teton
raptor
center

2017 Annual Reports

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BALD EAGLE GENETICS IN THE GYE

2017 Annual Report

Project Collaborators:

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Statement of Study Purpose & Objectives:

The Bald Eagle population in the Greater Yellowstone Ecosystem (GYE) was an isolated population during the 1980's when the Bald Eagle was listed as an endangered species in the United States and was considered a source population that significantly helped the recovery of this species. Banding efforts during the 1980's and 1990's within the GYE resulted in hundreds of nestlings being tagged, several of which have been known breeders within and around the GYE. We are proposing to utilize historic genetic samples and new samples from nestlings and known-aged eagles with known banding locations to investigate the following objectives:

- Relative genetic success and dispersal distances of individuals within and surrounding the GYE
- Genetic connectivity, inbreeding coefficients, and current eagle management sub-units
- Understand the degree to which the GYE population acted as a genetic source to the Bald Eagle recovery
- Understanding the genetic health of the GYE Bald Eagle population following recovery
- Determine how the GYE population fits into the eagle management units across North America

Results

In 2016, we began collecting genetic samples within the GYE and continued throughout the 2017 nesting season. Teton Raptor Center collected data from Montana and Wyoming, while Michael Whitfield and Heart of the Rockies concurrently collected data in Idaho. We collectively banded 55 eagle chicks from 32 nests in the tri-state region. Teton Raptor Center crews targeted nests from Dillon to Red Lodge in the southern extent of Montana, additional nests in the Jackson Hole region, Yellowstone National Park, and south along the Green River through Seedskadee National Wildlife Refuge.

With funding for 2017 provided by 1% for the Tetons, Teton Raptor Center crews visited 60 historical nest sites in Montana and 25 nest sites in Wyoming to assess occupancy, activity and accessibility for climbing. Primary observers were Nathan Hough and Nick Ciarvella (TRC) with significant help from volunteers Mary Maj and Jim Roscoe in MT. S. Patla provided nest site and activity data from flights conducted in WY. Brenna Cassidy provided nest site information for Yellowstone National Park. Additional help and banding was provided by B. Bedrosian, Katherine Gura, and Becky Collier (TRC).

Adding to the eight eaglets banded from five nests in 2016, we banded 33 nestlings from 20 nests in 2017 (Figure 1, Table 1). We collected blood samples from all but three individuals due to small, weak size or inability to collect a blood sample but at least one eaglet was sampled from nests in which siblings were not. All nestlings received a solid green aluminum color band engraved with a unique alpha code. We also collected molted feathers from below 25 nests in 2017, 11 of which we did not sample nestlings (Table 2). Two eaglets exhibited pied plumage; one in Paradise Valley, MT (2017) and the other in Jackson (2016).

In Wyoming, all nests checked were determined as active by S. Patla prior to us checking nests later in the season. Apparent nest failure was 28% (n = 7). Average brood size was 1.22 chicks/nest for all nests for which we had accurate chick counts (n = 18). Brood size for successful nests was 2.0 chicks/nests. We could not calculate nest success in Montana because nests were only visited once and nest initiation prior to visits was unknown. We visited territories listed as active since 2012 in the MT Natural Heritage database that were visible from public roads. 54% of historical nests visited were not active or alternative nests were not located. This estimate should not be interpreted as territory occupancy because we did not actively search all territories for alternate nests.

Average brood size of successful nests was 1.61 chicks/nest in Montana. Collectively, an average of 1.69 chicks were produced per successful nest across both Wyoming and Montana in 2017. It appeared there were a lot of nest failures in Yellowstone National Park this year, likely due to high water and late spring in 2017. Similarly, nest failures seemed to be more abundant in Jackson Hole, compared to further south on the Green River where spring runoff was less.

Most nests visited across the region were inaccessible for banding due to unsafe cottonwood trees for climbing. Landowner access was granted in most cases, with the biggest difficulty being finding contact information for landowners while crews were still within the area. Only in a few instances were crews denied access.

Future Work

Due to delayed nest timing, failures, and other circumstances, we have decided to extend data collection into 2018. Our sampling across southern Montana will provide a balanced sample of sampling areas, but additional samples will be needed from several areas in Wyoming, including Yellowstone National Park, northern Grand Teton National Park, Upper Green, and the east slope of the Rockies. We reached out to biologists on the east slope this year in an effort to find nests to sample near Cody, Dubois, and Lander. Only one nest was identified in an unsafe tree near Cody by USFS. Two nests were located on the Wind River Reservation but we were not granted access by tribal council. There may be one or two territories to scout in 2018 in the Lander region. Many nests on private lands can be potentially accessed in the Upper Green region in 2018 that we were unable to sample this year.

Data Access

Data on nests visited, location, nest status, and productivity (when known) will be provided individually to each state or Park biologist.

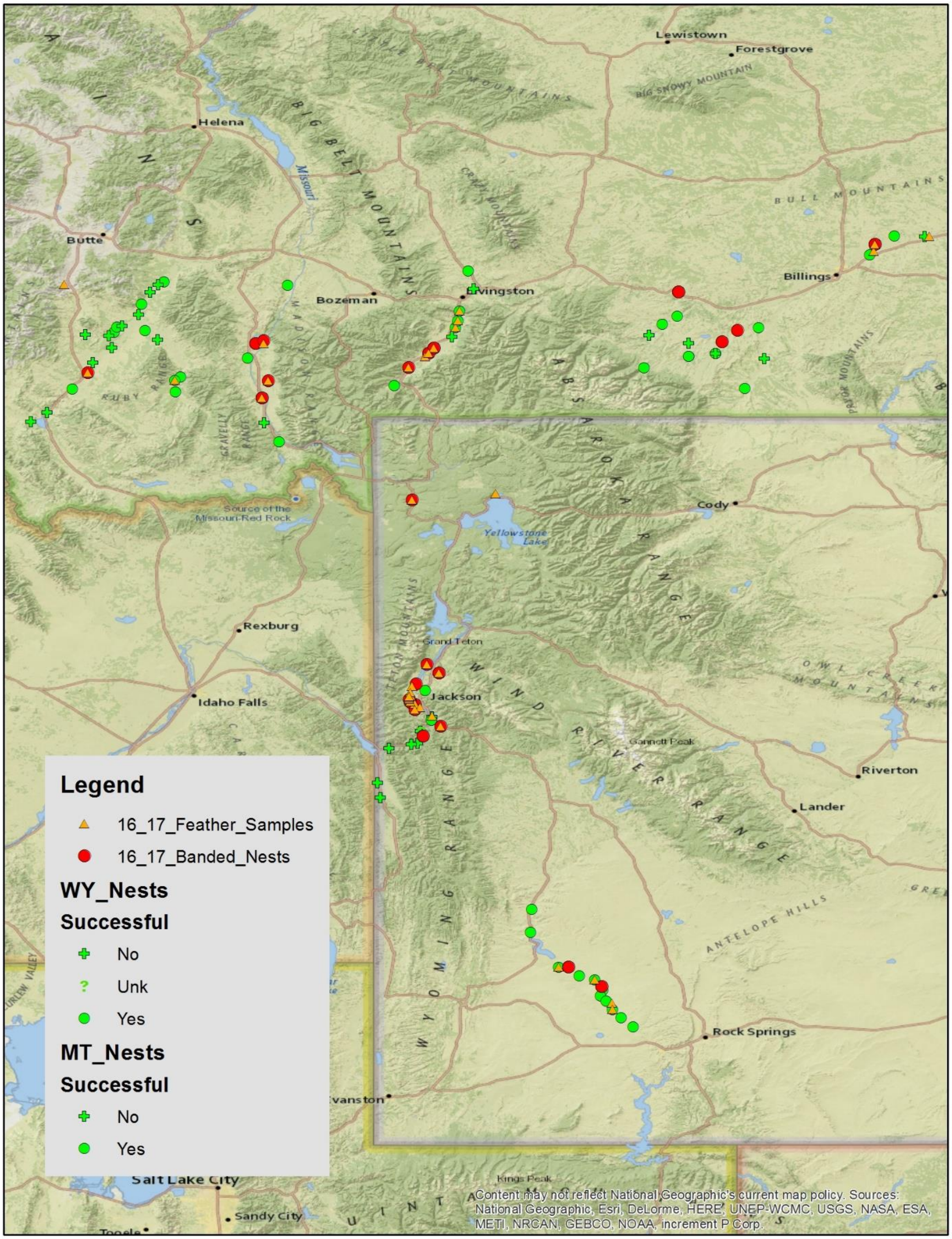

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Figure 1. Nests checked in 2017 by status and sample collection locations in 2016 and 2017.

Table 1. Banding records for Teton Raptor Center from 2016/17. (MT Permit #2017-095-W; WY Permit 33-1066; GTNP Permit GRTE-2017-SCI-0020; YNP Permit YELL-2017-SCI-7078).

