Greater Yellowstone Network
Inventory & Monitoring Program

Bighorn Canyon National Recreation Area
Grand Teton National Park
John D. Rockefeller Jr. Memorial Parkway
Yellowstone National Park

THE GRYNDOW

Summer 2016

Welcome to THE GRYNDOW newsletter, the window into GRYN science in Greater Yellowstone Ecosystem parks.

INSIDE THIS ISSUE

GRYN Science to be Featured in Special Edition of *Ecosphere*

We are excited to announce the publication of our Greater Yellowstone Network article titled, "Influence of climate drivers on colonization and extinction dynamics of wetland-dependent species" in *Ecosphere*, the online journal of the Ecological Society of America. This article will also be part of a Special Issue of *Ecosphere* dedicated to the outstanding science the NPS Inventory & Monitoring division is conducting in honor of the National Park Service Centennial to be released late in 2016.

Western tiger salamanders are a long-lived species found mostly in permanent and semipermanent wetlands. NPS photo.

The article highlights the first seven years of our continuing study of the effects of climate drivers on the breeding dynamics and occupancy of three amphibians in Grand Teton and Yellowstone national parks: Columbia spotted frog, boreal chorus frog, and western tiger salamander. These and other wetland-dependent species are particularly vulnerable to climate change. Changes in temperature, precipitation, and evapotranspiration (i.e., climate drivers) will likely alter flooding regimes of wetlands and affect the vital rates, abundance, and distributions of wetland-dependent species.

The Columbia spotted frog is a highly aquatic species that typically uses permanent water for breeding. NPS photo.

We discovered that models incorporating climate drivers explained the variation in occupancy and breeding dynamics (extinction and colonization rates) of these amphibians better than models based exclusively on wetland habitat characteristics including wetland elevation, depth, area, and isolation measures.

Placed in the context of anticipated climate change for this region, amphibian breeding patterns in wetlands are likely to deviate from historical patterns. Less amphibian breeding has been associated with warmer conditions when breeding is restricted to a smaller number of deep wetlands. Long-term data sets like this one will be crucial for evaluating the risk of loss to wetland-dependent species and developing mitigation measures.

Boreal chorus frogs in this region use a variety of shallow water habitats for breeding. NPS photo.

You can read our full *Ecosphere* article at http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1409/full.

Citation:

Ray, A. M., W. R. Gould, B. R. Hossack, A. J. Sepulveda, D. P. Thoma, D. A. Patla, R. Daley, and R. Al-Chokhachy. 2016. Influence of climate drivers on colonization and extinction dynamics of wetland-dependent species. Ecosphere 7(7): e01409. 10.1002/ecs2.1409

Monitoring Updates

Wetlands and Amphibians

June began our 11th year of annual monitoring of 30 catchments (watersheds) in Yellowstone and Grand Teton national parks. We are examining how temperature, precipitation, evapotranspiration and runoff affect amphibian breeding dynamics. At Big Hole National Battlefield, we are working with Upper Columbia Basin Network (UCBN) and USGS to conduct Columbia spotted frog (*Rana luteiventris*) egg mass surveys and tadpole trapping.

In cooperation with USGS and Montana State University scientists, we are piloting the Wetlands Biodiversity Project at Grand Teton NP. Mary Levandowski, hydrologic technician at GRYN, is leading this effort to use wildlife cameras, audible and ultrasonic acoustic loggers and eDNA techniques to develop a comprehensive list of species using the wetlands. She will present her pilot project at the Yellowstone Biennial Scientific Conference in October 2016.

Whitebark Pine

In this 13th year of monitoring the health of whitebark pine in the Greater Yellowstone Ecosystem, we begin our fourth set of surveys (2016-2019). In addition, we will continue to evaluate white pine blister rust infection rates and overall mortality in newly identified five-needle pine stands on Bureau of Land Management lands in portions of Wyoming.

Analysis of our third set of surveys (2012-2015) is complete and a full trend report will be published in fall 2016. While the estimated proportion of whitebark pine trees infected with white pine blister rust in the Greater Yellowstone Ecosystem remained fairly constant between survey 2 and survey 3, we did note a decrease in the proportion of trees infested with mountain pine beetle between these two survey periods resulting in a dramatic decline in observed tree mortality.

Upland Vegetation

In 2016, we continued to collect plant and groundcover estimates in three distinct vegetative communities in Bighorn Canyon and to assist Grand Teton and Yellowstone NPs in similar efforts.

