



Many Hands...

Collaboration has become the standard for landscape-level conservation, restoration, monitoring, and assessment work. The Southern Plains Network's (SOPN's) long-time program manager, Rob Bennetts, was a champion for collaboration. His legacy of collaboration lives on today in our work through the Southwest Network Collaboration (SWNC). The SWNC partnership, established more than a decade ago, formalizes the relationship between the Chihuahuan Desert, Sonoran Desert, and Southern Plains Inventory & Monitoring networks. The partnership characterizes our mutual interest in working collaboratively—an approach that improves our ability to complete field work safely and on time, share knowledge, create learning and mentoring opportunities for early career individuals and interns, streamline reporting, and deliver actionable science that informs park management.

SOPN has also maintained a strong working relationship with the Southern Plains Fire Group (SPFG). Our teams are in communication year-round, staying in touch about common monitoring procedures and shared plots across SOPN parks. Our collaboration also includes early season trainings and fieldwork when schedules permit, and, most importantly, we are exploring better ways to share and summarize data. In the fall of 2023, SOPN team members met with the SPFG at Chickasaw National Recreation Area (NRA) and Washita Battlefield National Historic Site (NHS) to review the condition of SOPN and fire effects monitoring plots, and to discuss SPFG's plans for future treatments. These meetings represent special opportunities to interact, share observations and data, and learn from fire scientists how fire can be used to improve the ecological health of park grasslands.

Stewarding national parks also requires partnering with and gaining public support. SOPN believes that connecting with the public benefits from welcoming artists

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in our work. The illustrations, paintings, and photographs that artists create offer an entry point into park natural history. Outreach efforts enriched through partnerships with artists reach new audiences, leave lasting impressions, and inspire people in ways that support park stewardship. For these reasons, SOPN is collaborating with scientific illustrators, like A.M. Rasmussen, to diversify and strengthen our outreach efforts.

While partnerships are essential to the success of conservation and outreach efforts, and a necessity for programs like SOPN's (with modest financial resources), we also know and appreciate the idiom, many hands make light work. Across the NPS, our success depends on the support and commitment of volunteers, interns, and partners within and outside our agency. At SOPN, we have tried to embody this sentiment, working with partners to: complete our monitoring work; strengthen analyses, outreach, and reporting; and develop lasting relationships that enhance our understanding of the status and condition of natural resources.

We are currently building relationships with partner agencies, non-governmental organizations, and universities (particularly through their natural heritage programs and museums and collections teams). Our goal is to expand our network of partners and better deliver the information parks need at a time and in a format that is most useful. Our success in this matter will depend on our ability to see the whole landscape, leverage diverse perspectives, and work across boundaries to focus on shared conservation needs. We fundamentally believe that collaboration is essential to our own durability and sustainability.

We appreciate the long-standing work and commitment of partners and look forward to working with new partners this year.

Andrew Ray, SOPN Program Manager

STAFF UPDATES

Scientists in Parks (SIPs)

The NPS SIP program places interns with parks and programs to assist with resource management activities. SOPN shares some SIP positions with the other SWNC networks (i.e., CHDN and SODN). SIPs work on SOPN monitoring crews and assist with the network's GIS and data management needs.

Elayna (Ella) Bump—Ella moved to Santa Fe, New Mexico, and started her work as a SIP Hydrology Assistant in November 2023. Her background is in watershed science and snow hydrology, doing field work in wintery alpine environments in Colorado; however, she has a profound love for the desert and is excited to be living among red rocks and cholla.

Ella's interest in water began with her summer college job—whitewater raft guiding on the Arkansas River in Buena Vista, Colorado. She completed her undergraduate degree in 2015 and is finishing up her M.S. degree in Watershed Science at Colorado State University. She is looking forward to spending time standing in rivers, measuring them, and thinking about the way they are changing over time, and she is excited about the world of coding and R programming. Her other interests include skiing, reading fiction, and getting into remote wilderness places.



Elayna (Ella) Bump, SIP Hydrology Assistant. Photo courtesy of Ella Bump.

Shelly Valdovinos—Shelly is excited to have joined the SOPN and greater SWNC networks as a SIP Ecology Assistant in September 2023. Shelly's fieldwork is comprised of collecting and managing data from various vital signs, including uplands, springs, grasslands, exotics, and wildlife.



Shelly Valdovinos, SIP Ecology Assistant. Photo courtesy of Shelly Valdovinos.

Shelly graduated with a B.S. in Conservation Ecology and a minor in Wildlife Biology from New Mexico State University. She worked with endangered Bolson tortoises at the Ladder Ranch, a Ted Turner Reserve. Because she has always been drawn to national parks, she made the step in that direction. She contributed to science education at Death Valley National Park, conducted rare plant surveys at Rocky Mountain National Park, and is excited to be back in the Southwest where she grew up, enjoying, observing, and exploring as many parks as she can.



SIP assistants Shelly Valdovinos (kneeling) and Ella Bump (standing) processing water samples collected from the Pecos River in April 2024. Water is collected using equal-width increment sampling methods and a DH-81 handheld depth-integrating sampler. Samples are then composited in a 3-gallon carboy and dispensed into laboratory-provided bottles for analysis. Samples are kept on ice until analyses are conducted at an EPA-certified laboratory. NPS photo.

