



Southwest Biological Science Center Monthly Update

As a unit of the U.S. Geological Survey (USGS), the mission of the Southwest Biological Science Center (SBSC) is to provide quality scientific information needed to conserve and manage natural and biological resources, with an emphasis on the species and ecosystems of the southwestern United States. The SBSC has two research branches: *Terrestrial Dryland Ecology* and *River Ecosystem Science*, which includes the Grand Canyon Monitoring and Research Center (GCMRC). Both branches conduct research on the biology, ecology, and natural processes of the Southwest. SBSC has two research stations in Arizona (Flagstaff and Tucson) and one in Moab, Utah. You can find the SBSC online at: <https://usgs.gov/centers/sbsc>.

WELCOME

Below are recent products and activities coming from the SBSC, and [SBSC personnel have an asterisk after their names](#). If you would like more information about the SBSC or with anything in this month's update contact Todd Wojtowicz (twojtowicz@usgs.gov).

IMAGE OF THE MONTH



A young desert tortoise.
(Photo credit: Shellie Puffer, USGS)

OUTREACH

Media, Broadcasts, and Films

Find us on Twitter

Look for us on Twitter (<https://twitter.com/usgsaz>). We post photos depicting field work, restoration approaches, arthropods, wildlife, flowers, and beautiful natural areas. We also provide links to our website and highlight some of our recent science.

Experimental bug flows from Glen Canyon Dam

1) The Bureau of Reclamation published a press release on April 30 about the ongoing flow experiment at Glen Canyon Dam that is expected to provide better conditions for aquatic insect eggs in the Colorado River in Grand Canyon. Increased numbers of insects are expected to benefit Grand Canyon fish and wildlife because many species feed on the immature, aquatic insects, or when the insects emerge from the river in their adult, reductive stage. The press release is titled, **First experiment to be conducted under the Glen Canyon Dam Long-Term Experimental and Management Plan**, and can be found here:

<https://www.usbr.gov/newsroom/newsrelease/detail.cfm?RecordID=62133>. Much of the impetus for this experimental flow comes from the results of a BioScience paper published by several SBSC scientists, including the lead author Ted Kennedy*. The paper is titled, **Flow management for hydropower extirpates aquatic insects, undermining river food webs**, and can be found here: <https://academic.oup.com/bioscience/article/66/7/561/2463266>.

2) Scott VanderKooi*, Ted Kennedy*, and Jeff Muehlbauer* were interviewed by an Associated Press reporter about the experimental flows from Glen Canyon Dam. The article is titled, **“Scientists hope bug experiment fattens Colorado River fish”** and can be found here: <https://www.apnews.com/accec230d442406fa7bedf4af219c5d1/Scientists-hope-bug-experiment-fattens-Colorado-River-fish>. The article was picked up by The New York Times, The Washington Post, and many smaller venues.

3) Ted Kennedy* was quoted by KNAU, an NPR affiliate, for a piece about the experimental bug flows in a piece titled, **Colorado River managers begin first experimental ‘bug flows’**, and can be found here: <http://kнау.org/post/colorado-river-managers-begin-first-experimental-bug-flows>.

Dust in the Southwest

Seth Munson* and Jayne Belnap* were some of the people interviewed for an Arizona Daily Sun article titled, **“Arizona dust is creating problems for Rocky Mountain snowpack”**. The article is about the consequences of dust in the Southwest to water supplies and mentions that SBSC scientists are trying to find ways to mitigate those issues. The article can be found here: http://azdailysun.com/news/local/arizona-dust-is-creating-problems-for-rocky-mountain-snowpack/article_03286bd7-b1d6-5d94-839a-a5829b80268b.html#comments.