Date	Location	State	Latitude	Longitude	USGS Band
6/1/2016	BLM by Lockhart	WY	43.432878	-110.845699	0629-44405
6/1/2016	BLM by Lockhart	WY	43.432878	-110.845699	0629-44406
6/1/2016	Lockhart	WY	43.41988	-110.820451	0629-44403
6/1/2016	Lockhart	WY	43.41988	-110.820451	0629-44404
6/6/2016	Ford South	WY	43.446668	-110.850693	0629-44407
6/8/2016	Butler	WY	43.390923	-110.818933	0629-44408
6/9/2016	Romney Pond	WY	43.592647	-110.686144	0629-44409
6/9/2016	Romney Pond	WY	43.592647	-110.686144	0629-44410
5/8/2017	Rock Creek - West	MT	45.47748	-109.04547	0629-44411
5/9/2017	Stump Gulch	MT	45.688556	-109.370222	0629-44412
5/9/2017	Stump Gulch	MT	45.688556	-109.370222	0629-44413
5/9/2017	Stump Gulch	MT	45.688556	-109.370222	0629-44414
5/11/2017	Deer Point	MT	45.94991	-108.29031	0629-44415
5/11/2017	Deer Point	MT	45.94991	-108.29031	0629-44416
5/11/2017	Deer Point	MT	45.94991	-108.29031	0629-44417
5/15/2017	Rock Creek - North	MT	45.41371	-109.12927	0629-44418
5/15/2017	Rock Creek - North	MT	45.41371	-109.12927	0629-44419
5/16/2017	Indian Creek	MT	45.10401	-111.66078	0629-44421
5/16/2017	Indian Creek	MT	45.10401	-111.66078	0629-44422
5/16/2017	Indian Creek	MT	45.10401	-111.66078	0629-44423
5/18/2017	Cameron	MT	45.19909	-111.62619	0629-44420
5/19/2017	Lagoon	MT	45.24234	-112.61693	0629-44424
5/20/2017	Ennis Lake	MT	45.40437	-111.69494	0629-44425
5/20/2017	Ennis Lake	MT	45.40437	-111.69494	0709-05876
5/20/2017	Jourdain Creek	MT	45.41944	-111.65271	0709-05877
5/23/2017	Dome Mountain	MT	45.27022	-110.85297	0709-08401
5/23/2017	Grey Owl	MT	45.38002	-110.71698	0709-08402
5/23/2017	Wanigan	MT	45.35113	-110.74409	0709-08403
5/23/2017	Wanigan	MT	45.35113	-110.74409	0709-08404
5/23/2017	Grey Owl	MT	45.38002	-110.71698	0709-08405
5/23/2017	Grey Owl	MT	45.38002	-110.71698	0709-08406
5/23/2017	Seedskadee Sage Pools	WY	41.869657	-109.793493	0709-08286
5/23/2017	Seedskadee Sage Pools	WY	41.869657	-109.793493	0709-08287
5/23/2017	Seedskadee Toman's	WY	41.975545	-110.975545	0709-08288
5/23/2017	Seedskadee Toman's	WY	41.975545	-110.975545	0709-08289
6/12/2017	Cabin Creek - Snake River	WY	43.24414	-110.774904	0709-08291
6/12/2017	Cabin Creek - Snake River	WY	43.24414	-110.774904	0709-08292
6/19/2017	Moose	WY	43.639469	-110.753761	0709-08294
6/20/2017	West Gros Venture Butte	WY	43.532387	-110.813255	0709-08293
6/20/2017	Yellowstone Goose Complex	WY	44.543998	-110.833716	0709-08408
6/22/2017	Spotted Horse - Hoback	WY	43.298242	-110.677721	0709-08411

TETON COUNTY FLAMMULATED OWL SURVEYS

2017 Teton Raptor Center Report

Teton Raptor Center, funded by Teton Conservation District in 2016 and the Meg and Bert Raynes fund in 2017, initiated Flammulated Owl (*Psiloscops flammeolus*) surveys in a portion of Teton County in 2016 and continued surveys in 2017. The Flammulated Owl is a small, nocturnal, migratory owl whose population status in Wyoming remains unknown. No nest sites have ever been located in Teton County, and prior to surveys conducted in 2016, there were little data verifying whether Flammulated Owls occur in the county. Following 2016 surveys conducted by Teton Raptor Center, there were 18 detections of Flammulated Owls and 14 potential nesting territories in Teton County, indicating the presences of breeding-aged individuals in this region of northwest Wyoming.

Our 2017 Project Objectives were:

- Conduct pre-treatment surveys within areas slated for 2017 forest treatment through the Teton-to-Snake Fuels Management Project
- Verify known territories and locate additional ones throughout the valley by conducting play-back surveys
- Confirm the presence of breeding individuals by locating nest sites
- Assess productivity by monitoring nests
- Conduct prey surveys at nest sites during the breeding season

Our Long-Term Project Objectives are:

- Assess pre- and post-treatment occupancy and nesting within the Teton-to-Snake Fuels Management Project area
- Create a nesting habitat model based on nest site locations
- Investigate nest site fidelity by banding or deploying PIT tags
- Understand seasonal migration movements through the use of 1 gram GPS transmitters

Methods

We followed the Partners In Flight Flammulated Owl call-back survey protocols (Fylling et al. 2010). In short, surveys consisted of a two-minute listening period, followed by a 30-second call, two-minute listening period, 30-second call, two-minute listening period, 30-second call and a final two-minute listening period, for a total survey time of 9.5 minutes of at each location.

Our survey locations were determined using our knowledge from the 2016 surveys as well as Geographic Information System (GIS) and Teton County and Bridger-Teton National Forest vegetation cover layers. Using these data with any pertinent data from published work, we created a predictive habitat model to help find potential nesting habitat.

In order to meet our 2017 study objectives, we utilized two technicians to conduct fieldwork focused on Flammulated Owls during the summer season.

Surveys:

From mid-May through mid-June, team-members conducted play-back surveys four nights/week within areas scheduled for 2017 forest treatments throughout the Teton-to-Snake Fuels Management Project and additional habitat in Teton County predicted as potential habitat from remote GIS vegetation layers. Crews also conduct play-back surveys at known territories as well as in other areas of suitable habitat.

If owls were detected, we deployed automated recording units (ARUs) at and around the detection site. Flammulated Owls can fly to areas as far as 1km to respond to playback calls. Our intent with deploying ARUs was to better define territory centers from unsolicited calling over a week period. We also were interested in creating a call library from which we could make our own automated software detector for the species to facilitate reviewing recordings from other areas.

Nest Searching:

Following play-back surveys, technicians spent a minimum of 3 field days (or nights) / week focusing on locating nest sites within territories. Nest-searching involved locating trees containing suitable cavities during the day. In order to check nests, technicians scratched on nest trees to flush nesting birds, viewed inside cavities via a small camera attached to an extendable pole (when the cavity is accessible), and/or observed the cavity for ~15min after dusk for a food delivery or for begging vocalizations.

At all survey locations, we recorded dominant tree species and average tree diameter at breast height (DBH). We recorded all owls detected to species, gender (if known), call type (e.g., territorial, contact, etc.), estimated direction of the call, and estimated distance to the owl. We later calculated the “actual” location of the owl using these estimates and used the calculated location for reporting purposes.

Results

We conducted night callback surveys at 179 points (Figure 1), resulting in 23 potential Flammulated Owl territories, five of which were also occupied in 2016. We investigated the utility of using automated SoundScout recorders at 37 locations. Using calls from three known territories, we created an automated detector in sound analysis software, Kaleidoscope. Using this detector and manual analysis of recordings, we detected Flammulated Owls we found an additional territory not found by callback surveys in the Mosquito Creek area.

Using remote sensing data in buffers around owl and survey locations, we found that owls tended to use coniferous forests more than expected in our study area (Table 2). When looking at tree type measured during the surveys, mixed aspen/conifer forests tended to be preferred by Flammulated Owls.

Using vegetation data we collected at the site, most survey locations were predominantly aspen (Populous tremuloides) stands, followed by an aspen/conifer mix, and fir/spruce (Table 1). While conducting surveys, we also classified average stand age into three classifications of diameter at breast height (DBH): <10”, 10-20”, and >20” (i.e., young, mid, old). Eight percent of the surveyed locations were classified as young, 84% as mid, and 8% as old.

We recorded 35 detections of Flammulated Owls (Figure 1). Several studies of Flammulated Owl home ranges sizes have indicated mean areas (minimum convex polygons) of 10 and 12 ha. To determine the number of potential territories located we combined owl locations within 300m to account for imperfect estimates of distance to owl when heard. The radius of a 12ha circle is 110m, so owl territories could be up to 220m in diameter. But considering territories are rarely circular, using a 300m threshold to separate potential neighbors was a conservative estimate for this pilot effort. Using this criterion, we located the 23 potential nesting territories.

Discussion

Flammulated Owls were detected at 10% of our survey points in Teton County during the 2017 searching effort. Although we had a large effort searching for nests, we were unable to confirm any nest cavities or find any fledglings in presumed territories. We did locate one cavity that had Flammulated Owl feathers below it, but the nest may have failed or fledged prior to discovery.

Our general impression of habitats near detection sites were that Flammulated Owls occurred in older-aged aspen stands with nearby older conifers. Theoretically, owls need aspen for nesting (cavities) and coniferous trees for preferred prey (moths). This supposition is supported by the higher proportion of mixed forest habitat type near owl locations than proportion of that habitat type sampled (Table 1).

We did not randomly select locations for the survey points due to the goal of finding territories, not necessarily surveying the entire study area evenly. The SoundScout audio recorders were generally placed in the more hard to reach locations for crew safety since they can be deployed during the daytime and provide two weeks’ worth of data, meaning the points do not have to be surveyed a second time. This could explain the lower owl detection percentage for the recorders verse traditional callback surveys, since they were not generally in what we would consider ideal Flammulated owl habitat.