Mary Levandowski (GRYN), Shan Burson (GRTE), and Robb Diehl (USGS) discuss amphibian acoustic monitoring strategies in Grand Teton NP. NPS Photo.

Kami Crockatt and Natilya Blades conduct whitebark pine monitoring on Beaverhead-Deerlodge National Forest. NPS Photo.

Liana Edwards and Mary Levandowski measure stream discharge in Soda Butte Creek in June 2016. NPS photo.

Erin Shanahan and Natilya Blades conduct uplands monitoring at Bighorn Canyon NRA. NPS Photo.

All park vegetation monitoring data through 2015 are available on *VegViz*, a publically available, interactive, data sharing program developed by Mike Tercek in collaboration with GRYN, UCBN, and Grand Teton and Yellowstone NPs. With *VegViz*, users can display single or multiple years of data collected by NPS in the Columbia Basin and Greater Yellowstone regions as graphs, tables, maps or in query format. You can access *VegViz* at www.vegviz.org.

Water Resources

Quarterly monitoring of the Bighorn and Shoshone rivers started in March with assistance from two volunteers from Montana State University. Water quality monitoring at Yellowstone and Grand Teton NPs began in April. Our sampling locations are co-located with USGS stream gages to monitor flows in addition to river and stream water chemistry.

We are working on the discharge-based monitoring protocol that complements our current water quality monitoring. By design, this protocol will closely align with other discharge-based protocols currently used parks in the Southwest Alaska and Sierra Nevada networks. In GRYN parks, we will be measuring the timing and magnitude of peak flows, timing of half flows, number of days below the 25th percentile of low flows, the total annual flow volume, and the number of days with ice cover. We are excited to implement these discharge-based metrics into our monitoring given that the predicted changes in climate for this region are likely to alter flow patterns in measureable ways.

We continue post-reclamation water quality monitoring on Soda Butte Creek, an impaired water due to mining. This creek, a tributary of the Lamar River, enters Yellowstone NP at its northeast boundary. 2015 and 2016 results show that metal concentrations are lower today than prior to the completion of the reclamation effort.

Early Indication of Drought?

Droughts stress plants, increase the likelihood of fires, and reduce stream flow. These changes have cascading effects on vegetation communities, fish, and wildlife. GRYN models drought stress on several ecosystem indicators or 'vital signs' by estimating water deficit. Water deficit is the amount of water needed to sustain plant function that is not supplied by precipitation. Although native plants and animals are adapted to differing levels of drought stress, exceptionally dry years like 2016 can take a severe toll on condition, reproduction, and in some cases survival. For example, GRYN amphibian monitoring over the last decade found chorus frog and Columbia spotted frog breeding was lowest during the drought year of 2007. Vegetation monitoring at BICA showed that by early June, vegetation that was green in 2014 had already senesced several weeks earlier in 2016.

The Lamar River looking downstream from the USGS Stream Gage near Tower Ranger Station. Flows on 8/3/16 were 184 cfs, ~25 cfs below historic flows for this date. NPS Photo, A. Ray.

Right now (August 1, 2016), we can assess the magnitude of the evolving drought by comparing conditions in 2016 against wet (1997) and dry (1988) years that place current conditions in an historical context. Figure 1 shows that deficits at the end of July in all three GRYN parks were more similar to 1988, an historic fire year in the Greater Yellowstone Area, than to 1997, a wet year remembered by record stream flows.

The timing and severity of drought at the end of July 2016 was similar to conditions in 1988, but will the drought last? A single large storm or several small storms could change the outlook for the fire season, but early and mid-growing season drought in 2016 has already affected park vital signs, and analysis of data collected this summer will tell a more complete story. However, we already know the drought resulted in earlier senescence in BICA, many dry wetlands in YELL, and low stream flows regionally. For example, streamflow on the Lamar and Yellowstone rivers are currently below the 10th percentile of flows for these sites. The Lamar River is at a record low (from a 76-year monitoring record) for this date (see Photo), while flows on the Snake River at Flagg Ranch, Gros Ventre River and Big Horn River are near or below the 25th percentile for this date.