Insect eggs (white material on rock at water level) in the Colorado River during the first week of the experimental bug flow (Photo credit: Ted Kennedy, USGS)



Clear day in Moab, UT



Dust storm in Moab, UT

Moab, UT on a clear day (top panel) and during a dust storm (bottom panel) (Photo credit: Seth Munson, USGS)

Tamarisk beetles in Grand Canyon

SBSC's Joel Sankey* and Northern Arizona University's (NAU) Teki Sankey were interviewed by KNAU, an affiliate of NPR, about tamarisk beetles in Grand Canyon. The title of the piece is, "**Scientists map non-native tamarisk beetles in Grand Canyon**", and can be found here: <http://knau.org/post/scientists-map-non-native-tamarisk-beetles-grand-canyon>. The interview was based on a recently published paper with NAU and SBSC co-authors (Joel Sankey* and Laura Druning*). The paper is titled, "**Remote sensing of tamarisk beetle (*Diorhabda carinulata*) impacts along 412 km of the Colorado River in the Grand Canyon, Arizona, USA**" and can be found here:

<https://www.sciencedirect.com/science/article/pii/S1470160X1830102X#!>.

SBSC science highlighted in a new book

A newly published book titled, **The Colorado**, by Christa Sadler features SBSC research and photos. Chapter 6 of the book discusses the science of SBSC's Grand Canyon Monitoring and Research Center (GCMRC) and some of its past research. A photo taken by David Topping* is used, which depicts the sediment-laden Paria River flowing into the clear Colorado River. Ted Kennedy's* research on aquatic insects and his use of citizen science is referred to, and a photo depicting Anya Metcalfe* and people engaged in citizen science is also in the book. Additionally, there are repeat photos used in the book from collections housed at the SBSC. Meredith Hartwell* is acknowledged in the book for her efforts in working with Christa on the repeat photos.

U.S. Geological Circular 1366, **Effects of three high-flow experiments on the Colorado River ecosystem downstream from Glen Canyon Dam, Arizona**, is referenced. Circular 1366 was edited by Ted Melis* and contains chapters authored by SBSC personnel (Paul Grams*, Ted Kennedy, and Ted Melis), and can be found here: <https://pubs.usgs.gov/circ/1366/>. A USGS featured news story titled, **A river ran through it and brought life, at least for a while**, was also cited in the bibliography and this piece highlights SBSC research from Pamela Nagler*, Charles van Riper III*, Paul Grams, and David Topping. The news piece can be found here: <https://www.usgs.gov/news/a-river-ran-through-it-and-brought-life-least-a-while>.



Paria River containing sediment flowing into the clear Colorado River (Photo credit: David Topping)

Public, Partner, and Youth Outreach Activities

Outreach to Utah high school students

David Ward*, Jeff Lovich*, and Kristy Cummings* talked to 23 Utah high school students and three high school and University of Utah staff about native and nonnative fish in the Colorado River, general turtle biology and ecology, and current SBSC research on turtles and tortoises.

USGS science activities and desert ecology

Jayne Belnap* and Mike Duniway* shared information on USGS science activities and general desert ecology on April 18 at The Nature Conservancy Western States Government Relations Retreat at the Canyonlands Research Center and led a nature hike in Canyonlands National Park in southeastern Utah.



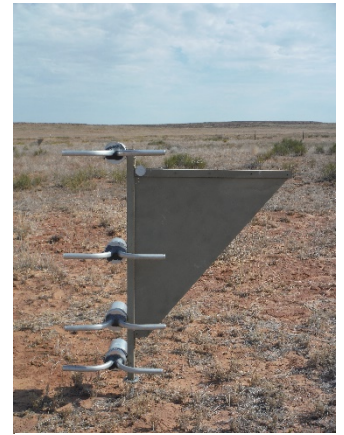
Western painted turtle
(Photo credit: Jeff Lovich, USGS)

Bureau of Land Management outreach

1) Travis Nauman* and Mike Duniway* gave a presentation on April 17 to the Bureau of Land Management's Moab Field Office and Canyon Country District Office sharing results from their recent work evaluating the influence of climate, off-highway vehicles, roads, and grazing on dust emissions.