Surveys will continue in the same manor for the 2018 and 2019 seasons, but will expand to a more statewide approach for a better understanding of statewide population and habitat usage. Further, more usage of automated recorders may expand our understanding of calling patterns and timing while simultaneously allowing for a larger area to be surveyed without having to have a large crew.

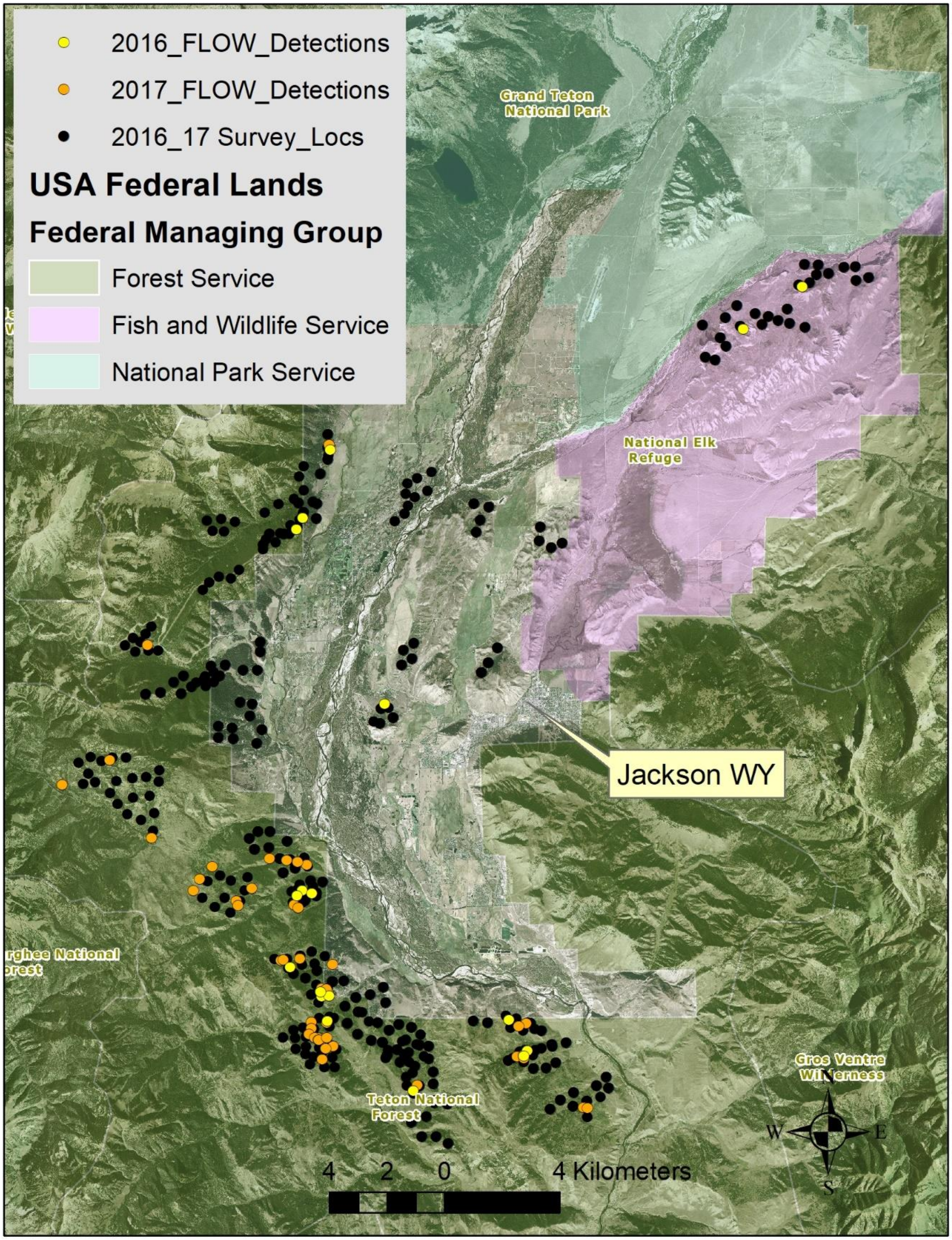

Figure 1: All survey points for Flammulated owls including detections for the 2016 and 2017 field seasons

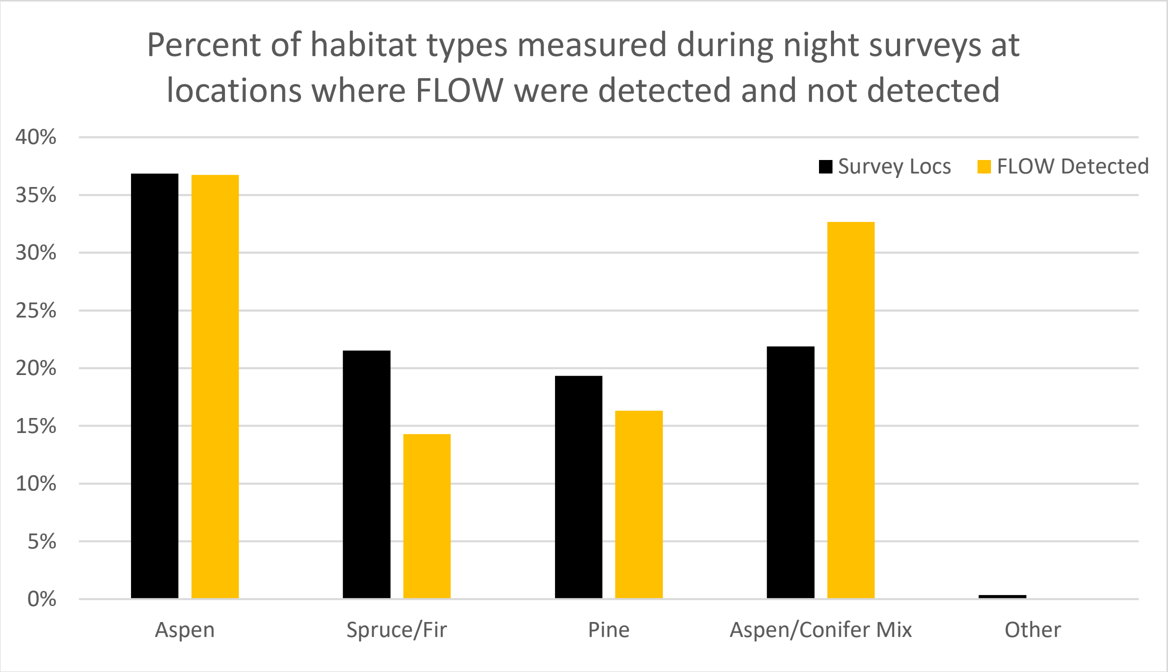

Table 1: Habitat that was measured during the nighttime callback surveys where Flammulated owls were detected and not detected.

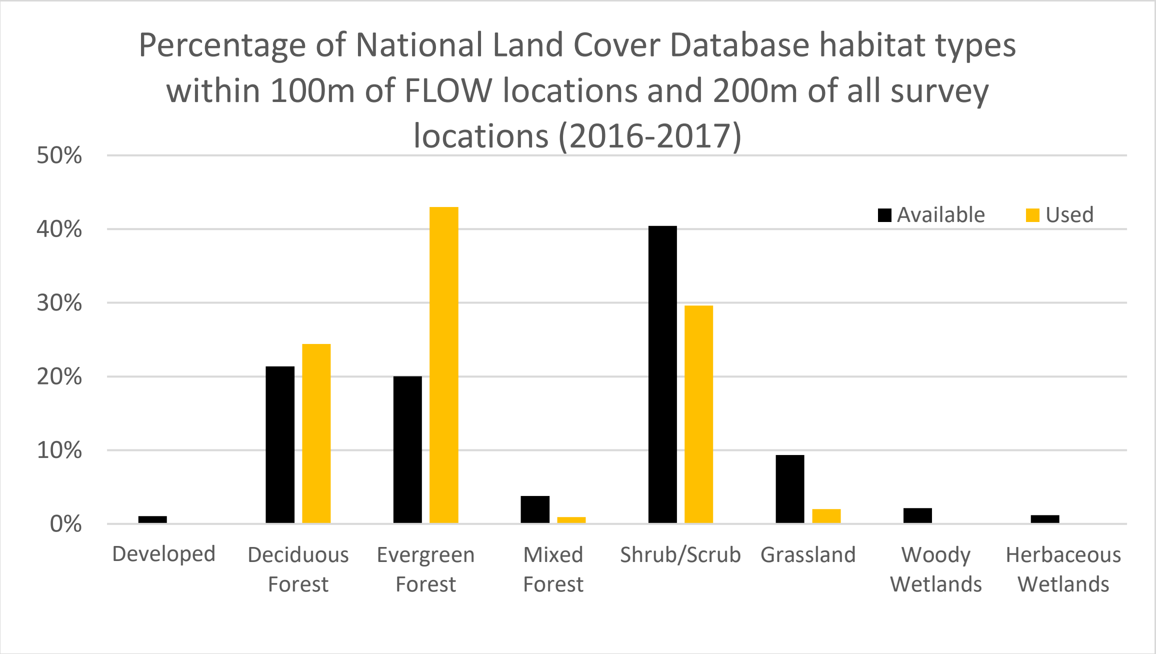

Table 2: Habitat classified using National Land Cover Database (2011) in areas where Flammulated owls were detected.

