The GRYNdow

Winter 2017 Newsletter

National Park Service
U.S. Department of the Interior

Greater Yellowstone Network
Inventory & Monitoring Program

Greater Yellowstone Network staff and partners

NPS

The GRYNdow is a window into GRYN science in Greater Yellowstone Ecosystem parks.

Inside this Issue

1 Mutualistic Relationships
2 Monitoring Updates
3 Soda Butte Creek Water Quality: A Success Story
3 *Ecosphere* Publishes Our Whitebark Pine Research
4 Staff Spotlight
4 2017 Field Calendar
4 Recent Publications

Mutualistic Relationships

While we often think of symbiotic relationships occurring with animals and plants, the Greater Yellowstone Network has mutualistic relationships with our partners. We recognize that mutually beneficial partnerships are critical to meeting individual missions and lead to overall protection and conservation of natural resources on public lands.

Collaborative monitoring is a major focus of these partnerships. We work closely with the Bureau of Land Management (BLM) on their long-term five-needle pine assessment and monitoring. In partnership with the Upper Columbia Basin Network, U.S. Geological Survey (USGS), and Bighole National Battlefield, we are actively initiating an amphibian monitoring program. As important as the monitoring itself, we have engaged our partners on shared approaches that improve science integration into management decision-making and public outreach.

Collaboration is also key to recruiting and training the next generation of park stewards and scientists. We have an internship program with Montana State University, a partnership with the NPS MOSAICS in Science Diversity internship program, and we participate in local school science events.

Strong partnerships allow us to develop a deeper understanding of natural resources and improve our ability to take on future scientific work in support of conservation. To learn more about one of our collaborative projects and the contributions of partners, check out the Soda Butte Water Quality story on page 3 of this newsletter.

Greater Yellowstone Network Partners

- Bureau of Land Management
- U.S. Forest Service
- U.S. Fish & Wildlife Service
- U.S. Geological Survey
- Northern Rockies Conservation Cooperative
- Montana State Department of Environmental Quality
- Montana State University
- Montana Institute on Ecosystems
- National Parks
- Other NPS Inventory & Monitoring Networks
- NPS MOSAICS science internships
- Local schools
- Cooperative Ecosystem Studies Unit
- Greater Yellowstone Coordinating Committee
- Great Northern Landscape Conservation Cooperative
- Craighead Institute
- Other non-profit organizations

NPS

Whitebark pine cooperative monitoring (BLM foresters, GRYN Montana state University intern, and GRYN Geoscientist in the Park intern.

Monitoring Updates

NPS

Amphibian monitoring at Grand Teton National Park.

NPS

Whitebark pine monitoring on U.S. Forest Service land.

NPS

River sampling at Tower Ranger Station, WY.

Wetlands and Amphibians: We visited 335 individual wetland sites spread across the 31 permanent catchments in 2016. Of these, 104 (31%) were dry or too shallow to survey. From surveyed sites, 62% were occupied by at least one species of breeding amphibian. Interestingly, none of the 31 catchments monitored contained breeding evidence by all four widespread species (boreal chorus frog, Columbia spotted frog, western tiger salamander, and western toad). This was down from two in 2015 and four in 2014, highlighting the type of inter-annual breeding variability that takes place even in protected areas.

Climate: *Swing high, swing low.....*This year, an unusually cold January was followed by an unusually warm February. Based on monthly average temperatures, it was the coldest January since 1987 at Lovell, WY (-15.7° C) and the 2nd coldest at Old Faithful (-10.3° C) and Moose (-13.6° C). February 2017 was the 2nd warmest February since 1987 at Lovell, WY (1.0° C), 2nd warmest at Moose (3.6° C), 4th warmest at Old Faithful (-4.9° C), and 2nd. warmest for the entire United States. A rapid spring melt and heavy runoff may be in store for rivers in the region.

After two years of below average precipitation, the 2016 summer drought and above average temperatures set the stage for large wildfires in Grand Teton and Yellowstone NPs and near-record low flows in rivers and streams. October brought four to five times higher than normal rains that extinguished wildfires. Snow water equivalent stored in the snowpack is currently well above average at Snotel stations in Yellowstone (116-178%) and Grand Teton (124-165%) NPs, but it is close to average at Bald Mountain (104%) near Lovell, WY.

Whitebark Pine: In 2016, we visited 43 whitebark pine transects and assisted with five-needle pine monitoring on Wyoming BLM lands. We worked collaboratively with BLM staff to initiate implementation of the Interagency Whitebark Pine Monitoring Protocol. We were excited to share our findings with an international audience in the December 2016 *Ecosphere* issue (see pg. 3). Our second whitebark pine step-trend report which evaluated 12 years of whitebark pine monitoring data was completed. We detected no significant change in the proportion of live trees infected with blister rust in the Greater Yellowstone Ecosystem with an estimate of 20% live trees infected. Monitoring in 2017 will concentrate on revisiting Panel 2 transects, continuing to assist with five-needle pine efforts on BLM lands and we will host two internship positions again.