2) Mike Duniway* and Travis Nauman* gave a presentation at a meeting for the Bureau of Land Management (BLM) Soil, Air, and Water program at the BLM Colorado State Office in Lakewood, Colorado on May 9th. Nauman and Duniway have several ongoing research projects, done in collaboration with BLM, in which they are using new digital soil mapping approaches to create predictive soil maps to address BLM management needs across the west.

3) Travis Nauman* trained Bureau of Land Management Assessment, Inventory, and Monitoring crews on field soil field description on May 15 in Grand Junction, Colorado.



Dust collector at a study site outside of Moab, UT (Photo credit: Todd Wojtowicz, USGS)

Agriculture ecosystem research

Mike Duniway* attended the US Department of Agriculture (USDA) Long Term Agroecosystem Research (LTAR) Network workshop held in El Reno, Oklahoma on April 23-26 and delivered a presentation to the assembled group of USDA scientists and leadership on the grazing research program the USGS, The Nature Conservancy, and collaborators are initiating at the Canyonlands Research Center (CRC) in southeastern Utah, with the goal of better integrating the agroecosystem research done at the CRC with this important USDA effort.

River sediment work with the U.S. Army Corps of Engineers

David Dean* and Daniel Buscombe (Northern Arizona University) recently completed a week of work on the Chippewa River in western Wisconsin. This work was conducted in collaboration with the U.S. Army Corps of Engineers (USACE), and the USGS Minnesota and Wisconsin Water Science Centers. The goal of this work is to comprehensively measure sediment transport on the Chippewa River; sediment from the Chippewa River regularly impacts navigation on the Mississippi River near the Chippewa River confluence. This work will help inform the USACE as to the annual amount of sediment that will need to be dredged from Mississippi River navigation channels.

Energy facilities and wildlife

Kathryn Thomas*, senior author of the recent Energy Policy paper, **Landscape-scale wildlife species richness metrics to inform wind and solar energy facility siting: An Arizona case study**, provided the paper and data links to representatives of the Arizona State Bureau of Land Management office and the Habitat Division of the Arizona Department of Game and Fish. Other requests for the paper have come from the Defenders of Wildlife and a Canadian environmental consulting firm. Kathryn's paper can be found here:

<https://www.sciencedirect.com/science/article/pii/S0301421518300600>.



Agassiz's desert tortoise rigged for radio telemetry near a wind energy facility (Photo credit: Jeff Lovich, USGS)

Non-native insects

Kathryn Thomas* meet with representatives of the USA-National Phenology Network (NPN) to present the status of findings of her Powell working group, **Predicting the impact of non-native insects**. The working group had developed a predictive model of the probability an invasive insect feeding on conifers will cause high-impact damage. Thomas and NPN staff discussed how this work could integrate with the new project of the NPN to develop phenologically-based risk maps for some key insect herbivores currently in the U.S.

Endangered and threatened amphibians

USGS personnel from other USGS science centers, Blake Hossack, Erin Muths, Jamie Barichivich, and SBSC's Brent Sigafus* conducted field work around the areas of Imuris and Cananea in Sonora, Mexico April 27-May 2, 2018. They were joined by staff from the University of Georgia, Naturalia, and other U.S. and Mexican volunteers. The main focus of the work was to expand the knowledge of the known range for the U.S. federally endangered Sonoran tiger salamander (*Ambystoma mavortium stebbinsi*) and U.S. federally threatened Chiricahua leopard frog (*Rana chiricahuensis*), collect buccal swabs for future genetic work, dermal swabs for disease, and collect eDNA,. This work was conducted under the USGS Amphibian Research and Monitoring Initiative (<http://armi.usgs.gov/>).