Great Gray Owl Project Report, 2017 Annual Report

Principle Investigator: Bryan Bedrosian, Senior Avian Ecologist, Teton Raptor Center, bryan@tetonraptorcenter.org; 307.690.2450

Project Personnel: Katherine Gura

Wyoming Game and Fish Department Permit #: 33-1011
Study Species: Great Gray Owl

INTRODUCTION

In 2017 we continued a multi-year study on Great Gray Owls in northwestern Wyoming that began in 2013. Working from the vast dataset gathered on nest sites and movements of Great Gray Owls amassed over the past three years, our goal in 2017 was to continue the data collection on territory occupancy, nest initiation rates, productivity, and survival of previously marked owls. We also continued to monitor snow characteristics within Great Gray Owl territories to assess how snow conditions relate to Great Gray Owl habitat use, movements, and nest success across years. Snow characteristics likely have a strong influence on Great Gray demographics. Snow loads in the spring and crust hardness may affect timing of nesting, hunting success, and prey abundance. We also continued to utilize automated recorders to monitor territory occupancy of Great Gray Owls.

METHODS

The primary study area in 2017 included the base of the Teton Range and the Snake River riparian corridor from the areas around Moose, WY in southern Grand Teton National Park south to the Snake River Canyon. The study area also included northern areas within Grand Teton National Park (e.g., Emma-Matilda/Two Oceans area) and Bridger-Teton National Forest (e.g., Rosie's Ridge and Blackrock areas). The typical forest habitats consisted of Douglas fir, lodgepole pine, sub-alpine fir (*Abies lasiocarpa*), and aspen (*Populus tremuloides*) surrounding the valley and mixed cottonwood (*Populus* spp.) spruce (*Picea* spp.) forests within riparian areas. Both mesic and sagebrush (*Artemesia* spp.) meadows occurred throughout the study area. Housing subdivisions are common throughout the study area but rarely extend beyond 1.5km from the valley floor.

We continued to track previously radio-tagged owls and monitor known Great Gray Owl territories through night surveys, nest-checks, and fledgling surveys. We surveyed for pocket gophers and snow conditions in a number of Great Gray Owl territories and monitored existing nesting platforms to determine if nest sites may be limiting nesting.

Call-Back Surveys

During the courtship period of Great Gray Owls (mid-February – April), we deployed audio recorders adjacent to known nest sites across the study area to determine whether Great Gray Owls were present. Our main intent was simply to determine whether these known territories were active or not. We analyzed the recordings by running them through Kaleidoscope®, an automated bioacoustics software. We trained the software to locate Great Gray Owl territorial calls, and if a call was detected, we determined the territory was occupied.

Nest Monitoring

We monitored all known Great Gray Owl territories. We considered a territory "active" only if we found direct evidence of breeding, such as an incubating female or fledglings. We considered a territory "occupied" if we documented a territorial Great Gray Owl on our recordings. We also continued to check the 42 nesting platforms we installed in a portion of our study area in previous years to see if they were used by Great Gray Owls. We checked all platforms at least once during the incubation period.

Gopher Surveys

We surveyed for pocket gopher abundance following van Ripper et al. (2013). We digitized all meadows within 500 m of known nests and randomly selected three (when available) for surveys. We started at the head of each meadow and walked 45-degree diagonal transects back and forth until reaching the end of the meadow, tallying fresh and old gopher mounds visible within 10 m of the transect. We are interested in relative abundance between years and among territories, so we tallied total survey area (total transect length x 20 m) for each territory and divided by the total number of mounds to create an index of gopher abundance. Because we regularly observe owls hunting within forested areas, we also added a survey transect bisecting the territory through representative forest habitat. We tested for correlations between new, old, and total gopher mound abundance and between forest and meadow. We tested for relationships between years and between gopher abundance and productivity.

Tracking

We continued to monitor Great Gray Owls that are outfitted with VHF transmitters. We attempted to listen for each marked owl once per month throughout the study to confirm that each owl is alive.

Snow Measurements

In the winter of 2017 we continued conducting snow measurements near known Great Gray Owl territories across the study area. We measured each territory on the same day. We collected snow data one day/month from January-April. We measured snow depth by placing a measuring stick vertically down through the snow until it reached the ground. We measured snow crust strength by dropping a filled 1-liter Nalgene water bottle (ca. the same weight as an adult Great Gray Owl) one meter above the top of the snow (not the ground) and measuring how far the bottle penetrated the snow. We dropped the bottle both horizontally and vertically and averaged the depths. In each territory, we measured snow characteristics in a meadow and in a forest representative of the territory. The same meadow and forest sites were consistently measure d across years. We made sure to conduct the measurements in areas representative of the area's average snow conditions (ie. not directly in a tree well, nor in an area disturbed by human activities).

RESULTS

Call-Back Surveys

Our previous data has indicated that call-back surveys are not an effective means for determining occupancy of Great Gray Owl nests. Approximately half of all active territories would have been recorded as inactive if we only used data from call-back surveys. Subsequently, we deployed automated recorders in all known territories in 2017 to document occupancy rates and create a long-term bank of calls. We are still analyzing recordings to determine occupancy rates in 2017 and identify individuals.

Nest Monitoring

In 2017, we monitored 24 known Great Gray Owl territories in the study area. From all known nest sites, we documented only one active nest, which failed before the eggs hatched. Therefore, of our 24 known territories, zero fledged young in 2017, amounting to a 0% apparent nest success rate.

Gopher Surveys

We conducted pocket gopher surveys at 16 territories between 8 of June and 17 of July. We are still analyzing this prey data to see how gopher abundance in 2017 compares to previous years.

Snow Measurements

We conducted snow measurements at sixteen known Great Gray Owl territories across the study area. Measurements were taken as early as 16 of January through 16 of April. We took measurements at each site once/month, at all territories on the same day. We are still analyzing snow measurement data to see how snow conditions within Great Gray Owl territories in 2017 compared to previous years.

Banding

In previous years of the study, we banded fledglings from Great Gray Owls nests. However, because no known territories fledged young, we did not band owlets in 2017.

CONCLUSION

Long-term monitoring of Great Gray Owls is essential in order to assess overall population health. In 2017, only one of our known Great Gray Owl nests was active and none successfully fledged young. In contrast, 2016 was the most productive year within our study, with 21 active nests and 17 successful attempts. 2017 was surprisingly low year for Great Gray Owl nesting and highlights the importance of monitoring nesting and productivity across years. Furthermore, by surveying prey and habitat conditions within territories, we can assess what factors are driving these stark fluctuations in nest success. We intend to continue nest-monitoring and prey-sampling in order to evaluate the health of Great Gray Owls in the Greater Yellowstone Ecosystem in the face of anthropogenic and natural changes over time. Snow conditions likely have an influence on Great Gray Owl winter habitat selection, seasonal movements, timing of breeding, and nest success, but these data need to be collected across years in order to adequately assess how climate affects this species. Furthermore, as Great Gray Owls are a denizen of boreal forests that will likely be effected by climate change, it is important to study how this species responds in light of rising temperatures and a changing environment.

Rough-Legged Hawk Project Report, 2017

Principle Investigator: Bryan Bedrosian, Research Director, Teton Raptor Center
bryan@tetonraptorcenter.org; 307.690.2450

Project Personnel: Katherine Gura, Allison Swan, Nathan Hough, Sarah Ramirez

2016

In the winter of 2016, capture efforts first began, targeting Rough-Legged Hawks in northwestern Wyoming. Banding began 1 January 2016 and continued through 15 February 2016, and then began again 15 November 2016 through 19 December 2016. Capturing involved the use of standard bal-chatri and pan traps baited with mice.

In 2016, we captured three Rough-Legged Hawks, all of which received backpack transmitters. Blood samples and standard ornithological measurements were taken from these three birds as well. We captured one subadult female, one adult female, and one juvenile male Rough-Legged Hawk. Both the adult female and juvenile male were outfitted with PTT satellite transmitters, and the subadult female was outfitted with an Ecotone GPS/GSM logger.

Transmitters on two of the Rough-Legged Hawks were deployed in the Jackson Hole Valley in December 2016, and the third transmitter was deployed near Big Piney in January 2016. The individual tagged in Big Piney (Figure 1, Red) migrated south and settled on the Wyoming/Colorado border for winter. In the spring, this bird migrated north through Alberta and the Northwest Territories, finally summering in Nunavut, Canada. In the fall, this bird migrated south through Nunavut, passed across Saskatchewan and south through Alberta and Montana before settling on the Wyoming/Colorado border again just west of Laramie.

2017

In the winter of 2017 we continued capture efforts targeting Rough-Legged Hawks in northwestern Wyoming to document migration routes and important stop-over areas of hawks that winter in Wyoming. Banding began 13 November 2017 and continued through 29 December 2017. Capturing involved the use of standard bal-chatri traps baited with mice.

In 2017 we captured two Rough-Legged Hawks, one of which received a backpack transmitter. We captured one juvenile male and one adult female Rough-Legged Hawk. The adult female was outfitted with an Ecotone GPS/GSM logger. To date, this adult has stayed local in the Pinedale area for the past month. We did not outfit the juvenile with a transmitter since we are targeting adults for this study. Blood samples and standard ornithological measurements were taken from both birds.

