collaborative white pine monitoring project among four I&M networks.

Jackson, J.I.; Smith, S.B.; Nesmith, J.C.; Starcevich, L.A.; Hooke, J.S.; Buckley, S.; Jules, E.S. Whitebark Pine in Crater Lake and Lassen Volcanic National Parks: Assessment of Stand Structure and Condition in a Management and Conservation Perspective. Forests 2019, 10, 834.

Story Map: Join a Field Crew to Monitor Mountain Lakes

Crew Lead Talia Chorover (left) and crew member Marisa Monroe.

Explore this story map, joining a Sierra Nevada Network (SIEN) field crew as they travel to remote areas and study lake ecosystems. Learn more about what these scientists do to monitor lakes and how they travel to these remote sites. The condition of these lakes is affected by deposition of air pollutants, warming temperatures, and non-native species. The information gathered will help stewards make science-based decisions for these parks.

Marisa Monroe, Geoscientist-in-the-Parks intern in 2018, and SIEN Data Manager Alex Eddy developed the story map. It is an outreach product associated with SIEN's Lake Monitoring Protocol.

Birders Add Five Species to CECH List

Over 30 volunteer birders and five National Park Service staff enjoyed a successful morning of birding at Cesar E. Chavez National Monument (CECH) on Saturday, February 22nd. A total of 51 different species were observed, and 5 species were newly documented – Green-winged Teal, Downy Woodpecker, Merlin, Wrentit, and Rufous-crowned Sparrow. The checklist for the monument is now up to 88 species. This year marked the fifth year of annual birding events at the monument, co-coordinated by Kern Audubon, the Sierra Nevada Network Inventory & Monitoring Program, and CECH. Thank you to the Cesar Chavez Foundation for providing access to a larger area of the monument for this annual event. We thank Karen Fernandez and Kyle Gallaher, SEKI Education Technicians, who provided organizational support and birded at the event.

NPS staff and Kern Audubon members birding at the monument

What Is Happening with Inventories 2.0?

The next generation of National Park Service natural resource inventories, Inventories 2.0, will be launched in the coming year as a set of 12 species inventory pilot studies that span regions, taxa, data collection methods, and management uses of data.

To develop the Inventories 2.0 Plan, the Inventory & Monitoring Division (IMD) used park resource stewardship strategies and foundation documents, and sought input from parks, I&M networks, regions, and national programs. Species inventories ranked as a high need among all of these entities.

Ten types of inventories were identified as servicewide needs. IMD will lead three of the ten inventories (Species, Vegetation Community Mapping, and Surficial Geology/ Soils Mapping), and contribute to the others in partnership with other programs.

For the three IMD-led inventories, IMD will develop (or work with the Geologic Resources Division to develop) peer-reviewed inventory science plans that lay out inventory objectives and methods for data management, analysis, and integration to ensure that credible and useful inventory data are provided to parks in a timely manner.

In the inventory proposal process, the request for data will originate from parks in a technical assistance request format. IMD staff will coordinate with park and network staff to draft a study design, and project implementation will be managed through contracts that IMD administers.

During the next two years, IMD will focus on meeting species inventory needs that are directly tied to park management. IMD is using information learned during this year's pilot study design and solicitation processes to determine study criteria and screening processes for 2021. To learn more, watch the recorded webinar (NPS only).

Deanna Dulen Retired May 29th - Congratulations!

Deanna Dulen, Superintendent of Devils Postpile National Monument (DEPO), retired on May 29th. Deanna's federal career spanned over 37 years working for several land management agencies and the US Postal Service. Deanna served as DEPO Superintendent for 20 years.

Deanna Dulen near Rainbow Falls, Devils Postpile NM

Deanna advocated for and initiated many critical projects and partnerships to improve scientific understanding of Devils Postpile National Monument's natural resources and biodiversity. She engaged numerous outside scientists to conduct local research. Deanna helped launch the Sierra Nevada Network Inventory & Monitoring Program, and remained an enthusiastic supporter of the network's projects at the monument. Deanna served on the SIEN Board of Directors since its first meeting in 2002.