Chiricahua leopard frog
(Photo credit: Brent Sigafus, USGS)

Turtle education at the Phoenix Zoo

Brent Sigafus* of the SBSC assisted Cristina Jones, Turtle Project Coordinator with the Arizona Game and Fish Department, on May 18-20 with the 13th Annual Turtle Trapping at the Phoenix Zoo. This event, led by Arizona Game and Fish, brings together the zoo, non-government organizations, university students, federal partners, educators, and the general public to educate thousands of zoo patrons on the issues of releasing non-native turtles into the wild.

Humpback chub

David Ward* and Ben Vaage* spent some time in the Little Colorado River to collect early juvenile humpback chub for the U.S. Fish and Wildlife Service. The fish were to be cared for and allowed to grow so they could be used for relocation efforts into Colorado River tributaries in Grand Canyon. However, juvenile humpback chub numbers were very low, possibly do to a lack of spring runoff this year, and it was decided to not capture any fish.



Humpback chub (Photo credit: Scott VanderKooi)

Grand Canyon Monitoring and Research Center tour

Anya Metcalfe* gave a tour of SBSC's Grand Canyon Monitoring and Research Center (GCMRC) to a Northern Arizona University undergraduate and Grand Canyon Youth intern. Anya took the student to the aquatic insect lab, demonstrated how and why the GCMRC incorporates citizen science into their work, discussed the mission and goals of the GCMRC, the type of work the GCMRC conducts, qualifications for an entry-level position, etc.

Department of Energy presentation

Scott VanderKooi* gave a presentation titled '**USGS science informs decision-making regarding potential effects of hydropower on recreation, land management, and cultural resources**' at the Department of Energy's Hydropower Environmental R&D Workshop in Washington, DC on April 25, 2018. VanderKooi's presentation was one of three given by USGS scientists at the workshop on USGS research relevant to the environmental effects of hydropower. Other presentations were given by Alex Haro of the Leetown Science Center and Julie Kiang of the Water Mission Area

Glen Canyon Dam Adaptive Management Program

1) Scott Vanderkooi*, Mike Moran*, Helen Fairley*, and Paul Grams* of SBSC's Grand Canyon Monitoring and Research Center (GCMRC) attended a meeting of the Glen Canyon Dam Adaptive Management Program's Technical Working Group (TWG) in Phoenix, Arizona on April 23-24. Scott Vanderkooi, GCMRC Chief, gave presentations on possible experimental actions for calendar year 2018 and state of the GCMRC Fiscal year 2018 budget and work plan. Paul Grams, GCMRC hydrologist, gave presentations on evaluating the frequency of triggered spring High Flow Experiments (HFE) and a discussion of HFE design.



On the Colorado River looking upstream at Glen Canyon Dam (Photo credit: Todd Wojtowicz, USGS)

2) Scott VanderKooi* and Ted Kennedy*, research ecologist at the GCMRC, gave presentations during a webinar meeting of the Glen Canyon Dam Adaptive Management Program's Adaptive Management Working Group (AMWG) on May 22. VanderKooi and Kennedy presented on preliminary results of experimental flows designed to benefit the aquatic foodbase of the Colorado River in Grand Canyon. In addition, VanderKooi presented on GCMRC's proposed fiscal year 2019 budget and work plan.

Restoration Assessment & Monitoring Program for the Southwest

1) Seth Munson* and Molly McCormick* were given a tour of Aqua Fria National Monument. The tour included site visits to vegetation treatment areas and recent burns, and the group discussed strategies to address invasive species on the monument.

2) Molly McCormick* and Katie Laushman* toured Petrified Forest National Park with park biologists. They discussed issues concerning recovery of cattle tanks on newly acquired park lands. The group was also looking for a site to install a restoration field trial as a way to develop protocols for vegetation recovery at the park.

3) The Restoration Assessment & Monitoring Program for the Southwest (RAMPS) is mentoring four Northern Arizona University undergraduate students in the School of Earth Science and Environmental Sustainability for their environmental programs capstone project. The project is titled, "**Quantifying socioeconomic values of intact and disturbed ecosystems in the Southwest United States**".