We captured an additional two Rough-Legged Hawks at a migration site on Grassy Mountain, Montana on 10 October 2017 using a bow-net. Both birds were adult, one male and one female, and were equipped with Ecotone GPS/GSM loggers. One individual (Figure 1, Purple) flew from western central Montana, southeast across the state of Wyoming, and stopped just northeast of Denver. The other individual (Figure 1, Pink) spent some time around Montana before flying southwest through a portion of Wyoming and Idaho, until reaching Utah, stopping just north of Salt Lake City. From here, the bird continued west into Nevada, and has been spending the winter in the central part of the state.

One of the individuals tagged in the Jackson Hole Valley migrated north through Montana, Alberta, and the Northwest Territories before settling in the northern region of Nunavut (Figure 1, Blue). This bird’s GPS has not checked in after this past summer of 2017. The other individual tagged in the Jackson Hole Valley flew north through Montana, up into Alberta, crossing over into Saskatchewan before continuing up to the Northwest Territories, and settling in the northern region of Nunavut (Figure 1, Black). This bird’s GPS has also not checked in after this past summer of 2017.

It is interesting to note all three birds migrated north on the eastern edge of the Rocky Mountains through Montana, but took different paths after reaching the Calgary area. The one tagged individual that returned this winter did not migrate south in the same fashion. We will continue to monitor the movements of all tagged individuals remotely via transmitters.

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Figure 1. Tracks from Rough-legged Hawks tagged by Teton Raptor Center. Purple and Pink are hawks tagged on Grassy Mountain, Montana in 2017. Blue and Black are 2016 tagged birds from the Jackson Hole Valley, who wintered in Nunavut, Canada but GPS units did not check in after the summer. Red is a 2016 tagged bird who wintered in Wyoming, summered in Nunavut, and returned to Wyoming for the winter.

TETON RAPTOR CENTER

2017 Teton to Snake Project Report

Goals

1. Conduct surveys for sensitive raptors for two years pre- and two years post-treatment, when possible.

A. March 15 – April 5th	SoundScout surveys for BOOW, GGOW, and NOGO, simultaneously
B. April 6 – April 28th	Follow-up SoundScout surveys at locations of positive detections that also have ambiguity in nesting forest stand
C. May 15 – June 15:	SoundScout and/or night-time surveys for FLOW
D. June 5 – July 14:	SoundScout surveys for nestling GGOW and NOGO chicks in areas inaccessible for spring surveys or in areas nests are not located

2. Nest search for target species, when possible

A. May 1 – June 15:	GGOW and NOGO in areas with positive detections
B. June 15 – July 15:	FLOW in areas with positive detections

Survey areas for 2017

- All mechanical treatment areas (T1-11, 14-16, 19, 21, 25, 31, 33, 35, 36, 43)
- 2018 prescribed fire (PF 20, 29)
- 2019 prescribed fire, if time allows (PF 01, 02)

Methods

Survey locations were predetermined in a GIS using a 300m detection radius of the SoundScout automated recording units (ARUs). Topography, access, and safety were all considered when placing survey locations. Areas of unsuitable habitats were not included and all potential habitat was covered with survey locations. Survey locations were divided into two groups, depending on safety, into a low-slope (safely accessible in spring) and high slope (inaccessible for spring surveys).

Recorders were deployed for a total of six consecutive nights, once during the early call period (A). Recordings will be reviewed for species occurrence the week following deployment. Flammulated Owls were surveyed for with a mixture of call-backs and recorders (C). We conducted targeted nest searching, when possible, in nest stands with positive detections of Great Gray Owls, Northern Goshawks and Flammulated Owls. Inaccessible areas in the spring were surveyed later in the season (D) and recordings were reviewed for fledgling Great Gray Owls and Northern Goshawks. In several instances, we combined recorders for objectives C and D for efficiency.

We targeted six deployment areas over the main three week calling period for owls and goshawks. With the aid of BTNF backcountry snow patrol, we deployed 24 ARUs in the Phillips Ridge/Trail Creek areas in week one. We then deployed seven units along the Mosquito Creek road corridor, followed by 19 in the Red Top, Butler Creek and Taylor Creek areas. Later in the season, we deployed 39 ARUs in the Mosquito Creek area, including several re-deployments due to failed batteries and follow-up surveys in Flammulated Owl territories. We also deployed 21 ARUs up Phillips Canyon in the late season period.

Table 1. Sensitive raptor monitoring schedule for Teton-2-Snake fuels reduction project. Schedule is designed for two years pre- and post-treatment (when possible).

						Raptor Surveys				
Unit	**Map_Label**	**Treatment Year**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Rec Trail Unit 1	T-14	2017	X	X	X					
Rec Trail Unit 2	T-11	2017	X	X	X					
Rec Trail Unit 3	T-16	2017	X	X	X					
Rec Trail Unit 4	T-15	2017	X	X	X					
Phillips Bench Unit 1	T-05	2018	X	X	X	X				
Phillips Bench Unit 2	T-03	2018	X	X	X	X				
Phillips Bench Unit 3	T-07	2018	X	X	X	X				
Phillips Bench Unit 4	T-08	2018	X	X	X	X				
Phillips Bench Unit 7	T-04	2018	X	X	X	X				
Red Top Unit 1	T-33	2018	X	X	X	X				
Red Top Unit 2	T-35	2018	X	X	X	X				
MosqCrk RX	PF-20	2018	X	X	X	X				
Taylor Mtn RX Unit 4	PF-29	2018	X	X	X	X				
Highland Hills Unit 1	T-31	2019		X	X	X	X			
Phillips Bench Unit 5	T-06	2019	X	X	X	X	X			
Phillips Bench Unit 6	T-09	2019	X	X	X	X	X			
Powerline Unit 1	T-10	2019	X	X	X	X	X			
Red Top Unit 4	T-43	2019		X	X	X	X			
Singing Trees Unit 2	T-23	2019		X	X	X	X			
Phillips Canyon RX Unit 1	PF-01	2019	X	X	X	X	X			
North Fork Phillips RX	PF-02	2019	X	X	X	X	X			
Red Top Unit 5	T-36	2020	X	X	X	X	X	X		
Singing Trees Unit 4	T-25	2020			X	X	X	X		
MungerMtn RX Unit 1	PF-47	2020			X	X	X	X		
Singing Trees RX	PF-26	2022					X	X	X	X
Trails End RX	PF-34	2022					X	X	X	X
Rec Trail Unit 5	T-19	unk								
Rec Trail Unit 6	T-18	unk								
Rec Trail Unit 7	T-17	unk								
Singing Trees Unit 1	T-21	unk								

Results

In 2017, we deployed SoundScout ARUs at 93 locations to detect Great Gray Owls, Northern Goshawks, and Boreal Owls (Figure 1). We surveyed all treatment areas outlined in Table 1 for 2017. With the help of BTNF crews, we deployed ARUs in 49 locations from 14 March – 28 March and an additional 44 locations from 6 June – 24 August to detect all of the aforementioned species and Flammulated Owls. We reviewed recordings for territorial calls in the early season deployments. Late season deployments were reviewed for territorial calls of Flammulated Owls and begging calls of Great Gray Owls and Northern Goshawks.

This year, we detected Great Gray Owls calling at 16 locations within the project areas (Figure 2). Most detections were in the Red Top mechanical treatment areas and Taylor Mountain burn. We have two known nest sites within the Red Top treatment areas and the Taylor burn is between two known nest sites. There was no known Great Gray Owl production in 2017 and only one of 25 known nest sites even initiated a nest. Low production precluded nest searching in 2017. Low production also limits our ability to make inferences on Great Gray nesting in the areas surveyed later in the season. Since most owls did not produce nests, we do not anticipate hearing any fledglings on recordings and therefore may have missed territories within these regions (Mosquito and Phillips Canyon).

We detected three Northern Goshawks in 2017, two within the Red Top project area and one adjacent to the Mosquito Mtn Rx (Figure 3). We suspect the detection south of the Mosquito burn is associated with the nest site south of the road. We extensively searched for a nest site near Red Top but did not find an active nest in 2017. This may also be due to low raptor production in 2017. Similar to Great Gray Owls, if production was low in 2017, then we may have missed territories in the late season recorders since those targeted begging calls of young birds.

Boreal Owls are abundant throughout the study area and we recorded owls at 30 of 50 locations surveyed during the early season (Figure 4). We do not anticipate detecting territorial calls of Boreal Owls during the late season, so effectively did not survey for owls in the late season locations (Figure 1) due to safety reasons. There is no reason to believe that Boreal abundance in those areas would not mirror what we detected in other areas.

In 2017, we detected at least 12 Flammulated Owl territories within or directly adjacent to the T2S project areas surveyed (Figure 5, 6). We also opportunistically searched portions of the T2S project areas in 2016 as part of a different study. Adding data from 2016, an additional two territories have been identified within the project areas. We re-surveyed around many of the initial detections, so individual detections (n = 37) represents multiple detections of individuals. We estimated nesting territories by combining any detections within 300m. It is possible that call-back surveys attracted owls from greater than 300m, so additional work needs to be completed to determine the true number of territories in the project areas. We surveyed several of the territories for nest sites. We were unsuccessful in finding any active nests but one potential nesting cavity (with Flammulated Owl feathers) was located near Red Top Unit 1.

Conclusions and Continued Work

We found that recorders and automated detectors worked well to effectively survey for calling raptors within the extensively large areas within the Teton to Snake project areas. Hard weather conditions in 2016/17 precluded many raptors from nesting and therefore we could not locate nest sites. Also because of weather, we were unable to survey much of the area in the typical raptor calling period. Low production likely resulted in underestimating raptor abundance in the Mosquito Creek and Phillips Canyon burns, since there were not fledglings to hear on the recordings. Additional years of data collection should help alleviate this issue.