Previously, Deanna worked as Director of the Inyo National Forest Mono Basin Visitor Center and Interpretive Program for the Mono District and the Eastern Sierra Scenic Byway from 1991-2000. She also worked as a seasonal park ranger in four national parks.

Deanna is especially proud of the recent update to the 2019 Fire Management Plan and the implementation of Devils Postpile's first wilderness prescribed fire, which took place in November 2019. She also led DEPO in development of its General Management Plan, Natural Resource Condition Assessment, and Resource Stewardship Strategy. These efforts set the stage for science informing management at the monument. Pursuing a high priority for local resource stewardship, Deanna convened a climate change refugium workshop with scientists and managers in 2017 to identify climate change impacts and adaptation strategies at DEPO's Soda Springs Meadow.

In retirement, Deanna plans to devote more time to international conservation efforts. Deanna and her husband Wangdowa Sherpa will also continue efforts to bring education, health care, and conservation awareness to remote and impoverished areas in the Himalaya through a non-profit that they founded.

Annie Esperanza – A Legacy of Park Science

Last spring, we lost colleague and friend Annie Esperanza, who worked nearly 40 years in Sequoia and Kings Canyon National Parks (SEKI), helping build a legacy of long-term monitoring and resource management programs. Annie passed away on March 29, 2020, at Stanford Hospital from complications after a heart transplant.

Annie Esperanza monitors the heartbeat of a tranquilized bear.

During her years in the parks' Research Office and the local USGS Field Station, she helped establish research programs that measured atmospheric deposition, climate, and human-induced changes in high-mountain lakes and watersheds. Later, working as SEKI's Air Quality Specialist and Physical Sciences Branch Chief for Resources Management and Science, Annie managed a diversity of monitoring programs, including air and water quality, wildland fire smoke, caves and karst, soundscapes, and more.

Annie jumped in enthusiastically to help in the earliest days of the SIEN I&M Program. She attended each park and network-level vital signs workshop, where managers and scientists identified and prioritized vital signs. She served on several protocol work groups – lakes, rivers, and climate – helping us make important decisions about monitoring objectives and approaches. And, she served as a local park point of contact for our lakes monitoring field seasons.

As we carry the monitoring torch forward with our colleagues at SIEN parks, Annie remains a source of inspiration and optimism as we continue to build on the legacy of park science that she helped establish. For a longer tribute to Annie's career and contributions to the National Park Service and the local park community, please see the InsideNPS article, or this local newspaper article.

What's New with SIEN and Park Staff?

SIEN Field Staff Launch from Field Work to Graduate School

At least 16 former SIEN field crew members have gone on to graduate school. We have started featuring them in web articles, highlighing their graduate work and how they decided to take those paths. Click on the names below to link to short online articles about each person:

Vlad Kovalenko, former forest crew member, is pursuing a MS degree in systems ecology at the University of Montana and just started his field work on the whitebark pine ecosystem in Glacier National Park.

Megan Mason, former lakes crew member, has just completed her MS degree in geophysics with the Cryosphere Geophysics and Remote Sensing lab at Boise State University, Idaho. She used airborne LiDAR surveys to study spatial consistency of snow depth patterns seasonally and annually in Tuolumne Meadow, Yosemite National Park.

Sam Zuckerman, former forest crew member, started a PhD program last year in natural resources at the University of New Hampshire and is studying anatomical and physiological capacities for northeastern tree species to acclimate to drought conditions.

Vlad Kovalensky, Glacier National Park, MT

Megan Mason, Grand Mesa, CO

Sam Zuckerman, Sequoia National Park

Alex Eddy Assists on Park Incident Management Team for COVID-19 Response

Alex Eddy, SIEN Data Manager, recently served on the Sequoia and Kings Canyon National Parks COVID-19 Response Incident Management Team (IMT). From the end of March through May, she was assigned as the Documentation Unit Leader within the Plans Section. In this capacity, she assisted with incident documentation, file permissions, security, and sharing, technology support, and planning. She helped the team successfully stand up as a "remote incident command", with most incident staff working together through online collaboration tools. Park staff continue to do outstanding work in planning and operations as the parks re-open and expand public services. Alex is grateful for the opportunity to work closely with our talented and committed colleagues, who have admirably served the parks and each other throughout these challenging months.