Aqua Fria National Monument wildlife biologist in a stand of invasive black mustard (*Brassica negra*) (Photo credit: Molly McCormick, USGS)

4) RAMPS co-organized the Southwest Seed Partnership Arizona Stakeholder meeting in Phoenix, Arizona. There were 62 people representing federal and state agencies, tribal nations, private businesses, and non-profit non-governmental organizations at the meeting. Molly McCormick*, RAMPS coordinator, accepted nominations to two committees: target species and research.

5) SBSC's RAMPS program is co-organizing a Society for Ecological Restoration chapter at Northern Arizona University (NAU). The chapter will provide hands-on experience for NAU students in many aspects of ecological restoration. The chapter recently hosted two kick-off events: sowing penstemon seeds in a greenhouse to help with a restoration project at the Museum of Northern Arizona, and preparing one of NAU's campus gardens to become a long-term restoration site for the chapter.

6) RAMPS coordinator, Molly McCormick*, was invited along with select City of Flagstaff employees and community members for a "green stormwater infrastructure design charrette." The purpose of the meeting was to help design low-water use native plant gardens around city hall to address City Council's goals of water conservation and climate action.

7) The RAMPS program recently supported a team of Northern Arizona University undergraduate students during their capstone project. The team presented a poster of their project during the Undergraduate Poster Symposium.

SCIENCE

Published Papers, Reports, Data Releases, etc.

- Bradford, J.B.*, Betancourt, J.L., Butterfield, B.J., Munson, S.M.*, and Wood, T., 2018, **Anticipatory natural resource science and management for a changing future**: *Frontiers in Ecology and the Environment*, <https://esajournals.onlinelibrary.wiley.com/doi/abs/10.1002/fee.1806>.
- Duniway, M.C.*, Geiger, E.L.*, Minnich, T.J., Phillips, S.L., and Belnap, J.*, 2018, **Insights from long-term ungrazed and grazed watersheds in a salt desert Colorado Plateau ecosystem**: *Rangeland Ecology & Management*, <https://www.sciencedirect.com/science/article/pii/S1550742418300320>.
- Jarchow, C.J., Didan, K., Barreto-Muñoz, A., Glenn, E.P., Nagler, P.L.*, 2018, **Application and comparison of the MODIS-derived enhanced vegetation index (EVI) to VIIRS, Landsat 5 TM, and Landsat 8 OLI platforms—A case study in the arid Colorado River Delta, Mexico**: *Sensors*, v. 18, no. 5, article 1546, <https://doi.org/10.3390/s18051546>.
- Munson, S.M.*, Reed, S.C.*, Peñuelas, J., McDowell, N.G., and Sala, O.E., 2018, **Ecosystem thresholds, tipping points, and critical transitions**: *New Phytologist*, v. 218, p. 1315-1317, <https://nph.onlinelibrary.wiley.com/doi/10.1111/nph.15145>.
- Runge, M.C., Yackulic, C.B.*, Bair, L.S.*, Kennedy, T.A.*, Valdez, R.A., Ellsworth, C., Kershner J.L., Rogers, R.S., Trammell, M.A., and Young, K.L., 2018, **Brown trout in the Lees Ferry reach of the Colorado River—Evaluation of causal hypotheses and potential interventions**: U.S. Geological Survey Open-File Report 2018–1069, 83 p., <https://doi.org/10.3133/ofr20181069>.
- Sankey, J.B.*, Caster, J.J.*, Kasprak, A.*, and East, A.E., 2018, **The response of source-bordering aeolian dunefields to sediment-supply changes 2—Controlled floods of the Colorado River in Grand Canyon, Arizona, USA**: *Aeolian Research*, v. 32, p. 154-169, <https://doi.org/10.1016/j.aeolia.2018.02.004>.
- Sankey, J.B.*, Kasprak, A.*, Caster, J.J.*, East, A.E., and Fairley, H.*, 2018, **The response of source-bordering aeolian dunefields to sediment-supply changes 1—Effects of wind variability and river-valley morphodynamics**: *Aeolian Research*, v. 32, p. 228-245, <https://doi.org/10.1016/j.aeolia.2018.02.005>.