Upland Vegetation: In our 6th year of upland vegetation monitoring in Bighorn Canyon NRA we collected data from 575 quadrats in 10 sample frames. Sample frames include two juniper woodland communities, four juniper-mountain mahogany woodland communities, and four sagebrush steppe and grassland communities. Vegetation monitoring now includes multiple independent observers in some quadrats. Our goal is to quantify variability among observers and, ultimately, improve the quality and consistency of future sampling. We continue to collaboratively develop and fine tune *VegViz* for improved clarity, usability, and more in depth data review. *VegViz* can be accessed by the public at www.vegviz.org.

Water Resources: The 2017 water resources monitoring season began in February at Bighorn Canyon NRA where quarterly samples will help document water quality in regional rivers. Starting in April, monthly water quality monitoring at Yellowstone and Grand Teton NPs will resume for the Yellowstone, Madison, Lamar, and two Snake River locations. We continue to sample locations co-located with USGS stream gages to document annual and long-term changes in flow in GRYN parks and across the region.

Data Management: We continue to work on improving procedures to make sure data are collected to meet or exceed standards; data receive prompt, comprehensive, and expert review; data are stored and documented in a way that guarantees long-term data preservation, accessibility, and utility; and data are available and provided in the formats needed to support established monitoring objectives and other scientific activities.

Soda Butte Creek Water Quality: A Success Story

Soda Butte Creek, a tributary of the Lamar River, enters Yellowstone National Park (NP) at its northeast boundary. A five-mile segment of the creek is included on Montana Department of Environmental Quality's (MT DEQ) list of impaired waters (303-d) for elevated levels of copper, iron, lead, and manganese. Contamination is likely the result of the stream's decade-long contact with a former mill and tailings site.

Between 2010 and 2014, MT DEQ's Abandoned Mine Lands Section completed a reclamation of the former mill and tailings site. This required excavation and stabilization (with quicklime) of approximately 0.5 million tons of mine tailings, pumping and treating more than 110 million gallons of contaminated groundwater, and reconstruction of approximately 1,800 lineal feet of the Soda Butte Creek stream channel. The five-year reclamation cost $22 million.

Over the last two years, we have worked collaboratively with the NPS Water Resources Division, Yellowstone National Park, and MT DEQ on an extensive water quality sampling campaign to characterize metal levels in the watershed. Sampling was used to characterize current concentrations of metals from 1) the formal mill and tailings site, 2) major tributaries, and 3) other mainstem locations along Soda Butte Creek. This effort benefited considerably from the U.S. Forest Service collection of water quality samples from Soda Butte Creek dating back to 2000.

Water flowing through the old mill and tailings site is cleaner now than it was prior to the reclamation. Data show marked improvements in total iron and copper levels in Soda Butte Creek. This collaborative monitoring effort has provided MT DEQ's Monitoring and Assessment Section with a current watershed-wide characterization of the sources and severity of contaminants (including from the former tailings site) to Soda Butte Creek, and ultimately, to Yellowstone NP. This information will be used for a formal evaluation of Soda Butte Creek's impairment listing.

Comparison of Soda Butte Creek downstream of the McLaren tailings impoundment in 2009 (left) and 2013 (right). Photo courtesy of Tom Henderson (MT DEQ).

Ecosphere Publishes Our Whitebark Pine Research

NPS

White pine blister rust (*Cronartium ribicola*) on the bole of a whitebark pine tree.

Our research on whitebark pine mortality was featured in the special issue of *Ecosphere* dedicated to the outstanding science conducted by the NPS Inventory & Monitoring Division. The article, titled "Whitebark pine mortality related to white pine blister rust, mountain pine beetle outbreak, and water availability," details results of whitebark pine monitoring throughout the Greater Yellowstone Ecosystem.

Whitebark pine forests have been adversely impacted by insect outbreaks, drought, and the exotic pathogen that causes white pine blister rust. We monitored trees from 2004 - 2013 to investigate associations between tree death and individual tree variables (location of white pine blister rust infection on the tree, duration of the infection, presence of mountain pine beetle, and tree size).

Many whitebark pine trees died in 2009 after increasing air temperatures (between 2006 and 2008) contributed to an outbreak of mountain pine beetles. Larger trees were preferentially attacked and killed by the beetles which led to a shift towards forests dominated by smaller trees. These forests may be more susceptible to white pine blister rust in the future since smaller trees are more likely to be killed by the rust that can girdle a tree. In stands with higher evapotranspiration rates (less droughty), larger trees were less likely to be killed by mountain pine beetles. This information could help managers identify areas to implement whitebark pine management.

You can read our full Ecosphere article at http://onlinelibrary.wiley.com/doi/10.1002/ecs2.1610/full.

Citation:

Shanahan, E., K. M. Irvine, D. Thoma, S. Wilmoth, A. Ray, K. Legg, and H. Shovic. 2016. Whitebark pine mortality related to white pine blister rust, mountain pine beetle outbreak, and water availability. Ecosphere 7(12):e01610. 10.1002/ecs2.1610.