SOPN'S ARTIST PARTNER

We are excited to announce that A.M. Rasmussen is working with SOPN to create illustrations that we can use in our science communication efforts. You'll find the first two illustrations she's produced for SOPN in this newsletter. We look forward to working more with A.M. in the coming year!

A.M. Rasmussen is a biological illustrator who creates artwork that supports education and engagement with science and nature. She grew up in Idaho, where she learned to love nature and nurtured an interest in drawing. Her curiosity and respect for nature led her to university, where she studied biology and used art to support her science training. A.M. recently received a Doctor of Arts in Biology, where her focal research explored how illustration can facilitate science education and research. In biological illustration courses and workshops, she engages students, educators, and researchers in using illustration as a learning tool to observe, record, and communicate. A.M. is an educator for informal and formal life-science education, and she participates in ecological research. As a biological illustrator, she seeks to represent nature through detailed illustrations that convey knowledge, generate curiosity and respect, overcome misconceptions, and influence action. Her work supports science education and outreach by bringing nature and science topics into the visual realm to make them more accessible and approachable to a wide audience. In addition to the two illustrations created for SOPN, examples of A.M.'s art are shown here.



Original illustration (California Condor) by and courtesy of A.M. Rasmussen.



Original illustrations by and courtesy of A.M. Rasmussen.

SCIENCE SPOTLIGHT #1

New Resource for Managing Amphibians

National parks and other protected areas are important for preserving landscapes and biodiversity worldwide. To manage parks effectively, managers need basic information about which species live in parks. Species lists, however, need constant maintenance to remain accurate. Having up-to-date information can mean the difference between taking conservation actions for at-risk species versus overlooking their needs.

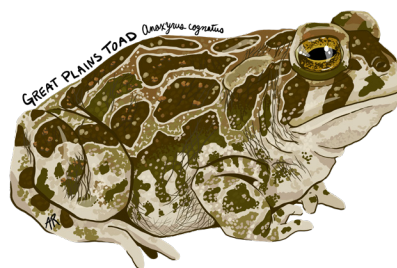
For that reason, a small group of staff from the National Park Service's Inventory & Monitoring (I&M) Division recently completed a new synthesis of amphibian occurrences across the National Park System. Many parks already had a list of amphibian species observed within their borders. These lists were compiled from various sources and were publicly available through the NPSpecies platform, but many of the observations were unverified. In many cases, the lists had not been updated to incorporate recent observations or changes in taxonomy. To create the updated dataset, I&M staff collated old and new park-level records and had them verified by regional experts.

The new dataset contains occurrence records for 292 of the 424 NPS units, including SOPN parks, and state- and international-level conservation rankings for each record. Note that the other 132 park units lack habitat for amphibians or did not have a list of resident amphibians. In the new dataset, there are hyperlinks to a supporting reference for each record, as well as data that can be used to better understand and manage amphibian biodiversity within a single park or group of parks. With this new database, managers now have more current information they can use to make decisions that promote amphibian conservation.

Citation:

LaFrance, B., A. Ray, R. Fisher, E. Grant, S. F. Spear, T. W. Pierson, J. M. Davenport, M. L. Niemiller, B. M. Glorioso, J. Barichivich, B. J. Halstead, K. Roberts, R. Brodman, B. R. Hossack. 2024. A dataset of amphibian species occurrence in U.S. National Parks. *Nature Scientific Data* (2024) 11:32. Available at <https://www.nature.com/articles/s41597-023-02836-2>.

And here's a web article on the work: [Updated Species Database Will Help Boost Amphibian Conservation Across the National Park Service](#).



Great Plains toad (*Anaxyrus cognatus*), a species that's present or possibly present in many SOPN parks. This relatively rotund amphibian is found throughout the grasslands of the central and southwestern U.S. It spends much of its time underground, emerging after heavy rains. Illustration by A.M. Rasmussen.

ANNOUNCEMENTS

- Andy Ray (SOPN), Andy Hubbard (SODN), Jason Mateljak (CHDN), and Matthew Johnson (Southern Colorado Plateau Network) presented I&M updates at the New Mexico Superintendents Meeting at the Old Santa Fe Trail Building on April 16–18, 2024.
- May 5–11, 2024 is [Amphibian Week](#), held during the first week of May each year. Partners in Amphibian and Reptile Conservation (PARC) organizes an *Amphibian Week* event in Washington D.C. that allows government agencies to showcase their work in amphibian conservation. This year Ben LaFrance and Andy Ray will highlight: 1) long-term monitoring activities in national parks; 2) recent results from Inflation Reduction Act-funded efforts to support native amphibian conservation through the control of non-native bullfrogs; and 3) recent results from national syntheses demonstrating the importance of large and small parks in supporting amphibian biodiversity.
- Merran Owen will be participating in the Fort Larned NHS Resource Stewardship Strategy (RSS) Workshop on July 9–11. An RSS is a long-range planning document for a park unit to achieve its desired natural and cultural resource conditions.
- Merran Owen, Heidi Sosinski, and Andy Ray are working with Clint Herriman at Lyndon B. Johnson NHP and BRD Restoration Ecologist, Katie Vinzant, on restoration plans for the prairie at the Johnson Settlement unit in Johnson City. Merran will be visiting the site in early May to do an assessment of exotic plants in the prairie.