The Red Top mechanical treatment areas have high use by all BTNF sensitive raptors and should be avoided for treatments based on our results. Similarly, the Taylor Mtn Unit 4 Rx should be carefully evaluated for raptor presence before continuing with treatment. Boreal Owls are generally ubiquitous across the study area and populations may be more robust than previously thought.

Surveying for Flammulated Owls provides several challenges with interpretation of results. First, Flammulated Owls likely respond to callbacks from greater distances than previous thought (ca. up to 1km). Conversely, Flammulated Owls calls are much softer than other raptors, so the detection radius of ARUs is such that we would need a large amount of recorders to cover the study area. One approach is to conduct targeted deployments of recorders in and around previously identified territories to help define territory centers using unsolicited calls. We can continue with broadcast surveys in novel forest patches but follow-up with recorders to determine territory centers.

We anticipate following the schedule outlined in Table 1 and have secured funding for the 2018 field season. We will seek additional funding from BTNF for subsequent years and strongly urge managers to continue the original goals of surveying areas for two years post-treatment to gather critical and novel information on potential treatment effects on the sensitive forest raptors. This information can greatly benefit future treatments across the forest.

Acknowledgements

We could not have completed this work without the significant investment and support of BTNF biologist Kerry Murphy. Flammulated Owl surveys in 2017 were conducted by Sam Diaz and Emily Smith. Nathan Hough also conducted surveys in 2016 to inform this project and helped in 2017. ARU deployments were completed by Nick Ciarvella, Katherine Gura, Steve Poole, Nathan Hough, Sarah Ramirez, and Bryan Bedrosian with significant help from Bridger-Teton National Forest crews. All people mentioned helped review recordings and Carrie Ann Adams, Allison Swan, and Emily Smith created, ran, and validated automated analysis software for this project.

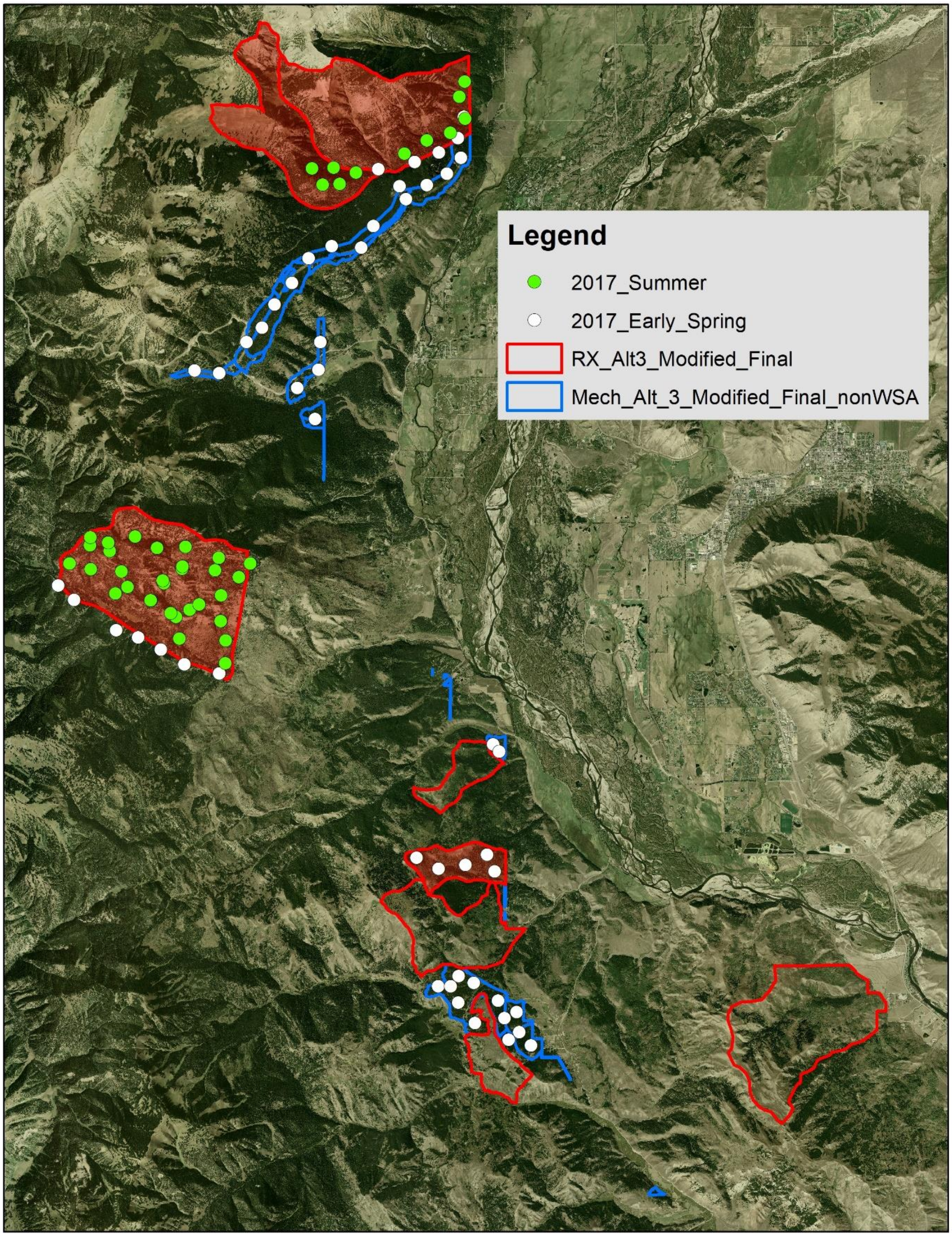

Figure 1. Locations of deployed automated recording units and treatment areas in 2017.

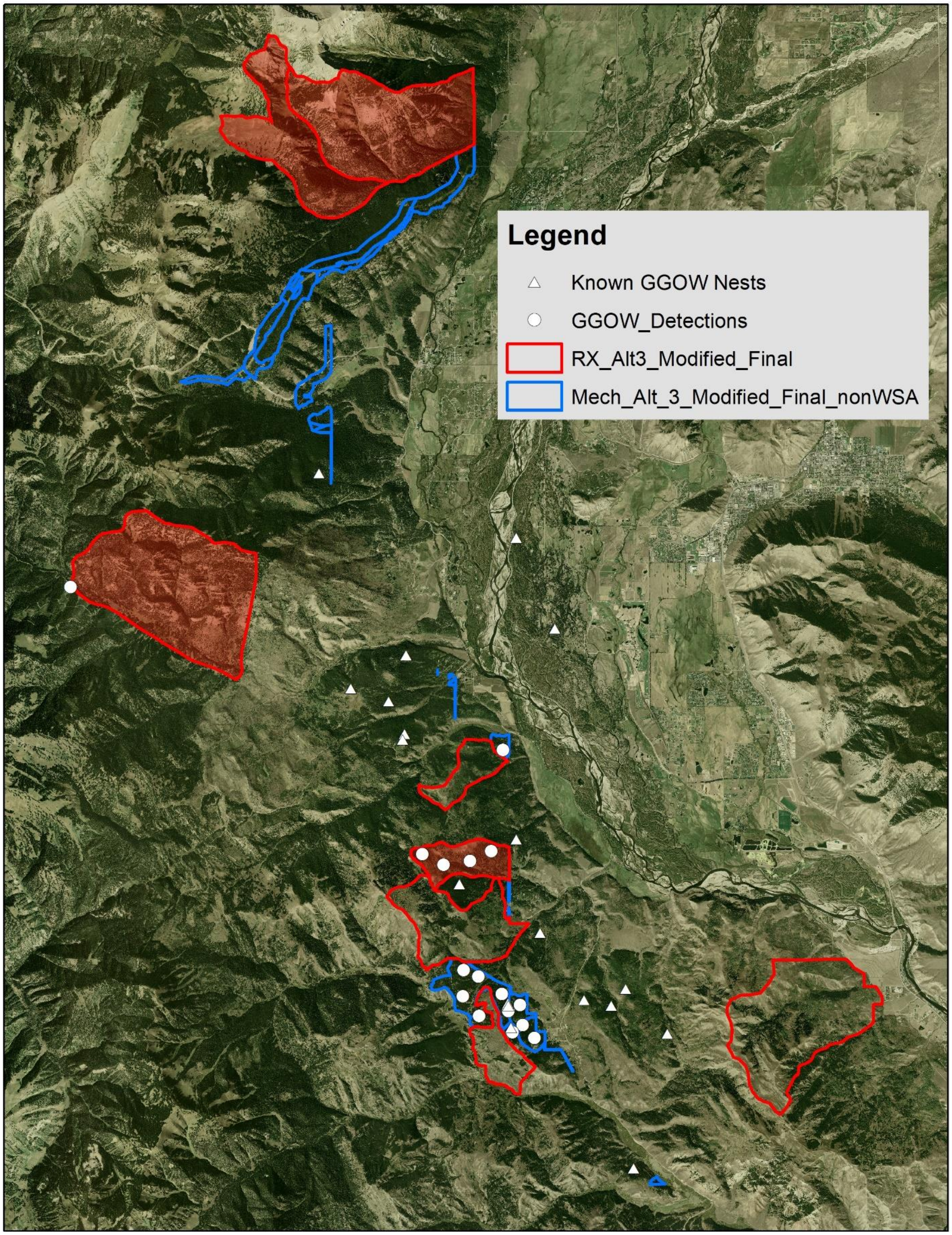

Figure 2. Locations of 2017 Great Gray Owl detections and known nest sites.

