IDAHO DEPARTMENT OF FISH AND GAME

Ed Schriever, Director

Project F19AF00801

Northern Idaho Ground Squirrel Annual Population Monitoring
Cooperative Endangered Species Conservation

Interim and Final Report

Performance Period
July 1, 2019 to September 30, 2020

Compiled and edited by: Diane Evans Mack

September 2020
Boise, Idaho

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ESA TRADITIONAL SECTION 6
INTERIM & FINAL PERFORMANCE REPORT

1. **State:** Idaho

   Grant number: F19AF00801

   Grant name: Northern Idaho Ground Squirrel Annual Population Monitoring

2. **Report Period:** July 1, 2019 to June 30, 2020 (and 30 September 2020)

   Report due date: September 28, 2020

3. **Location of work:** Adams and Valley Counties

4. **Objectives**

   a) Compile and summarize data from 2019 surveys to prepare for abundance and occupancy analyses
   b) Conduct field surveys for long-term population monitoring in spring 2020 based on a sampling design developed in 2013
   c) Incorporate an additional stratum into the survey design to document Northern Idaho Ground Squirrel (NIDGS) activity beyond the current sampling frame
   d) Conduct additional focused surveys as needed to address site-specific questions, such as change in NIDGS distribution in response to habitat treatment, wildfire, or competition with Columbian ground squirrels
   e) Provide field support as needed to the collaborative study of the effectiveness of forest restoration treatments on NIDGS led by the Idaho Fish and Wildlife Cooperative Research Unit at the University of Idaho (UI) partnering with the Payette National Forest (PNF), Idaho Department of Fish and Game (IDFG), and the U.S. Fish and Wildlife Service (FWS).

5. **If the work in this grant was part of a larger undertaking with other components and funding, present a brief overview of the larger activity and the role of this project.**

   This project is part of the overall recovery program for the northern Idaho ground squirrel (*Urocitellus brunneus*; NIDGS) and is conducted in collaboration with biologists and fuels specialists from the FWS, PNF, UI, species experts, and private landowners. IDFG implements the project. Data generated on surveys provide baseline information on population status to assess recovery. Results are incorporated by the above-listed entities to meet objectives detailed in the Recovery Plan (U.S. Fish and Wildlife Service 2003), improve habitat for NIDGS (specifically PNF), and evaluate NIDGS response to habitat (specifically UI). In addition, these results allow continued collaboration with land managers, regulatory agencies, and research partners by providing a range-wide reference point from which to identify objectives or compare results from other site- or topic-specific studies.

Population monitoring data have been an important part of two 5-year status reviews (2010, 2016) conducted by the FWS.

Extant populations of NIDGS found on federal land are managed by the PNF. In 2012 the PNF was selected to participate in the national Collaborative Forest Landscape Restoration Program (CFLRP). The PNF currently has three large-scale (>50,000 ac) projects underway which include a component to improve NIDGS habitat with thinning and prescribed fire. These actions aim to rejuvenate forage plants and create corridors to link populations. Habitat restoration by the PNF has had a positive effect on NIDGS populations. We have adjusted annual population monitoring to include portions of these projects in NIDGS surveys.

The OX Ranch, a private landholding in Bear, Idaho, supported this project by providing access to hundreds of acres for surveys. The OX Ranch entered into a Safe Harbor Agreement (SHA) with the FWS and IDFG in 2009 to help meet recovery goals for the NIDGS. The SHA covers 4,227 acres on the OX Ranch and encompasses a significant portion of the NIDGS population.

In addition to this Section 6 grant, data analyses for the 2019 survey season were supported by Section 6 Project F18AF01191 and 2020 field surveys were supported by the FWS Boise Field Office through a Cooperative Agreement Award.

6. Describe how the objectives were met.

During this reporting period, Grant F19AF00801 was used to support (1) development of the final report from the 2019 field season, and (2) field surveys in 2020, including salaries of 5 technicians, equipment, supplies, and field housing. Analysis of survey data from the 2020 field season is ongoing and covered under a different grant; thus, the 2020 population estimate and other statistics are not included in this report.