ANNOUNCEMENTS- *continued*

The Southern Plains Network is Expanding

As you may have heard, a new park has been established in the Southern Plains Network. Secretary Haaland formally established Amache National Historic Site (NHS; AMCH) on February 15, 2024. Thanks to the Town of Granada's donation of the land on which Amache is located, the nation's newest national park is now in Granada, Colorado. Amache's establishment came just days before the Day of Remembrance, the anniversary of the signing of Executive Order 9066, which allowed for the incarceration of Japanese Americans during World War II. The Day of Remembrance is commemorated each year on February 19th.



Temporary park entrance sign at Amache NHS, which was formally established on February 15, 2024. NPS photo.

With this formal establishment, Amache NHS will permanently protect the site for future generations and help tell the history of Japanese American incarceration during World War II. Amache's historic building foundations and road alignments are largely intact, preserved through the years by Amache survivors and their descendants, the Town of Granada, the Amache Preservation Society, and other individuals, institutions, and organizations. The site is nearly 500 acres in size and currently consists of a historic cemetery, a monument, concrete building foundations, a road network, and several reconstructed and restored structures from the World War II era, including a barracks, recreation hall, guard tower, and water tank. In March of this year, the park had an arbor assessment conducted by NPS staff trained from the Olmstead Center for Landscape Preservation, and is currently finalizing a task agreement with Colorado Natural Heritage Program to complete baseline vegetation mapping and potentially collect voucher specimens. These data collection efforts will be used by park management and SOPN staff to plan future projects and developments to the site.

Introducing Amache NHS's Site Manager

Chris Mather has worked for the National Park Service for nearly 14 years and began his NPS career at Grant-Kohrs Ranch National Historic Site. Since then, he has worked at Fort Laramie National Historic Site, Agate Fossil Beds National Monument and Yellowstone National Park. Mather earned a bachelor's degree in anthropology, with a minor in history, from University of Idaho, and a master's degree in American history and government from Ashland University. He has enjoyed exploring eastern Colorado with his wife, Jenna, and their three dogs.



Barracks, water tower, and guard tower (from left to right), at Amache NHS, located in Granada, Colorado. Japanese Americans were incarcerated at the site from 1942-1945, during World War II. NPS Photo.

VITAL SIGNS UPDATES

Grasslands

We are currently preparing for the 2024 grasslands field season and are excited to meet with park managers while we are on site for annual surveys. Please see Table 1 for dates when we will be in each park. In addition to field work preparations, we worked this winter to update and improve our park plant species lists. We accomplished this in part by creating a system for our crews to voucher plant specimens and house them in an NPS or partner herbarium, and in part by making our species lists publicly available through the SEINet Portal Network. The SEINet data portal is a Symbiota-based, public website that allows users to search through a consortium of over 300 herbarium collections across North America (Figure 1; SEINet Portal Network 2024). Users can search for and view digitized plant specimens or records from universities, museums, public land agencies, and other collections. The data portal also allows users to search for educational information on any particular plant species, and view photos, written descriptions, and a map showing the location of all digitized specimens in the database. To view the species list for one of our park units on SEINet, select “Agency Floras” from the website’s homepage, then “NPS-Intermountain.” This will bring up a list from which users can select any SOPN park. While browsing through a species list, one can bring up a page of information on any given plant simply by clicking on the plant name. This will display photos, digitized pressed specimens, and an interactive

map showing the collection location of all SEINet records for the given plant.

SEINet Citation:

SEINet Portal Network. 2024. Available at <https://swbiodiversity.org/seinet/index.php>. Accessed on 18 April 2024.

Table 1. 2024 Grasslands and exotic plant monitoring schedule.

Dates	Park Unit / Location	Grassland Plots	Exotic Plant Work
5/20 to 5/27	LAMR	9	Reveg. Mon.
6/5 to 6/12	WABA	9	–
6/19 to 6/26	CHIC	7	–
7/6 to 7/11	FOLS	7	–
7/17 to 7/24	SAND	15	Reveg. Mon.
7/31 to 8/07	BEOL	12	Grid Survey
8/14 to 8/17	CAVO	4	–
8/18 to 8/21	FOUN	4	–
8/28 to 8/30	PECO	6	–
8/31 to 9/04	LAMR	7	–
9/11 to 9/14	LYJO	1	Reveg. Mon.