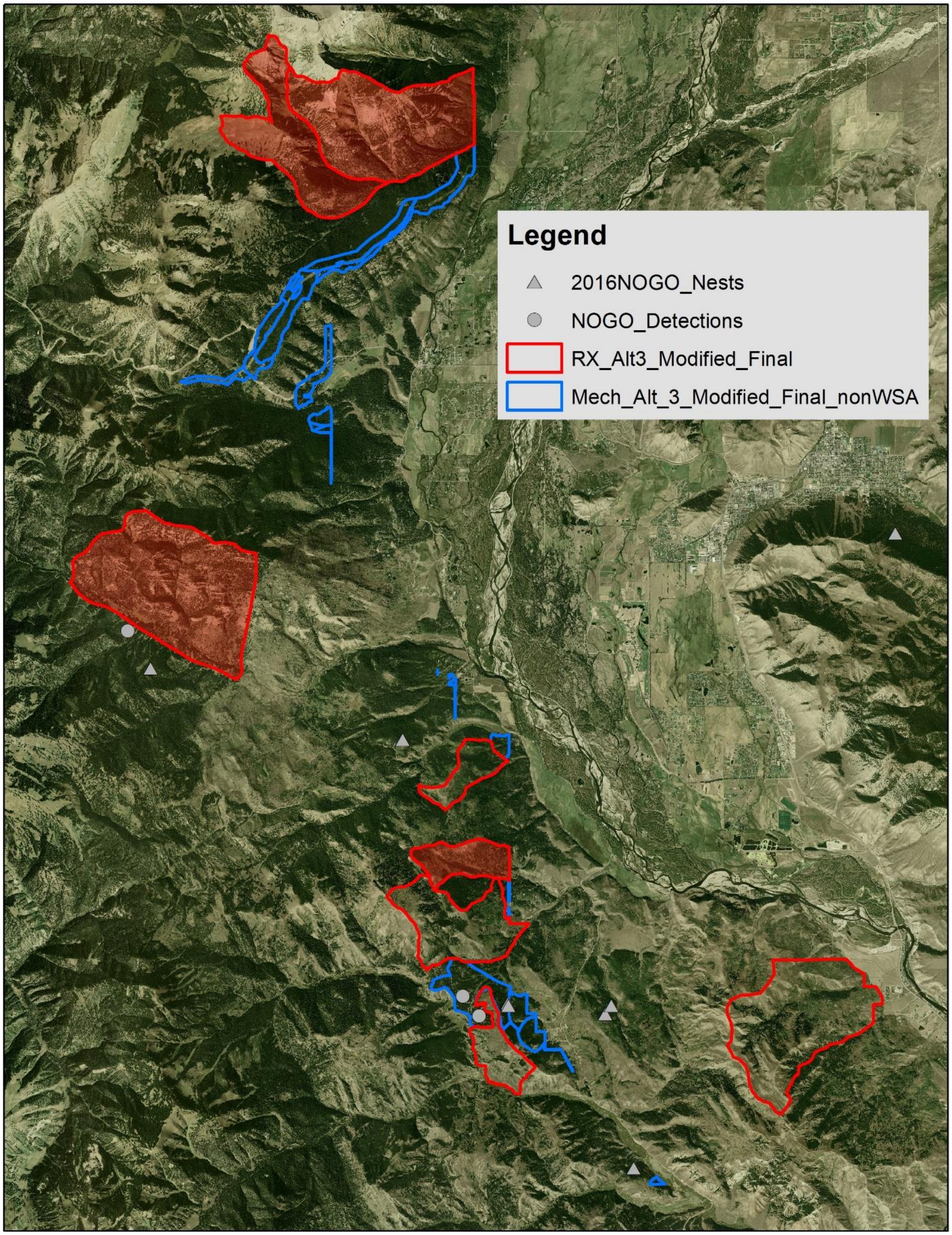

Figure 3. 2017 Northern Goshawk detections and known nest sites.

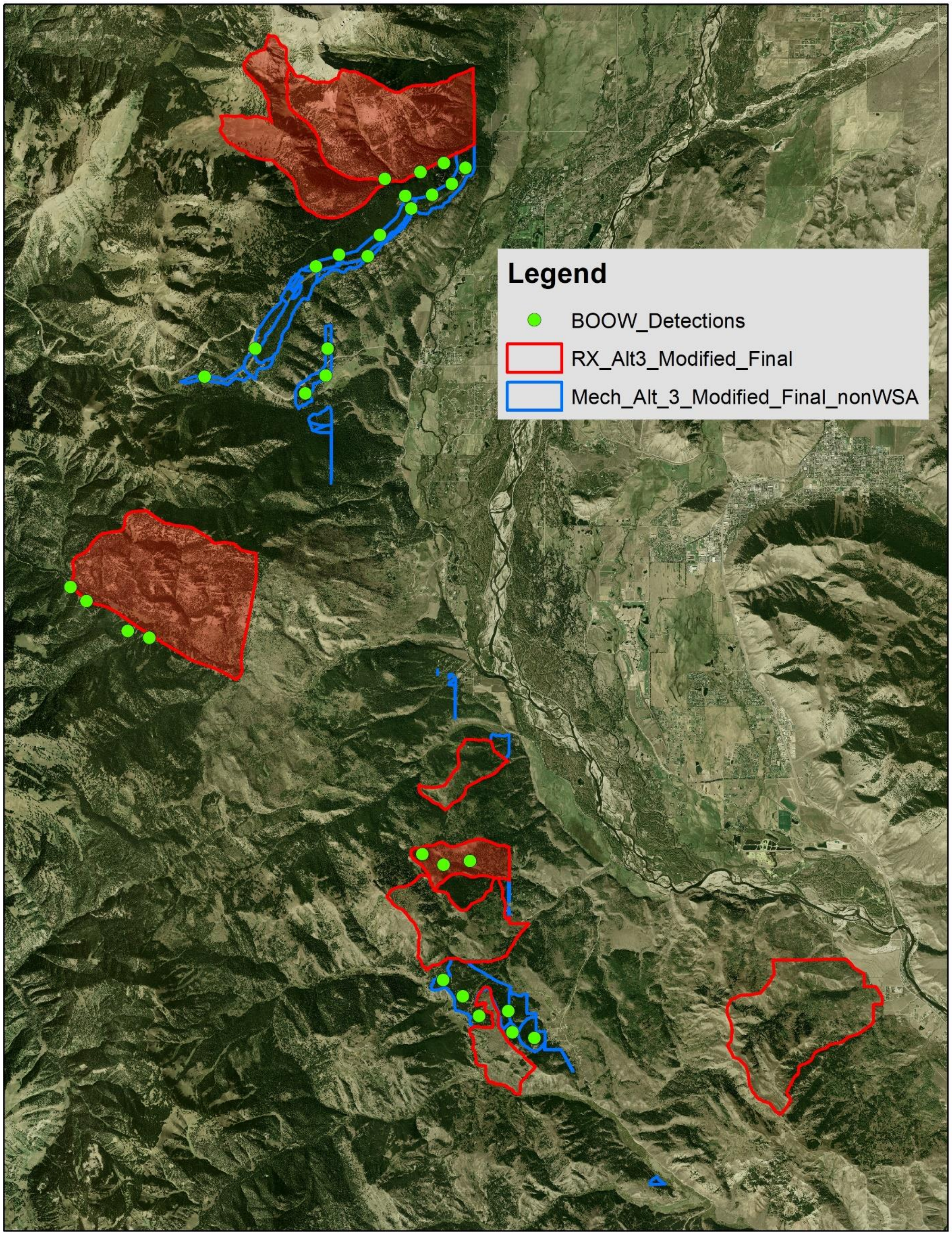

Figure 4. 2017 Boreal Owl detections. Note that surveys were not conducted at late-season locations (see figure 1).