Staff Spotlight

Mary Levandowski: Mary is currently pursuing a Master's degree in ecology at Montana State University. She works for Greater Yellowstone Network as a hydrologic technician catching amphibians and collecting data on large water systems. Mary fell in love with field work after her first trip into the backcountry at Saguaro National Park in Tucson, Arizona following her graduation from the University of Arizona. She went on to work for the Mojave and Chihuahuan Desert I&M networks monitoring arid land springs which led to her interest in joining our I&M team to work in Greater Yellowstone Ecosystem parks.

Tyson Roth: Growing up in Montana, Tyson was exploring public lands at an early age. His deep appreciation for wilderness and the Greater Yellowstone Ecosystem (GYE) led him to his position as a biological science technician for Greater Yellowstone Network. Monitoring whitebark pine and amphibians has taught him "how subtle environmental changes can precipitate significant effects on a visually rugged landscape." Tyson is a registered nurse by training and enjoys backcountry skiing, trail running, climbing, and general adventuring in the GYE. Tyson is moving on in his career as a nurse and will be greatly missed. Thank you Tyson for dedicating five years to our network. Good luck in your future endeavors!

2017 Monitoring Schedule

Location	Amphibian	Sagebrush Steppe	Upland Vegetation/ Sagebrush	Water Resources	Whitebark Pine
BICA			late May - late June	Quarterly	
GRTE	mid June - Aug	early July		April - Oct	late June - Sep
JODR	mid June - Aug				late June - Sep
YELL	mid June - Aug			April - Oct	late June - Sep
USFS/BLM					late June - Sep

Recent Publications

Al-Chokhachy, R., A. Sepulvida, A. Ray, D. P. Thoma, and M. T. Tercek. 2017. Evaluating species-specific changes in hydrologic regimes: an interative approach for salmonids in the Greater Yellowstone Area (USA). Reviews in Fish Biology and Fisheries DOI 10.1007/s11160-017-9472-3.

Beever, E. A., J. D. Perrine, T. Rickman, M. Flores, J. P. Clark, C. Waters, D. Thoma, and G. H. Collins. 2016. Pika (*Ochotona princeps*) losses from two isolated regions reflect temperature and water balance, but reflect habitat area in a mainland region. Journal of Mammalogy 97(6): 1495-1511.

Esposito, D. M., E. Shanahan, and T. Rodhouse. 2016. UCBN and GRYN sagebrush steppe vegetation monitoring; double observer study 2015: John Day Fossil Beds National Monument-Clarno Unit and City of Rocks National Reserve. Natural Resource Report. NPS/UCBN/NRDS—2016/1052. National Park Service. Fort Collins, Colorado.

Levandowski, M., and A. Ray. 2017. Water quality summary for the Lamar River, Yellowstone River, and Madison River in Yellowstone National Park: Preliminary analysis of 2015 data. Natural Resource Report NPS/GRYN/NRR—2017/1389. National Park Service, Fort Collins, Colorado.

Preston, T. M. and A. M. Ray. 2016. Effects of energy development on wetland plants and macroinvertebrate communities in Prairie Pothole Region wetlands. Journal of Freshwater Ecology, DOI 10.1080/02705060.2016.1231137.

Shanahan, E., K. M. Irvine, D. Thoma, S. Wilmoth, A. Ray, K. Legg, and H. Shovic. 2016. Whitebark pine mortality related to white pine blister rust, mountain pine beetle outbreak, and water availability. Ecosphere 7(12):e01610. 10.1002/ecs2.1610.

Skovlin, J., and D. Thoma. 2015. Interactions underfoot: The subtle influence of soil moisture on vegetation pattern. Park Science 32(2): 60-63.

Thoma, D. P., S. M. Munson, K. M. Irvine, D. L. Witwicki, and E. L. Buting. 2016. Semi-arid vegetation response to antecedent climate and water balance windows. Applied Vegetation Science 19:413-429.

Weissinger, R., T. E. Philippi, and D. Thoma. 2016. Linking climate to changing discharge at springs in Arches National Park, Utah, USA. Ecosphere 7(10):e01491. 10.1002/ecs2.1491.

Witwicki, D. L., S. M. Munson, and D. P. Thoma. 2016. Effects of climate and water balance across grasslands of varying C_3 and C_4 grass cover. Ecosphere 7(11):e01577. 10.1002/ecs2.1577.

Greater Yellowstone Network

2327 University Way, Suite 2
Bozeman, MT 59715

Kristin Legg – Program Manager
(406) 994-7734

Rob Daley – Data Manager
(406) 994-4124

Andrew Ray, PhD – Aquatic Ecologist
(406) 994-7498

Dave Thoma, PhD – Hydrologist
(406) 994-7725

Erin Shanahan – Field Ecologist
(406) 994-7530

Mary Levandowski – Hydrology Tech
(406) 994-7530

Cayley Faurot-Daniels - Field Tech

Malek Robinson - Mosaics in Science Intern

Kami Crocket - MSU Intern

Seasonal Bio-techs - Vacant

GRYNdow Editor: Tani Hubbard
(*Northern Rockies Conservation Cooperative*)