Wertin, T.M.*, Young, K.*, and Reed, S.C.*, 2018, **Spatially explicit patterns in a dryland's soil respiration and relationships with climate, whole plant photosynthesis and soil fertility**: *Oikos*, <https://onlinelibrary.wiley.com/doi/full/10.1111/oik.04935>.

Yackulic, C.B.*, Korman, J., and Coggins, L., 2018, **Population dynamics of humpback chub, rainbow trout and brown trout in the Colorado River in its Grand Canyon Reach: modelling code and input data**: U.S. Geological Survey data release, <https://doi.org/10.5066/F7FN15HC>.

Presentations, Posters, Lectures, Workshops, and Panels

Bair, L.*, 2018, **Peoples' values and objectives for river use: an example from the Colorado River in Grand Canyon** [presentation]: Amazon Dams Network workshop.

Boyce, A. J., and van Riper, C. III*, 2018, **Variation in nest success and offspring development in a migratory songbird using natural and artificial nest-sites** [poster]: American Ornithological Society meeting.

Cummings, K.L.*, Puffer, S.R.*, Lovich, J.E.*, and Meyer-Wilkins, K., 2018, **Biodiversity of amphibians and reptiles at the Camp Cady Wildlife Area, Mojave Desert, California and comparisons with other desert locations** [presentation]: Desert Symposium 2018.

Dean, D.*, 2018, **Hydrologic change and the geomorphic transformation of the Little Colorado River** [presentation]: Cottonwood Ecology Group, Northern Arizona University.

Dean, D.J.*, and Topping, D.J.*, 2018, **Geomorphic change and biogeomorphic feedbacks in the Little Colorado River, AZ** [presentation]: Cordilleran/Rocky Mountain Geological Society of America Regional meeting.

Drost, C.*, and Cirulii, E., 2018, **Kingsnakes (*Lampropeltis* spp.) in southern Arizona: distribution and hybridization** [presentation]: Madrean Conference 2018.

Grams, P.E.*, Buscombe, D.D., Kaplinski, M., and Topping, D.J.*, 2018, **Patterns of riverbed sand-storage change on the Colorado River in Grand Canyon** [poster]: Cordilleran/Rocky Mountain Geological Society of America Regional meeting.

Havelock, N., Sanders, D., Sawaya, J., and Yayoshi, T., and McCormick, M.L.B.*, 2018, **Socioeconomic values of intact and costs of disturbed ecosystems in the Southwest U.S.: Why Should we Promote Restoration Efforts?** [poster]: Northern Arizona University Undergraduate Poster Symposium.

Kennedy, T.*, Metcalfe, A.*, and Muehlbauer, J.*, 2018. **Little Bugs, big data, and Colorado River adaptive management** [presentation]: Grand Canyon River Guides Training Seminar.

Lovich, J.E.*, Fisher, R., Puffer, S.R.*, Cummings, K.*, Greely, S., and Ford, M.*, 2018, **The southwestern pond turtle (*Actinemys pallida*) in the Mojave River of California: past, present and future** [presentation]: Desert Symposium 2018.

McCormick, M.L.*, 2018, **Restoration research and coordination** [presentation]: Southwest Seed Partnership Arizona Stakeholder Meeting.

McCormick, M.L.*, Munson, S.M.*, Bradford, J.B.*, Butterfield, B.J., and Copeland, S.*, 2018, **RAMPS: working together to enhance landscapes** [presentation]: Aridlands Symposium.