2019 Results (Objective *a*)

To complete data analysis and develop the final report of 2019 population monitoring, we analyzed 2019 survey data in several ways. Based on the 1,720 NIDGS detections on line-transect surveys in 1,120 cells, we used program DISTANCE to estimate a density of 0.85 squirrels/ha and a total population size of 2,193 squirrels (95% CI: 1,990–2,429). We post-stratified data based on relative density (higher, lower, or unknown), with resulting densities of 0.97 squirrels/ha in stratum 1, 0.60 squirrels/ha in stratum 2, and 0.72 squirrels/ha in the newly created stratum 3. Corresponding unadjusted population sizes were 1,326, 233, and 602, respectively. Some unknown number of squirrels are underground during NIDGS line-transect surveys and not available to be counted. We adjusted estimates of population size from program DISTANCE upward by a factor of 1.35 to obtain an approximate abundance. This adjustment factor was calculated from a comparison of abundance estimates from line-transect surveys and mark-recapture at 10 sites in 2016 (Wagner and Evans Mack 2016). The comparison showed that 1.35 squirrels were present for every squirrel detected on a survey. Our 2020 adjusted index to overall abundance was 2,960 NIDGS.

We compared the 1-year change in population estimates between 2019 and 2018 in 3 ways: from the DISTANCE analyses of survey data from all 3 strata, from DISTANCE analysis of 500 core grid cells intended to be surveyed every year, and from a pair-wise comparison of the 500 core cells. The population estimates were essentially the same for the 2-year period.

Looking back 6 years, when the current long-term monitoring approach was implemented, NIDGS abundance in strata 1 and 2 has been on a downward trend since the peak observed in 2016 (Figure 1). However, the addition of stratum 3 in 2018 shows a plateau in estimated overall population size. Stratum 3 encompasses areas where squirrels have more recently been documented, in part as a result of squirrels moving on the landscape.

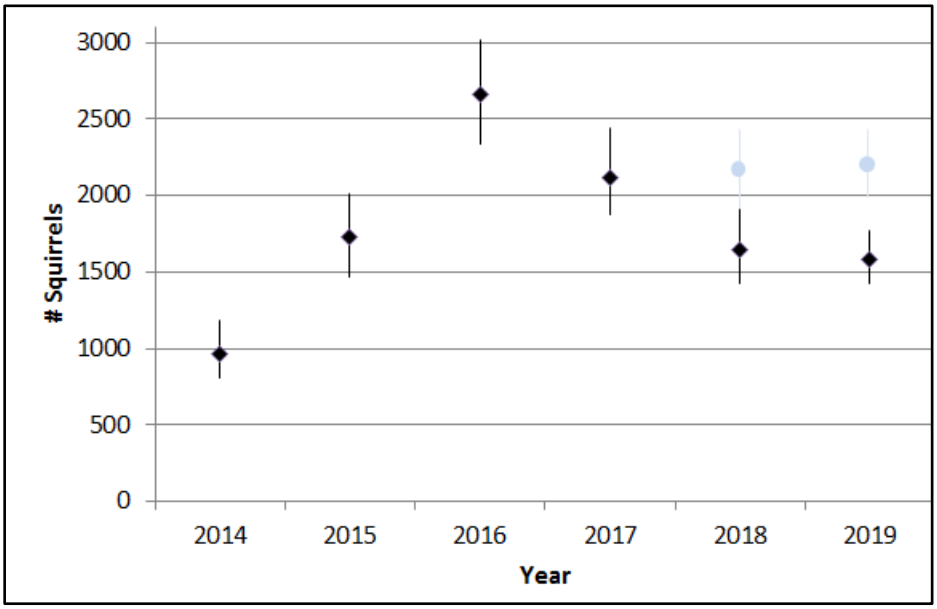

Figure 1. Unadjusted population estimates and 95% confidence intervals from program DISTANCE for strata 1 and 2 only (black); strata 1, 2, and 3 shown in blue for 2018 and 2019.

We explored several environmental variables, including tree canopy cover, aspect, heat load index, soil properties, and proximity to nearest squirrel, as site covariates in occupancy modeling with program PRESENCE. The most parsimonious model included proximity to nearest squirrel, tree canopy cover, and southerly aspect, with constant probability of detection across visits. We applied this model to the full 2,590-cell sampling frame to generate estimates of occupancy across occupied habitat. Almost half of cells in our expanded sampling frame had >75% probability of being occupied, a similar number of cells had <50% probability of being occupied, and only 4% of cells had 0 probability.