Reveg. Mon. = Revegetation Monitoring

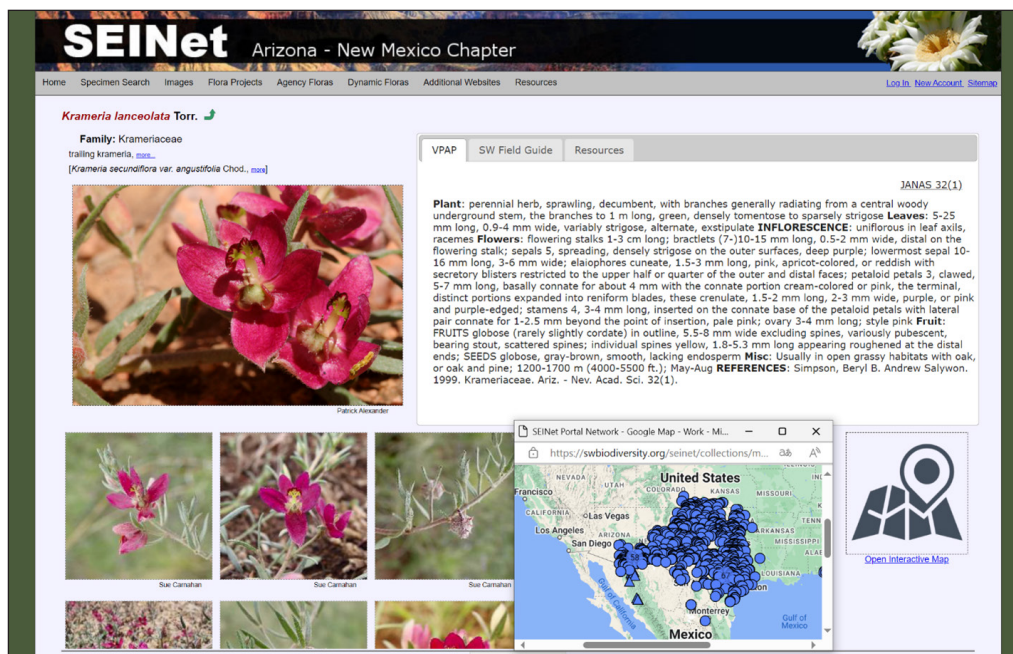


Figure 1. Screen shot of the SEINet Portal Network. Information on individual plant species can be viewed, including pictures, digitized pressed specimens, and an interactive map showing the location of all SEINet records. Note that individual photos in the screenshot show photo credits.

VITAL SIGNS UPDATES—continued

We are working to improve our plant vouchering program so that we may create a permanent, physical record of the plant species found within SOPN parks, to be stored at either NPS or partnering repositories, where they may be digitized and made publicly available. We hope our efforts will improve botanical research in the Southern Plains for the long term. Plant specimens housed at university herbaria reach a wide network of academic researchers and may be used in biodiversity, evolutionary, or genetic studies. They improve the accuracy of plant identification and provide a record of plant species distribution in our changing world, where vegetation communities are facing the impacts of climate change and invasive, exotic plants and animals. We will be reaching out to resource managers across the SOPN to learn the status of park herbaria and discuss the possibility of repository agreements.

Exotics

In addition to our long-term monitoring in park grasslands, SOPN has also spent the last 14 years monitoring exotic plant populations in parks. We monitor pathways at high risk for exotic plant invasion and infestation, such as roadsides, trails, boundary lines, and stream channels. We have also preformed multiple grid surveys

at each park, wherein exotic plant data are collected at predetermined grid points spaced evenly across the park landscape. This monitoring provides a record of the extent and distribution of invasive plants within the park.

These data are available to park staff and Invasive Plant Management Teams through the Southwest Network Collaboration (SWNC) Exotics Dashboard (Figure 2), hosted on the NPS ArcGIS Portal. The dashboard is a user-friendly place to download spatial files showing exact locations and sizes of infestation points and polygons. Users can also view, subset, and filter the data in the portal interface. Non-native plant data collected by SOPN since 2009 may be accessed there. To open the dashboard, sign in to your ArcGIS Portal account and open the SWNC Exotics Dashboard group. There are two dashboards available, one including data from 2009–2019, collected under our previous protocol, and one with data from 2020 to the present, collected under our current protocol and described in our most recent (2022) exotic plant reports (available on our website). We have added our current SOPN park contacts to the dashboard group. If you have any issues, please contact our data manager, Heidi Sosinski, for help.