- Melis, T.*, 2018, **The Glen Canyon Dam Adaptive Ecosystem Assessment & Management Program: Critical role of focusing events for operational changes** [presentation]: Seminário Internacional—Brasil, Bolívia, Peru.
- Munson, S.M.*, Bradford, J.B.*, Butterfield, B.J., Copeland, S.M.*, Bunting, E.L., and Webb, R.H., 2018, **Long-term plant responses to climate across the southwestern U.S.: implications for restoration** [presentation]: Arid Lands Symposium.
- Nagler, P.*, Jarchow, C., and Glenn, E., 2018, **Using optical remote sensing to evaluate changes in greenness and evapotranspiration in riparian vegetation in response to the Minute 319 environmental pulse flow to Mexico** [presentation]: Remote Sensing and Hydrology Symposium.
- Nagler, P.*, Jarchow, C., McCreedy, C., Glenn, E., and van Riper, C. III*, 2018, **Avian response to fire in the lower Sonoran Desert at Kofa National Wildlife Refuge, Arizona** [poster]: Madrean Conference 2018.
- Nauman, T.*, 2018, **The soil story book: using pedology to understand, map, model, and manage landscapes** [presentation]: Northern Arizona University, School of Forestry.
- Norris, J.L., Lovich, J.E.*, ResÉndiz, R.A.L., and Puffer, S.*, 2018, **How long can desert tortoises, *Gopherus agassizii*, hide in their burrows from climate change?** [presentation]: Desert Symposium 2018.
- Puffer, S.R.*, Tennant, L.A.*, Agha, M., Delaney, D., Lovich, J.E.*, Fleckenstein, L.J., Briggs, J., Arundel, T.R.*, Smith A.L., Walde, A., and Ennen, J.R., 2018, **Birds not in flight: using camera traps at desert tortoise (*Gopherus agassizii*) burrows to study avian behavior at a wind farm** [presentation]: Desert Symposium 2018.
- Thomas, K.*, 2018, **Tackling invasive species on public lands: a U.S. Geological Survey perspective** [presentation]: Madrean Conference 2018.
- Thomas, K.*, 2018, **Wind, sand, drought, and tumbleweeds, what is the problem?** [presentation]: Arizona Water Science Center seminar series.
- Thomas, K.*, Stauffer, B., and Jarchow, C., 2018, **A look to Sky Island plant community vulnerability to changing climate** [presentation]: Madrean Conference 2018.
- van Riper, C. III*, 2018, **Bridging the gap between science and avian conservation: lessons learned on integrating research into management actions** [presentation]: American Ornithological Society meeting.
- Yackulic, C.*, 2018, **Adaptive management in the Colorado River** [presentation]: Seminário Internacional—Brasil, Bolívia, Peru.

New Grants and Other Funded Opportunities

Paul Grams* and Dan Buscombe received funding for their USGS Community for Data Integration project titled, “**Mapping land-use, hazard vulnerability and habitat suitability using deep neural networks**”. Their project will use a computer analysis approach called deep learning to allow USGS scientists to provide a better understanding of natural hazards and habitats in the United States using remote sensed imagery.

John Bradford* also received USGS Community for Data Integration funding for a project titled, “**An interactive web-based tool for anticipating long-term drought risk**”. This project will produce an online product that will provide land managers with an estimate of past and future drought conditions for specific sites. Land managers can also input soil and vegetation condition data into the tool.

PUBLICATIONS HIGHLIGHTED BY OTHER SCIENTISTS & ORGANIZATIONS

A Spanish researcher at the Remote Sensing & Hydrology Symposium presented evapotranspiration maps for all of Spain using an algorithm published by Pamela Nagler* and modified by her in a later manuscript. The two papers with detailing the evapotranspiration algorithm can be found here: <https://www.sciencedirect.com/science/article/pii/S0034425705001616> and <http://www.mdpi.com/2072-4292/5/8/3849>.

