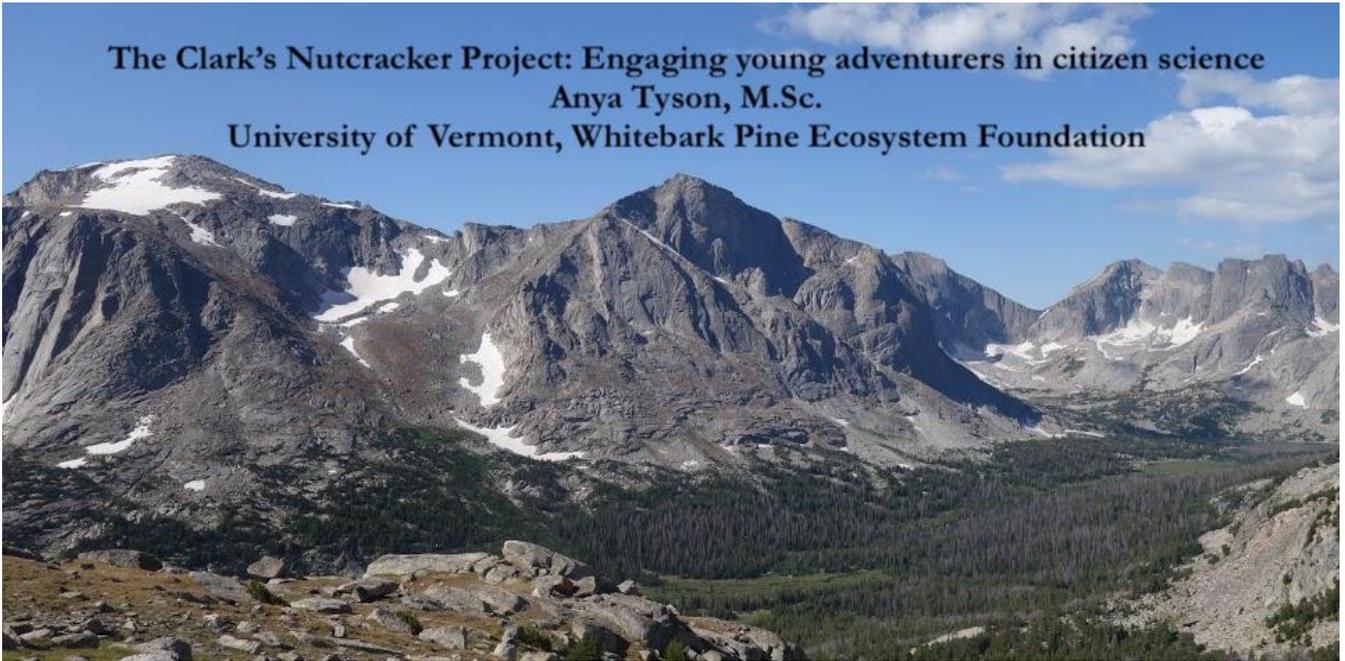


The Clark's Nutcracker Project: Engaging young adventurers in citizen science
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Introduction: “With a great view comes great responsibility”

When you scale a peak in western Wyoming, you will marvel at the sheer cliffs and the expansive skyline, but you may also find cause to grieve. Here, at the rooftop of Greater Yellowstone Ecosystem, you don’t have to look far to see the gray skeleton of a dead subalpine forest. The deceased? More often than not, it’s a whitebark pine, *Pinus albicaulis*.

Dead or alive, the whitebark pine is the spirit tree of any serious mountaineer in the northern Rockies. It grows on wind-tortured ridges, striking improbable and beautiful poses to match the elements. And though the conditions may be inhospitable, the whitebark pine is not — with boughs that shelter snowpack, roots that stabilize soil, and seeds that are more calorically dense than chocolate chips. These seeds feed over 30 species of animals, but the survival of whitebark pine depends on a single species of bird. While a climber puts her life entirely in the hands of her belayer, future generations of whitebark pine rely solely on the Clark’s nutcracker, *Nucifraga columbiana*, the seed-dispersing champion of high-elevation forests.



One out of every two whitebark pines has perished in the last few decades due to the combined effects of an invasive fungus and a native bark beetle. The research presented here addresses this environmental crisis by asking young adventurers to collect data on whitebark pine and Clark’s nutcrackers. Students of five organizations (NOLS, Teton Science Schools, the Community School, Wyoming Catholic College, and Powell High School) reinforced their commitment to wild landscapes by documenting whitebark pine health and the presence of Clark’s nutcrackers on wilderness expeditions. In total, they completed 54 surveys across four remote mountain ranges.





Map of study area and 2017 survey locations in the Wind Rivers, Tetons, and Absarokas in Wyoming and the Beartooths in Montana.

Purpose: “Why saving whitebark means saving nutcrackers (and mapping trees)”

Denizens of high elevations, whitebark pines are primarily a wilderness species. In order to protect these trees in remote areas, land managers need to know where they are and how they are faring. Equipped with a camera, a GPS, and a basic knowledge of tree identification, almost any adventurer is poised to provide these simple and critical data points.

Similarly, the charismatic and easily identified nutcracker is perfect for citizen science. With a limited amount of instruction, nearly any person can learn to identify Clark’s nutcrackers and conduct simple presence-absence surveys for nutcrackers. By using systematically collected presence-absence data paired with basic habitat characteristics, conservation biologists can tease apart which habitat features predict nutcracker presence. Our project partners intend to use this information to make management recommendations to benefit nutcrackers in the face of declining whitebark pine populations. For example, if a particular species of tree proves to be important predictor and likely food source for nutcrackers, the Forest Service can promote this species in proximity to surviving whitebark pines. Ultimately, in order to keep whitebark pines around, we need to keep nutcrackers around to spread their seeds.