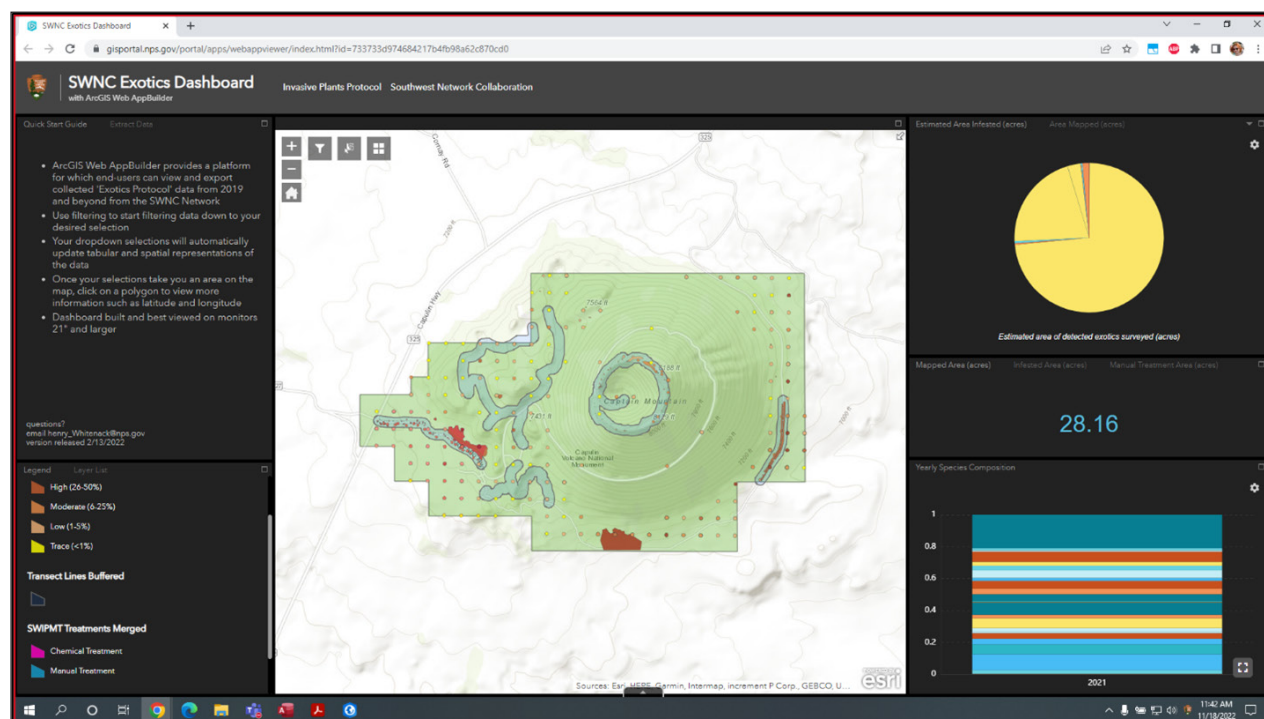


Figure 2. Screen shot of the Southwest Network Collaboration Exotics Dashboard, hosted on the NPS ArcGIS Portal, which can be used to view and download spatial files showing locations and sizes of non-native (exotic) plant infestations.

VITAL SIGNS UPDATES—continued

Water

SOPN hosted the SWNC Water Summit in Santa Fe in December 2023. The Summit was designed to pull together team members from across the SWNC (CHDN, SODN, and SOPN) to support conversations about the future of the water monitoring work at SWNC and identify near- and long-term staffing needs and strategies (field, data management, analysis/reporting) that support a durable and sustainable water monitoring program. We identified several priorities, including data certification and publication of existing data backlogs, priority reporting, and, importantly, how to accomplish this with our modest staff. For most of the SWNC, we decided to suspend field data collection activities until the backlog of water quality and quantity data are published, summarized, and shared with parks. We also identified datasets (e.g., stream macroinvertebrates) that would benefit most from support external to SWNC.

Ella Bump, a Hydrology Assistant through the SIP program (see Page 2), helped facilitate the Water Summit and is working towards the certification and publication of water quality data. Ella has already made great strides entering SOPN's backlog of quarterly water quality data into NPSTORET. NPSTORET is the NPS's Microsoft Access-based water quality database management system that is used by parks and I&M networks. Once data are in NPSTORET, they can be published to the Environmental Protection Agency's Water Quality Exchange portal.

SOPN's water quality monitoring activities are associated with two locations: the Arkansas River at Bent's

Old Fort National Historic Site and the Pecos River at Pecos National Historical Park (Table 2, BEOL and PECO, respectively). Water quality data collection began in 2012 and has been sampled intermittently since. Water quantity data are available from U.S. Geological Survey gages at several parks, and data availability ranges vary by location (see Table 2). Finally, macroinvertebrate data are available from two locations that have been sampled intermittently since 2012/2013. We hope to sample macroinvertebrates at Bent's Old Fort and Pecos this summer to round out our dataset and have it ready for an FY25 review supported under a funded Focused Condition Assessment (*Synthesis and Interpretation of Aquatic Macroinvertebrate Data [2012–2024] from Six Southwest National Parks: Evaluating the Aquatic Life Impairments of Park Waters with Biological Indicators*).

Web summaries of water quality and quantity data for SOPN parks are currently in development. Water quality data summaries for total dissolved and suspended solids, core parameters, primary nutrients, and common metals are available. An example summary indicating quarterly variation is shown in Figure 3 for the Arkansas River at Bent's Old Fort NHS.

Similarly, graphics for water quantity/flow trends are now available using a RMarkdown file developed in collaboration with the Greater Yellowstone Network (GRYN) and supported by the U.S. Geological Survey Exploration and Graphics for RivEr Trends (EGRET) R packages. Summaries can be generated using the entire or partial time series for any gaged river (see Table 2). See Figure 4 (top and bottom) for examples of output from this document.

Table 2. Years for which water quality, water quantity, and macroinvertebrate data are available for waterways in SOPN parks. Water quantity data are from U.S. Geological Survey gages.