AWARDS

Jenna Norris, a Northern Arizona University undergraduate, won second place for best student paper at the recent Desert Symposium. Jenna is mentored by SBSC’s Jeff Lovich*.

OTHER NOTABLES

On March 30 – April 1, Megan Daubert*, Ted Kennedy*, and Anya Metcalfe* went to Marble Canyon, Arizona for the Grand Canyon River Guides Training Seminar to recruit and distribute sampling equipment to citizen scientists to assist in the collection of aquatic insects in Grand Canyon. Outreach material about SBSC science was also distributed.

Molly McCormick* attended the Tribal Water and Habitat Restoration Forum in Phoenix, Arizona. Molly heard from and met with tribal natural resource officials and discussed their concerns in regards to restoration on tribal lands.

Charles van Riper III* was on the local organizing committee for the recent American Ornithological Society meeting held in Tucson, Arizona.

Scott VanderKooi*, chief of SBSC's Grand Canyon Monitoring and Research Center (GCMRC), went to Washington D.C. and met with the legislative assistants for Senator John McCain and Congressman Tom O’Halloran, and Representative O’Halloran himself joined one of the meetings. Scott also met with Peter Gallagher, Professional Staff, Committee on Natural Resources (Representative Raül Grijalva, Ranking Member). Scott discussed the science the SBSC conducts and its importance, and he fielded questions about SBSC science and the experimental “bug flows” from Glen Canyon Dam. The meetings were held on April 26.



Cordilleran flycatcher with a geolocator
(Photo credit: Charles van Riper III, USGS)

Pamela Nagler* was in Córdoba, Spain from May 8-10 for the Remote Sensing and Hydrology Symposium, organized by the International Association of Hydrological Sciences (IAHS), where she served on the Scientific Committee and was one of the conveners of the “**Observations of water cycle components**” session. Pamela will be a guest editor for all new submissions for publication in Proceedings of the IAHS under the Observations of Water Cycle Components theme. Pamela also participated on the editorial board for the International Association of Hydrological Sciences special issue in the Hydrological Sciences Journal.

Ted Kennedy* and Jeff Muehlbauer* went to Laughlin, Nevada / Bullhead City, Arizona from May 2-4 for a site visit with the Bullhead City pest abatement manager to discuss a caddisfly population outbreak that is affecting those communities. They discussed possible causes for the population boom and potential ecological control options.

Paul Grams* and David Dean* are part of the group convening the “**Advances in river science in the Intermountain West**” session of the joint Cordilleran/Rocky Mountain Geological Society of America Regional meeting in Flagstaff, AZ from May 15-17.

Ted Melis*, Lucas Bair*, and Charles Yackulic* recently participated in the May 14-17th Amazon Dams Network Workshop II entitled: **Rivers, Lands and Cultures: Learning from the Tocantians Social-Ecological System** [<http://amazondamsnetwork.org/>], convened at the Federal University of Tocantians, Palmas, BR. Bair and Melis participated on a panel about Colorado River management. The trio also participated in an informal technical meeting convened by the Lajeado Dam operator. Afterwards, Melis and Yackulic also attended a multi-day international seminar (held at the Ministerio Publico do Estado de Rondonia, Porto Velho, Rondonia), where they learned about the perspective of local fishers on the impacts of dam operations on fishing; gave presentations on adaptive management and river use in the Colorado River in Grand Canyon; heard from fishers from Brazil, Bolivia, and Peru who have been affected by hydroelectric dams on the Rio Madeira; toured the Santo Antonio Dam on the Rio Madiera; and participated in a meeting with Wildlife Conservation Society staff from Manaus, BR, to discuss a new citizen science project fish monitoring program throughout the Amazon Basin. Their travels further efforts to promote information exchange between those who have studied the Colorado River in the context of the Glen Canyon Dam Adaptive Management Program and their counterparts in the Amazon River Basin.

**For more information about the
Southwest Biological Science Center:**

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<https://www.usgs.gov/centers/sbsc>

