

**The impact of whitebark pine (*Pinus albicaulis*) mortality on Clark's Nutcracker (*Nucifraga columbiana*) demography and habitat selection**  
***2014-2024 Field Research: Multiscale landscape patterns of habitat selection and resource tracking by the Clark's nutcracker, an avian seed disperser***

**Project Report/Executive summary**

Clark's nutcrackers are obligate mutualists of whitebark pine, and facultative mutualists of multiple conifers, playing an important role in forest regeneration and seed dispersal for at least ten conifer species. Whitebark pine, a candidate for the Endangered Species List, is a critical component of the Greater Yellowstone ecosystem, where it contributes to biodiversity and ecosystem function. Evidence suggests that declining whitebark pine communities are leading to reduced local Clark's nutcracker populations, which would lead to reciprocal whitebark pine declines. Because Clark's nutcrackers are highly mobile, facultative migrants, it is difficult to accurately monitor local population trends. Therefore, information on landscape scale space use is essential for more accurate predictions of Clark's nutcracker metapopulation stability, and local and range-wide resilience of the Clark's nutcracker-whitebark pine mutualism. To address this information gap, as part of my larger study of Clark's nutcracker behavior, I began the first study to attempt satellite-tagging Clark's nutcrackers.

In fall 2014, I satellite-tagged seven Clark's nutcrackers near Jackson, Wyoming, using Microwave Telemetry PTT tags. I received the last transmission from these Wyoming birds in August 2018, almost four years after the first nutcrackers were satellite-tagged. In February 2018, I expanded the research into Washington's Cascades, and successfully satellite-tagged an additional seven nutcrackers in high density whitebark pine habitat in the eastern Cascades. I will satellite-tag an additional two birds, minimum, in moderate density whitebark pine habitat in the Okanogan-Wenatchee NF in April 2020, in collaboration with US Forest Service, then four nutcrackers, minimum, in low density whitebark pine habitat in the western Cascades, in North Cascades National Park, in April 2021. In March/April 2020 then in spring 2021, I will also fit Icarus satellite-transmitters (number TBD) in Yellowstone, as a co-PI, in collaboration with Diana Tomback and Doug Smith, as part of a newly initiated Clark's nutcracker-whitebark pine research project in the park.

I am currently continuing to collect and maintain the satellite data from the Washington satellite-tagged nutcrackers. I am analyzing the final data from the Wyoming birds and preliminary data from the Washington birds, in collaboration with Dr. Peter Singleton, US Forest Service. Satellite-tracking Clark's nutcrackers in two geographically distinct regions, northwest Wyoming and Washington's Cascades, enables comparisons, for the first time, of Clark's nutcracker resource tracking, landscape scale long distance movements, and habitat selection in regions with different habitat types and health. These analyses will allow for better predictions of population stability and resilience locally and throughout their range.

Results of this study will be directly applicable to researchers and managers involved with the conservation of subalpine communities in whitebark pine ecosystems. The results improve managers' ability to identify and manage Clark's nutcracker habitats, as well as identify connectivity between distant habitats. Additionally, the data will provide definitive information on Clark's nutcracker habitat selection and use, which is critical for designing effective management strategies.

**Outreach (2020):**

Since 2018, I have regularly updated a website for this project, [www.thenutcrackerecosystemproject.com](http://www.thenutcrackerecosystemproject.com). The following book, with my essay, is now in print: Schaming, T. D. 2019. Clark's Nutcrackers, Pivotal Players in the Absaroka-Beartooth Wilderness. *In* Parrie, T. N. and J. A. Logan, editors. *Voices of Yellowstone's Capstone, A Narrative Atlas of the Absaroka-Beartooth Wilderness*. Red Lodge, MT: Absaroka-Beartooth Wilderness Foundation. pp. 150-159.

Additionally, I have continued to collaborate with Anya Tyson, on her nutcracker citizen science project. She completed her M.S. on this project at the University of Vermont in fall 2017, but NOLS continued to collect additional data in 2018 and 2019. In collaboration with Anya, Teresa Lorenz (USFS), and Alison Scoville (Central Washington University), we are beginning a student-led citizen science project to monitor nutcrackers and whitebark pine in the Cascades, with the long-term goal of expanding throughout the whitebark pine range. For this piece of the Nutcracker Ecosystem Project, our overall goal is to understand environmental drivers of Clark's nutcracker space use, by examining which habitat characteristics influence nutcracker occurrence, with the ultimate purpose of aiding whitebark pine management decisions. Our primary project objectives are to (1) evaluate nutcracker occupancy as a function of whitebark pine stand density, health and habitat mosaic, using volunteer-deployed and -monitored acoustic monitors, and (2) inventory variation in yearly whitebark pine cone crop levels and whitebark pine health through volunteer cone counts and habitat surveys. Cone counts in seasonal ranges of local satellite-tagged Clark's nutcrackers will immediately provide data useful for interpreting the birds' movement patterns. Habitat surveys in whitebark pine stands previously surveyed by USFS R6 10-15 years ago, will also allow for an evaluation of habitat change over time. (3) Additionally, we are currently developing resource selection (RSF) function maps derived from movements of satellite-tagged Clark's nutcrackers. We will use the acoustic monitoring, whitebark pine cone counts and habitat surveys to validate the RSF maps, and start exploring the hypothesis that areas that show up as highly selected based on the telemetry RSF are important for nutcracker cone harvest and whitebark pine seed dispersal.

In the initial phase of this project, our objectives are to work with undergraduate students on a series of small projects to: (1) develop and test field protocols and volunteer training materials for acoustic monitor deployment, cone counts, and habitat surveys, (2) develop and test methods for filtering audio recordings to quantify nutcracker occupancy and duration of use in monitored whitebark pine stands, and (3) produce a volunteer management plan, including detailed strategies for volunteer recruitment, training, and retention. In the second phase, spearheaded by a graduate student, beginning fall 2020, we propose partnering with local organizations to work with a network of volunteers, to expand the number of acoustic monitors deployed, and perform a larger number of systematic whitebark pine cone counts and habitat surveys. Alison is working on recruiting three students this quarter, planning for them to begin their projects in the spring quarter, beginning March 31.

I will include my research results in a future presentation to the Jackson Hole Bird Club, sponsored by the Jackson Hole Wildlife Foundation and the Northern Rockies Conservation Cooperative.

**Publications Currently in Review/ in Revision/ in Preparation:**

Ray, C., R. M. Rochefort, J. I. Ransom, T. S. Schaming, J. C. B. Nesmith, S. A. Haultain, J. R. Boetsch, M. L. Holmgren, R. L. Wilkerson, and R. B. Siegel. (*In review. Submitted*)

- December 11, 2019.*) Trends in whitebark pine and Clark's Nutcracker in national parks of the Cascade-Sierra province. PLOS ONE.
- Schaming, T. D. and C. Sutherland. (*In revision.*) Occurrence patterns of Clark's nutcrackers in a region with large-scale whitebark pine decline. PLOS ONE.
- Schaming, T. D., T. L. Lorenz, P. Singleton, and J. I. Ransom. (*In preparation, to be submitted summer/fall 2020.*) Clark's nutcracker space use, home range and habitat selection, comparing two regions, the Northern Cascades, Washington and the Greater Yellowstone Ecosystem; implications for conservation.

**How grant money was used:**

Funds from the Meg and Bert Raynes Wildlife Fund award have been depleted, but the project is ongoing. Current funding is from Seattle City Lights (WA: 2020-2021); United States Forest Service (WA: 2020); North Cascades National Park NR Regional Block (WA: 2021); Ricketts Conservation Foundation (Yellowstone: 2020-2021).