Sites	Water Quality	Water Quantity	Macroinvertebrates
Arkansas River (BEOL)	2012–2016, 2017*, 2018*, 2022*, 2023*, 2024*	1939–current	2013, 2014, 2016, 2024 ^z
Pecos River (PECO)	2012–2016, 2017*, 2018*, 2022*, 2023*, 2024*	1919–current	2012–2017, 2024 ^z
Rock Creek (CHIC)	–	1989–current	–
Canadian River (LAMR)	–	1938–current	–
Pedernales River (LYJO)	–	2007–current	–
Washita River (WABA)	–	1990–current	–

* indicates not all quarterly samples were collected in that year.

^z indicates data collection is proposed.

VITAL SIGNS UPDATES—continued

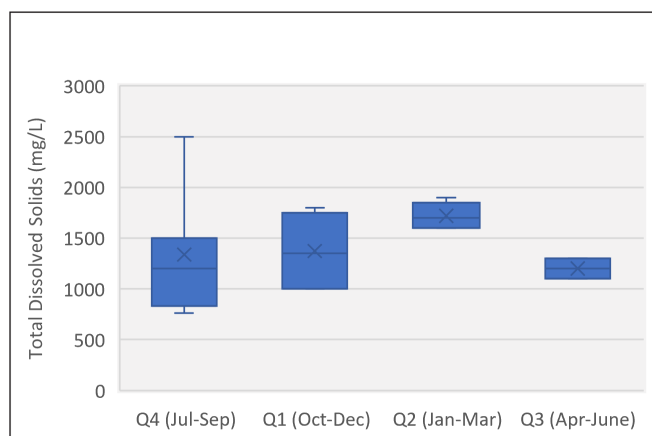


Figure 3. Quarterly summary of total dissolved solids from water samples collected from the Arkansas River at Bent's Old Fort NHS. Concentrations are in mg/L. The greatest amount of variation was detected in samples from July, August, and September (Q4).

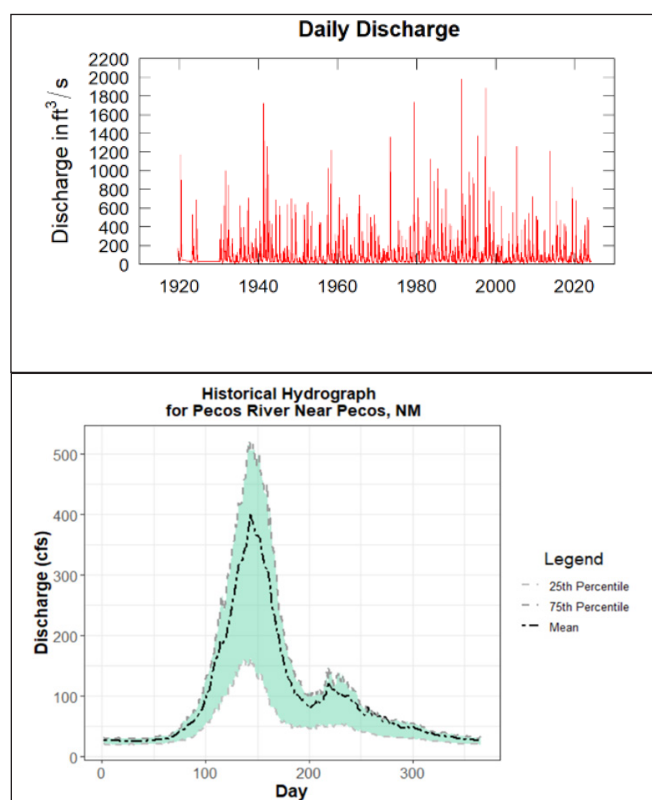


Figure 4. Daily flow (discharge) for the Pecos River at Pecos NHP from 1919 to 2024 (top). Daily data can also be summarized in a way that reflects the normal range of variability through time and is captured by the inter quartile range (mint green, bottom graph). From this hydrograph (bottom), two clear peaks occur each year—one peak corresponds to snowmelt runoff and the other to monsoon rains.

Climate

SOPN continues to support maintenance and upgrades to The Climate Analyzer, a website that produces custom graphics and tables from weather station data, satellite imagery, and other climate data sources. The data are updated daily and publicly accessible at <http://www.climateanalyzer.us/>. Long-term collaborator, Dr. Mike Tercek, maintains the website and welcomes suggestions or recommendations to simplify reporting or graphical summaries for information users. For example, Mike has developed climate dashboards for some parks and has worked with fire teams to develop near-real time summaries of drought severity or fire potential. Please explore The Climate Analyzer and reach out with questions or recommendations.

SWNC hydrologist Kara Raymond continues to produce Climate and Groundwater reports for SOPN parks (see reporting section below). For WY22, Kara was able to produce a climate and groundwater report for 10 SOPN parks, and we are just beginning our reporting cycle for WY23. Climate graphics for these reports are produced using The Climate Analyzer, and groundwater data are harvested from state and federal data sources. In WY22, we also summarized lake levels at Lake Meredith. Although lake surface water level is not a SOPN vital sign, it was included in this report because the lake level has implications for park resources throughout Lake Meredith National Recreation Area (NRA). Lake levels in WY22 were above the long-term average.

We have continued to work with Mike Tercek to develop park-specific climate briefs of past and future climate for SOPN parks. The first brief completed ([Past and Future Climate Patterns: Chickasaw NRA](#)) summarized historic, mid-century, and late century patterns in air temperature, precipitation, and biologically available water. Despite variations among 40 different climate projections, the park is expected to be much drier in the future. The biological and hydrological implications of these changes in moisture are discussed.