In addition to line-transect surveys, we conducted presence surveys at 2 sites within our sampling frame where no grid cells had been selected for surveys in 2019. We surveyed another 6 sites discovered in 2018 that were outside the sampling frame. We also made it a priority in 2019 to explore outside the sampling frame to gain a better understanding of

NIDGS occurrence and dispersal corridors within the known distribution. We targeted habitat between or adjacent to known occupied locations where we thought squirrels could have expanded into. We surveyed 1,540 ha and detected 246 squirrels at 12 locations between or adjacent to known occupied areas. We also surveyed 60 ha at a Bureau of Land Management site that had been considered extirpated and had not been surveyed since the late 1990s. We detected approximately 25 NIDGS at this site, which represents the lowest elevation and farthest south on the west side of the NIDGS range and is approximately 11 km from the next nearest known occupied site.

We distributed the 2019 final report to 27 individuals representing 13 federal, state, and private agencies and organizations.

Annual Population Monitoring (Objectives *b* and *c*)

The 2020 field season was the seventh year of surveys under the long-term monitoring approach piloted in 2013 (Evans Mack et al. 2013). This current sampling design combines grid-based line-transect distance sampling within a patch occupancy framework to provide a statistically valid, repeatable approach for estimating population size and trend each year for a time frame of 20–30 years. The sampling frame includes 2,590 sample units (100 m x 100 m grid cells) across occupied habitat (1,757 from the original design and 833 for a new stratum 3 added in 2018). Surveys follow a rotating panel design, where approximately 1,197 grid cells are surveyed each year. This includes a core sample of 500 cells that are surveyed every year, and a rotating group of ~700 cells that changes each year. All 2,590 cells are visited within 3 years.

During April through June 2020 we conducted at least 2 distance-based, line-transect surveys in most of the 1,197 grid cells selected for sampling. Surveys were still underway at high elevation sites by the end of this report period, thus data have not been compiled and summarized. We will use NIDGS detections, along with their corresponding distances from transect lines, to estimate an overall population density, group size, and abundance with 95% confidence using program DISTANCE. We will use the same data, along with environmental covariates, in an occupancy analysis to predict NIDGS occurrence across our baseline grid of NIDGS habitat, including at grid cells not surveyed. These analyses will occur under a future grant.

Every 3 to 5 years we validate line transect survey results with a mark-recapture effort. Because this was last done in 2016, we elected to repeat the effort in 2020. We live-trapped NIDGS on 3 different days at each of 10 sites. We aimed to complete trapping before pups emerged, to maintain consistency with surveys. Trap sites were encompassed by line-transect surveys, with the exception of 100 grid cells that fell within trap sites that had not been selected for surveys in 2020. We added these cells to the survey effort to provide a 1:1 comparison between trap and survey data at these 10 sites, but will exclude the extra cells from overall annual population estimates The mark-recapture data will be modeled to estimate the number of squirrels present at each of the 10 trap areas. Similarly, we will tally the number of NIDGS detected during surveys within the boundaries of each trap site. The average ratio of trap:survey numbers will provide a correction factor for overall surveys (e.g.,

a ratio of 1.35 suggests there are 1.35 squirrels present for every squirrel detected on a survey).

Additional Surveys (Objective *d*)
Given the addition of a live trapping effort to validate survey estimates, we put a lower priority on looking for NIDGS beyond where we routinely survey. We conducted 'exploratory surveys' at 6 locations and recorded 7 NIDGS detections at 2 of these locations.

Support to Collaborative Studies (Objective *e*)
The trapping effort in 2020 provided the opportunity to collaborate with the University of Idaho's Laboratory for Ecological, Evolutionary, and Conservation Genetics on a study to further explore NIDGS connectivity and local adaptations. This ongoing work uses emerging genomic methods to evaluate genetic diversity, connectivity, effective population size, and adaptive differences among NIDGS populations (Barbosa et al. 2019). This information will help us understand the extent to which NIDGS populations have had or continue to have genetic connectivity across the landscape, which populations are most important for species persistence, and which habitat features are appropriate targets for management actions (L. Waits, personal communication). IDFG submitted 153 genetic samples to this project in 2020. Genetic material (cheek swabs) were collected when squirrels were being weighed and examined as part of our mark-recapture effort. The IDFG samples represented 11 locations, 2 of which had not been sampled in any genetics study to date. These 2 new locations were significant in that they occur at the northern and southern extremes of the current NIDGS distribution on the west side of the NIDGS range. Their relative distance from other occupied sites will contribute new information on NIDGS genetic connectivity.