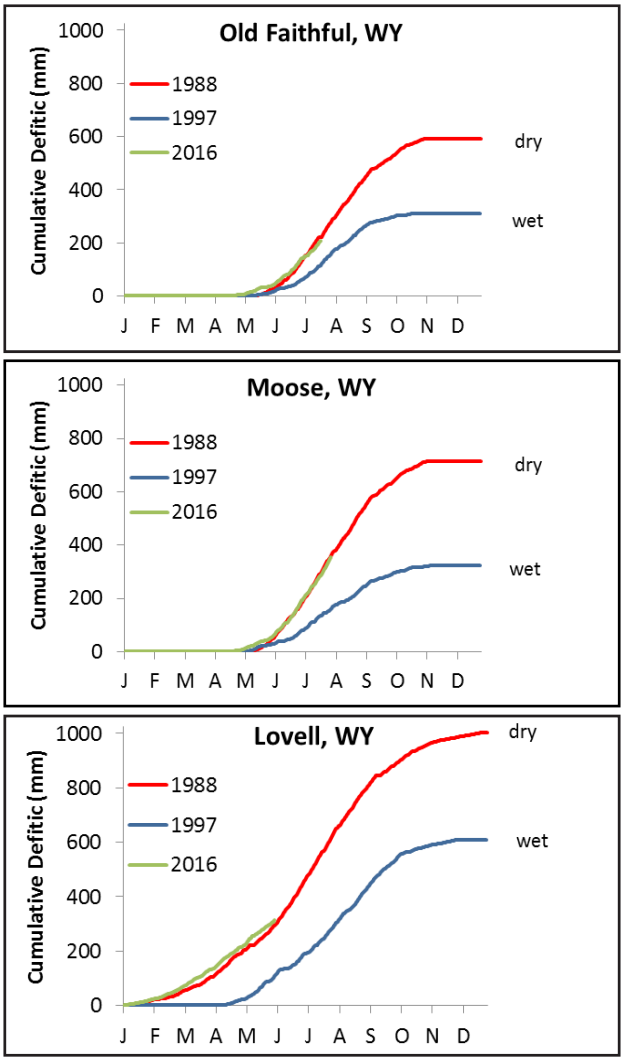

Figure 1. Water deficits at Old Faithful, Moose, and Lovell, WY. All chart data are from Climateanalyzer.org.

*Lovell station data were not current at time of chart preparation.

Data Management Update

Data consistency and validity are a priority at GRYN. Each year data collection and processing procedures are reviewed and updated, staff and cooperators are trained in data stewardship and responsibilities, electronic applications are prepared and loaded with allowed data values and checking tools, and data are reviewed and corrected within days of collection. From field survey crew members to ecologists and the program manager, data stewardship activities at GRYN are fully integrated into daily and seasonal workflows.

Archiving data in a way that is accessible for permanent use in the future is the last step. We recently completed a project with the Intermountain Region's Museum Services Program to permanently archive scientific reports and other materials generated by GRYN since 1999. We will continue to add new material to this collection, which is housed at the Western Archaeological and Conservation Center in Tucson, Arizona.

Spotlight on the Interns - Meet our fabulous interns!

Liana Edwards

Liana is an undergraduate Environmental Science student at the University of Vermont. She is an outdoor enthusiast and especially loves hiking, skiing and running. At GRYN, her work has focused on vegetation, water quality, amphibian, and whitebark pine monitoring in Grand Teton and Yellowstone national parks and the surrounding areas. Liana is gaining experience that will launch her natural resource career: "With the help from my incredible mentors, I am learning many new field skills that I can use in the future."

Kami Crockatt

Originally from Oregon, Kami will be a junior this fall, majoring in wildlife ecology and management, at Montana State. In March, Kami started working at GRYN as an Information Resources intern. Some of her data management projects include archiving and preserving data and GIS mapping. Working towards a career in natural resource field work, Kami is also getting field experience working on whitebark pine monitoring with Erin this summer. Kami works part time during the school year and full time each summer while she completes her degree.

Natilya Blades

Natilya is an undergraduate Environmental Science and Geology student at Georgia State University. She has an Associate's degree in Science in Geology. At GRYN, she is working as a Mosaics in Science intern on amphibian and whitebark pine monitoring. Natilya has been an active community volunteer bringing science experiences to children of all ages and worked on science research in a lab setting using infrared spectroscopy and gas chromotography. Natilya had never been west of Alabama before working here and is loving her field experience in Greater Yellowstone ecosystems.

Recent Publications

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(*on detail from Chihuahuan Desert Network*)