We also recently completed a similar brief for Capulin Volcano National Monument, and are currently working on a brief for Pecos National Historical Park. We are excited to receive feedback on these documents. See Reporting Updates for full citations of the briefs, as well as links to climate futures summaries produced by the NPS [Climate Change Response Program](#).

REPORTING UPDATES

Climate and Groundwater Web Reports

- Water Year 2022: [Climate and Water Monitoring at Capulin Volcano National Monument](#).
- Water Year 2022: [Climate and Water Monitoring at Fort Union National Monument](#).
- Water Year 2022: [Climate and Water Monitoring at Lake Meredith National Recreation Area](#).
- Water Year 2022: [Climate and Water Monitoring at Lyndon B. Johnson National Historical Park](#).

Please note that we announced the availability of climate and groundwater web reports for two other SOPN parks (CHIC and PECO) in the Fall 2023 Prairie Zephyr; all are available on the [SOPN website here](#).

Climate and Weather Web Reports

- Water Year 2022: [Climate and Weather Monitoring at Sand Creek Massacre National Historic Site](#).
- Water Year 2022: [Climate and Weather Monitoring at Washita Battlefield National Historic Site](#).

Please note that we announced the availability of climate and weather web reports for two other SOPN parks (BEOL and FOLS) in the Fall 2023 Prairie Zephyr; all are available on the [SOPN website here](#).

Climate Assessment Resource Briefs

SOPN and Mike Tercek have produced two climate resource briefs—one for Chickasaw National Recreation Area and one for Capulin Volcano National Monument. Both will be available in pdf and web versions:

Southern Plains Inventory and Monitoring Network. 2023. [Past and Future Climate Patterns: Chickasaw National Recreation Area](#). National Park Service, Southern Plains Inventory and Monitoring Network, Pecos, New Mexico.

Southern Plains Inventory and Monitoring Network. 2024. [Past and Future Climate Patterns: Capulin Volcano National Monument](#). National Park Service, Southern Plains Inventory and Monitoring Network, Pecos, New Mexico. [Link will be available soon].

Climate Change Response Program (CCRP) Climate Futures Summaries

Newly published climate futures summaries are available from the CCRP for three SOPN parks:

- [Bent's Old Fort National Historic Site](#)
- [Capulin Volcano National Monument](#)
- [Chickasaw National Recreation Area](#).

Peer-reviewed Publications*

LaFrance, B., A. Ray, R. Fisher, E. Grant, S. F. Spear, T. W. Pierson, J. M. Davenport, M. L. Niemiller, B. M. Glorioso, J. Barichivich, B. J. Halstead, K. Roberts, R. Brodman, and B. R. Hossack. 2024. A dataset of amphibian species occurrence in U.S. National Parks. [Nature Scientific Data \(2024\) 11:32](#).

LaFrance, B. J., K. Legg, J. C. Cram, M. Greenblatt, and A. M. Ray. 2024. Lessons learned from long-term, integrated monitoring of amphibians and wetlands in the Greater Yellowstone Ecosystem In: Olson, D. H. and D. S. Pilliod, Amphibians of the US West: Biogeography, Biodiversity, Threats, and Conservation. Chapter 11 In: Dodd, C. K, Jr., H. Heatwole, and S. King (eds.). Amphibian Biology, Volume 9 (Status of Conservation and Decline of Amphibians in the Western Hemisphere), Part 7 (Canada and the United States) of the Amphibian Biology World Encyclopedia. Edition Chimaira, Frankfurt, Germany.

Ray, A. M., J. A. Hubbard, E. R. Schnaubelt, O. T. Brown, E. R. Zylstra, J. T. Giermakowski, and B. R. Hossack. 2024. Albinism in American bullfrog, *Lithobates catesbeianus* Shaw, 1802, tadpoles from the Gila River, New Mexico, USA. *Herpetology Notes* 17:239–242.

* SOPN/SWNC-affiliated authors shown in bold.



Photo taken in Fall 2023 during annual fish surveys carried out in the Pecos River in Pecos National Historical Park. The work is a collaborative effort (see Page 1) between park staff, the Biological Resources Division, Southern Plains Network, and Scientist-in-Parks participants. In some years, biologists with the State of New Mexico also join the effort.

SCIENCE SPOTLIGHT #2

Managing for RADical Ecosystem Change

Climate change is rearranging the ecological and human-use patterns of public lands. In the National Park System, park boundaries have been successfully used to manage the impacts of some stressors to park landscapes, but land management boundaries do not limit parks from the exposure to individual and interactive effects of climate change. In some cases, climate change impacts have been so profound that they are transforming landscapes from woodlands to shrublands and grasslands. Consider the loss of Pinyon-Juniper (P-J) across large portions of the Colorado Plateau. The P-J decline has been hastened by the interactive effects of drought, wildfire, insect outbreak, and disease. Millions of trees in P-J woodlands have been lost. There has also been an accompanying decline of Pinyon Jays (*Gymnorhinus cyanocephalus*) and other species dependent on these ecosystems. Similarly, perennial or semi-permanent springs across the U.S. Southwest have changed in size and spring output as a result of climate change. Springs are biodiversity hotspots, and their loss will have cascading effects on overall park biodiversity.