Methods: “Many hands make light work”

How do you research a species that thrives in rugged terrain? You get the help of people who thrive in rugged terrain. To reach the greatest number of participants, the Clark’s Nutcracker Project equipped wilderness educators with scientific know-how through one-hour training sessions. To get at the “why” behind the science, each training kicked off with a rousing accordion song about the whitebark pine, the Clark’s nutcracker, and the ecological peril facing both species. Our trainees then brought their newly acquired knowledge into the backcountry to engage to hundreds of students in citizen science.





In order to collect data, participants of all ages must master Clark's nutcracker identification by sight *and* sound. Though nutcrackers are quite visually distinctive, survey teams carried tiny iPod shuffles® with birdsong to hone their ability to distinguish the nutcracker's gravelly, squawking calls. In addition to nutcracker skills, each survey team needed to confidently identify the seven tree species that live at high elevations in the Greater Yellowstone Ecosystem. To support our citizen scientists to this end, we sent expeditions with custom, pocket-sized tree identification guides in addition to providing live tree trainings.

Once our student and instructor teams were out on their backpacking or climbing trips, they carved out time to collect data at opportunistically established survey sites. The first step to data collection was a rapid habitat assessment. After recording GPS coordinates and taking a photo in each cardinal direction, a survey team of two to 10 people worked together to describe the tree species present at a site and their relative abundances. If whitebark pines were present at the site, the team collected specific data including the age and health status of nearby whitebark pines. After the habitat survey, each team member spent 10-minutes independently, but simultaneously, looking and listening for nutcrackers. At the end of the field season, Program Manager Anya Tyson compiled these data for our respective partners.

As of November 15, The Whitebark Pine Subcommittee of the interagency Greater Yellowstone Coordinating Committee had received the complete whitebark pine dataset from the 2017 field season of the Clark's Nutcracker Project. The subcommittee is eager to have access to a ground-truthed and photo-verifiable dataset from remote wilderness locations, and will use this information in the coming months to update the 2010 maps of whitebark pine distribution and stand condition.

The paired habitat and nutcracker dataset will also be made available to Dr. Taza Schaming for use in her Clark's nutcracker occupancy models. Though Dr. Schaming's investigations have included radio-tracking of dozens of individual birds, she believes occupancy modelling may allow her to research nutcracker habitat use at a scale that is relevant to the far-ranging species.

Discussion:

In both the science and climbing communities, it's understood that worthwhile projects can take years to come to fruition. As far as peer-reviewed results, a paper on the motivations, barriers, and benefits experienced by participating NOLS instructors during first season of the Clark's Nutcracker Project, is currently in review, and can be expected to be published in 2018 in the journal *Citizen Science: Theory and Practice*. Though we can't report on other scientific results or land management outcomes at this time, we can share our season stats along with the experiences and stories of our excellent volunteers.



In 2017, the Clark's Nutcracker Project engaged 289 total participants in data collection, including 236 young adventurers. To reach this audience, we gave several presentations directly to students and provided dozens of trainings to over 70 instructors representing nearly 50 expeditions. Though some of these expeditions did not succeed in their intention of collecting data, many instructors still explicitly commented on their students' positive interaction with the story of the Clark's nutcracker and other project content. For example, one instructor wrote, "tree identification and whitebark pine health in the Rocky Mountains



ended up being an integral part of the [environmental studies] curriculum that I was excited and able to teach about." Based on similar feedback, we estimate another two hundred students were exposed to these important place-based topics in camp and trailside discussions without participating in data collection.

A big part of the Clark's Nutcracker Project's mission is to introduce young climbers and hikers to a hands-on conservation ethic. One of our student participants wrote that "I really enjoyed being able to participate in a citizen science project and definitely want to look into getting involved in local ones when I get home." We sent our participants a link to our project website whenever possible with helpful suggestions on how to locate citizen science opportunities nationwide. Other stories from the field include many intimate wildlife sightings. Deep in the Wind Rivers, one watchful survey group was rewarded with the exhilarating sight of a lone wolf chasing a bull elk. Another instructor shared the following "nutcracker highlights":

- One perched on a branch four feet in front of my students on a hiking day, acting curious and engaged with our backpacks.
- Two hopping between branches, vocalizing in a cute little warble/cluck between each other while we watched.
- Numerous mornings, Clark's were our alarm clocks, 'kraaaaing' from the whitebark above.

Conclusion:

American Alpine Club will be the first to receive copies of any publications that stem from this project in the future. For now, we reflect here on the intangible conservation outcomes that sink in when individuals sit still, with intention, in wild places. If you total all the 10-minute surveys of each of our volunteers, over 63 hours were dedicated to silent wilderness observation in 2017 as a result of the Clark's Nutcracker Project. As humans, and perhaps especially as climbers, it takes intention to truly *see* the natural phenomena that we look at on a daily basis. When we view the world as a living, breathing fabric instead of a backdrop for social media, we are a one step closer to making conscientious environmental choices. When we appreciate the stories of the creatures with which we share the crag, we are likely to do a whole lot more sharing. And because sharing is something that most of us learn when we are young, the Clark's Nutcracker Project specifically asks students to look, listen, and make time for birds and trees.