Data collected during long-term population monitoring surveys continued to inform the UI's study of NIDGS population response to habitat treatments and plague. Specifically, our surveys established the overall population status as a reference point for the University's stepped-down work at a subset of NIDGS sites (Allison et al. 2019, Goldberg et al. 2017). For example, if NIDGS numbers were lower at individual research plots, our survey results from the entire suite of NIDGS sites provided a perspective as to whether overall numbers were trending up or down. Because long-term monitoring surveys occur at research study sites, we maintained a high level of coordination with the UI crew to minimize disturbance to NIDGS. This was especially so in 2020 because most of the sites at which we trapped overlapped the UI study. We coordinated to trap on the same days whenever possible and will share capture data to meet objectives of both studies.

7. Discuss differences between work anticipated in grant proposal and grant agreement, and that actually carried out with Federal Aid grant funds.

All objectives were completed as anticipated. Funds were completely expended by 30 June 2020, thus the interim report period was also the final report period.

8. List any publications or in-house reports resulting from this work.

Wagner, B., and D. Evans Mack. 2020. Long-term population monitoring of northern Idaho ground squirrel: 2019 implementation and population estimates. Endangered Species Section 6 Grant F18AF01191 and Cooperative Agreement No. F18AC00387. January 29, 2020. Idaho Department of Fish and Game, Boise, Idaho, USA.

Name, title, phone number, and e-mail address of people compiling this report:

Diane Evans Mack, Regional Wildlife Biologist
(208) 634-8137
diane.evansmack@idfg.idaho.gov

Betsy Wagner, Senior Wildlife Technician
(208) 634-8137
betsy.wagner@idfg.idaho.gov

Literature Cited

Allison, A. Z. T., A. M. Toumpas, A. R. Goldberg, and C. J. Conway. 2019. Effects of forest encroachment on behavior and demography of the northern Idaho ground squirrel: annual progress report 2019. Wildlife Research Report #2019-02. Idaho Cooperative Fish and Wildlife Research Unit, Moscow, Idaho, USA.

Barbosa, S., K. Andrews, A. Goldberg, C. Conway, and L. Waits. 2019. Population connectivity and adaptive differences among populations of northern Idaho ground squirrels (*Urocitellus brunneus*) and southern Idaho ground squirrels (*Urocitellus endemicus*). Final Report, Research Work Order 167. April 26, 2019. University of Idaho, Moscow, Idaho, USA.

Evans Mack, D., C. Gillen, and L. McDonald. 2013. Long-term population monitoring of northern Idaho ground squirrel: sampling design, pilot implementation, and 2013 population estimates. Unpublished report to the U.S. Fish and Wildlife Service, threatened and endangered species projects F11AP00417 and F12AP00815 and cooperative agreement no. F11AC00175. December 31, 2013. Idaho Department of Fish and Game, Boise, Idaho, USA.

Goldberg, A. R., A. Z. Allison, and C. J. Conway. 2017. Effects of forest encroachment and plague on demography of the northern Idaho ground squirrel: annual progress report 2017. Wildlife Research Report #2017-01. Idaho Cooperative Fish and Wildlife Research Unit, Moscow, Idaho, USA.

U.S. Fish and Wildlife Service. 2003. Recovery plan for the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). U.S. Fish and Wildlife Service, Portland, Oregon, USA.

Wagner, B., and D. Evans Mack. 2016. Long-term population monitoring of northern Idaho ground squirrel: 2016 implementation and population estimates. Unpublished report to the U.S. Fish and Wildlife Service, threatened and endangered species project F15AF00965 and cooperative agreement no. F11AC00175. December 19, 2016. Idaho Department of Fish and Game, Boise, Idaho, USA.

Submitted by:
David Smith

Grants/Contracts Specialist
David.smith@idfg.idaho.gov

Martha Wackenhut
Federal Aid Coordinator

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Toby Boudreau, Chief
Bureau of Wildlife