As managers grapple with the divergence, transformation, or wholesale loss of landscape components or ecosystems from a prior state, a decision framework is needed to consider how best to prioritize the conservation of at-risk and, in some cases, iconic, species, communities, and ecosystems in parks. The Resist-Ac-

cept-Direct (RAD) framework (see Lynch et al. 2021) is a future-focused approach to thinking about how to manage ecosystems toward states that will be different in structure and function than they were historically. Through this framework, managers will benefit from considering options that are more expansive than the traditional focus on simply resisting ecosystem change. In the RAD framework, managers will also consider whether to accept what is determined to be unavoidable change. They also can consider directing landscape components along some desirable transformation pathway that is more likely to be supported under a future climate. As we learn more about future climate conditions in our parks, balancing multiple management objectives will require sound science and a robust prioritization framework. The RAD framework offers a foundation for contemplating and responding to climate-induced ecosystem modification that has been embraced by land managers and offers flexibility in managing for multiple objectives.

Lynch, A. J., L. M. Thompson, E. A. Beever, D. N. Cole, A. C. Engman, C. H. Hoffman, S. T. Jackson, T. J. Krabbenhoft, D. J. Lawrence, D. Limpinsel, R. T. Magill, T. A. Melvin, J. M. Morton, R. A. Newman, J. O. Peterson, M. T. Porath, F. J. Rahel, G. W. Schuurman, S. A. Sethi, and J. L. Wilkening. 2021. Managing for RADical ecosystem change: Applying the Resist-Accept-Direct (RAD) framework. *Frontiers in Ecology and the Environment*. <https://doi.org/10.1002/fee.2377>.

How are SOPN parks coping?

At Sand Creek Massacre NHS legacy cottonwoods (*Populus* sp.) along Big Sandy Creek were witness to the massacre that occurred on 29 November 1864 (SAND Foundation Document). These mature trees are also emblematic components of the park's cultural landscape. Currently, these are the park's only mature trees, and there hasn't been recruitment since the 1960s (SAND Foundation Document). Given the connection of these cottonwoods to the historically significant events that took place there, the NPS, in consultation with the Cheyenne and Arapaho Tribes, can employ the RAD decision framework to prioritize conservation measures, including those related to the trees along Big Sandy Creek. In the *Accept* space of this framework, an option would be to accept what is determined to be unavoidable, climate-induced change contributing to the loss of recruitment in the park. In contrast, an alternative approach could include a rec-

ommendation to supplement water to this area and *Resist* the climate-induced loss of cottonwoods. The RAD framework offers tools for contemplating and managing in a way that is climate-informed yet capable of managing for multiple objectives.



Mature cottonwoods at Big Sandy Creek. NPS photo.

Southern Plains Inventory and Monitoring Network

National Park Service
U.S. Department of the Interior



SOPN Parks

Alibates Flint Quarries National Monument
Bent's Old Fort National Historic Site
Capulin Volcano National Monument
Chickasaw National Recreation Area
Fort Larned National Historic Site
Fort Union National Monument
Lake Meredith National Recreation Area
Lyndon B. Johnson National Historical Park
Pecos National Historical Park
Sand Creek Massacre National Historic Site
Washita Battlefield National Historic Site

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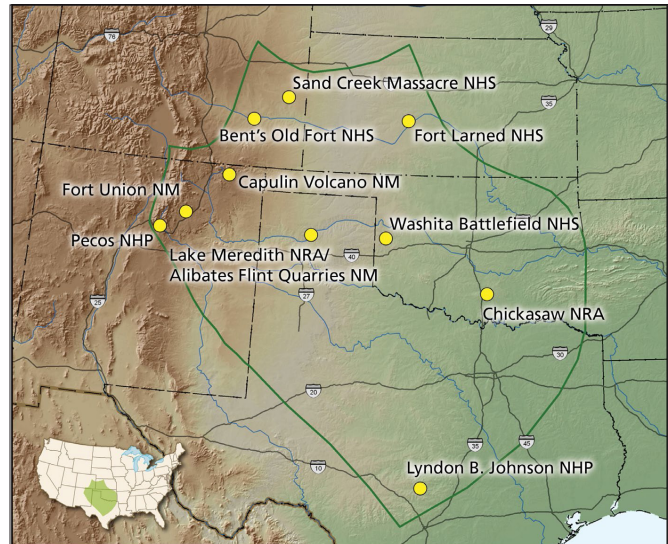
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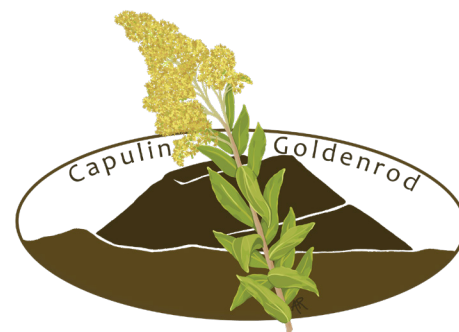


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