Linda Mutch Returns Full-Time to NPS Science Communication

In April, Linda Mutch returned to working full-time in her NPS science communication role. Starting in November 2017, she split her time between SIEN and the Northern Rockies Fire Science Network, where she served as a Co-Coordinator. That role involved planning and coordinating field trips and workshops to bring together fire managers and scientists, managing a web page that featured digital resources for fire managers, developing research briefs on important publications, developing newsletters, and planning educational videos for fire managers. While Linda found this opportunity to bring together her interests in fire and science communication rewarding, she is enjoying being able to devote her full attention again to NPS Inventory & Monitoring science communication efforts with both SIEN and the Mojave Desert Network, as well as working with SEKI staff on park nature and science web page updates and revisions.

New UC Merced Yosemite and Sequoia Field Stations Director - Breeanne Jackson

Breeanne (Breezy) Jackson became the new Yosemite and Sequoia Field Stations Director for the UC Merced Natural Reserve System on April 1st (no fooling!). Prior to this position, Breezy worked as a Wildlife Biologist from 2016-2020 in the Terrestrial Biodiversity Program with Yosemite National Park. She worked on butterfly, bat, Sierra Nevada red fox, and mountain lion research, as well as assisting with songbird and raptor research.

Breezy emphasizes that the Yosemite and Sequoia Field Stations are more than just physical facilities. They represent a research and education partnership between Yosemite and Sequoia & Kings Canyon National Parks and the UC Merced.

"Together we create knowledge necessary for wise stewardship of public lands, provide education opportunities for learning communities through California and the world, and honor the commitment of both institutions for diversification of the student body and workforce," Breezy said. "I am proud and excited to join UC Merced and work to support this important collaboration."

Breezy's research background is in stream and riparian ecology and disturbance ecology. Prior to her work for the NPS, she studied the effects of Yosemite wildfires on riparian vegetation, stream, geomorphology, benthic invertebrates, riparian spiders, and the American Dipper. She is especially interested in aspects of ecosystem function such as the transport of nutrients, carbon, and energy from aquatic primary producers to riparian consumers via emergent aquatic insects.

Breezy's academic background includes a PhD in Ecosystem Ecology, The Ohio State University in 2015; a MS in Environmental Science, University of Idaho, 2009; a MS in Outdoor Leadership, University of Idaho, 2008: and a BS in Environmental Science, St. Mary's College of California, 2004.

We look forward to working with Breezy in her new role.

Monica Buhler on Bureau of Land Management Detail

Monica Buhler, Natural Resource and Visitor and Information Services Program Manager at Devils Postpile National Monument (DEPO), has started a year-long detail and temporary promotion with the Bishop Bureau of Land Management Field Office. The Alabama Hills were designated as a National Scenic Area in 2019 and require a new management plan and Environmental Assessment. Monica is the project manager for the development and implementation of the plan. She is still doing some work for DEPO to maintain partnerships with other agencies and researchers, and complete some essential resource monitoring. Monica represents DEPO on the Sierra Nevada Network's Technical Committee.

Sierra Nevada Network

The Sierra Nevada Network is one of 32 National Park Service inventory and monitoring networks that monitor vital signs to assess the condition of park ecosystems and contribute to a body of scientific knowledge that informs park management decisions.

Parks in the network are:
*César E. Chávez National Monument (CECH)
Devils Postpile National Monument (DEPO)
Sequoia & Kings Canyon National Parks (SEKI)
Yosemite National Park (YOSE)

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*Established in 2012, César E. Chávez NM is not included in the vital signs monitoring program.