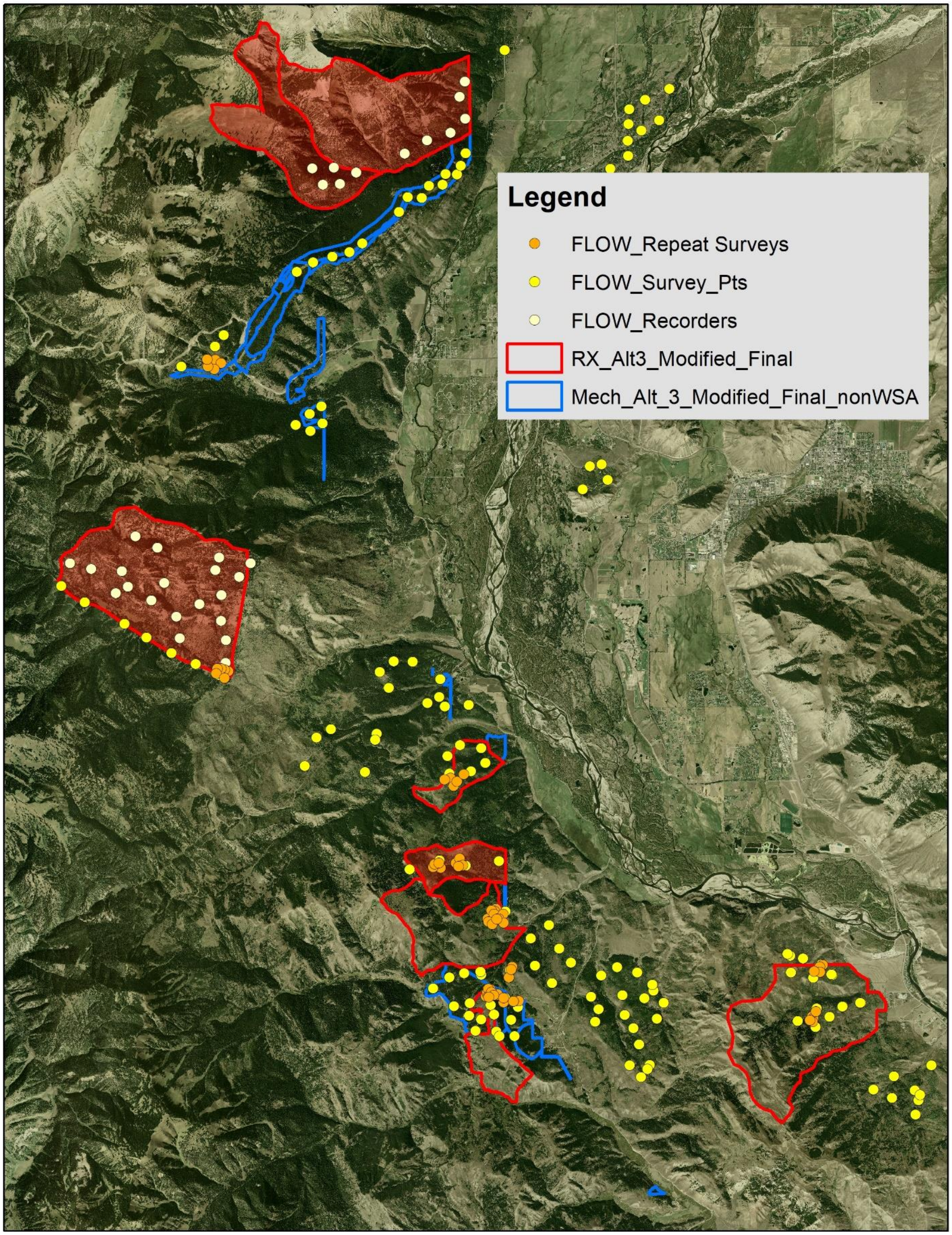

Figure 5. Survey locations (by type) for Flammulated Owl detections in 2017.

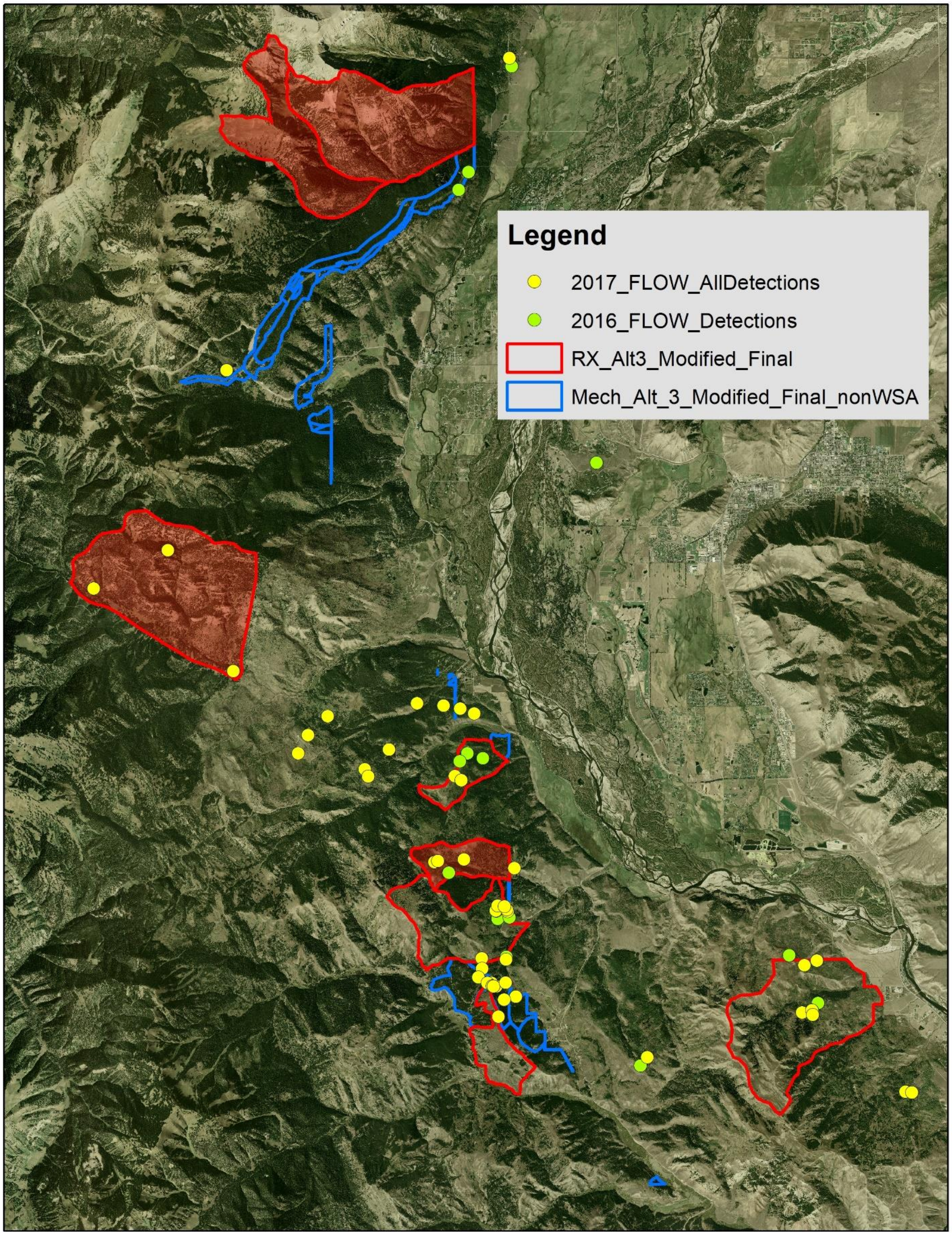

Figure 6. Detections of Flammulated Owls in 2016 and 2017 from all survey types. Note that we re-surveyed many areas so multiple detections may represent the same individual.

Appendix 1. Locations of Automated Recording Units deployed in the early season in 2017 and associated raptors detected at each location (0 = no detection, 1 = detection, a = not possible during survey period).

Deployment	General Location	Pt Num	UTM Lat	UTM Long	Start Date	Early_Late	GGOW	NOGO	BOOW	FLOW
187	Phillips	T2S17	509174	4820283	3/14/2017	Early	0	0	1	a
188	Phillips	T2S18	509969	4820438	3/14/2017	Early	0	0	1	a
189	Phillips	T2S19	510497	4820646	3/14/2017	Early	0	0	1	a
190	Phillips	T2S38	510914	4820965	3/14/2017	Early	0	0	0	a
194	Phillips	T2S49	511046	4821430	3/14/2017	Early	0	0	0	a
195	Phillips	T2S37	510983	4820529	3/14/2017	Early	0	0	1	a
196	Phillips	T2S36	510676	4820180	3/14/2017	Early	0	0	1	a
197	Phillips	T2S35	510236	4819934	3/14/2017	Early	0	0	1	a
198	Phillips	T2S25	506284	4816496	3/14/2017	Early	0	0	1	a
199	Phillips	T2S26	506617	4816815	3/14/2017	Early	0	0	0	a
200	Phillips	T2S27	506891	4817314	3/14/2017	Early	0	0	0	a
201	Phillips	T2S28	507280	4817790	3/14/2017	Early	0	0	0	a
202	Phillips	T2S29	507638	4818331	3/14/2017	Early	0	0	1	a
203	Phillips	T2S30	508150	4818593	3/14/2017	Early	0	0	1	a
204	Phillips	T2S31	508797	4818563	3/14/2017	Early	0	0	1	a
205	Phillips	T2S32	509062	4819037	3/14/2017	Early	0	0	1	a
206	Phillips	T2S33	509631	4819906	3/14/2017	Early	0	0	1	a
207	Phillips	T2S34	509773	4819629	3/15/2017	Early	0	0	1	a
208	Trail Creek	T2S23	505144	4815870	3/21/2017	Early	0	0	1	a
209	Trail Creek	T2S24	505686	4815813	3/21/2017	Early	0	0	0	a
210	Trail Creek	T2S20	507854	4815888	3/21/2017	Early	0	0	1	a
211	Trail Creek	T2S21	507784	4814807	3/21/2017	Early	0	0	0	a
212	Trail Creek	T2S22	507394	4815492	3/21/2017	Early	0	0	1	a
213	Trail Creek	T2S50	507898	4816495	3/21/2017	Early	0	0	1	a
217	Mosquito	T2S42	503909	4810029	3/21/2017	Early	0	0	1	a
218	Mosquito	T2S39	505679	4809234	3/21/2017	Early	0	0	0	a
219	Mosquito	T2S45	502149	4811165	3/21/2017	Early	1	0	1	a
220	Mosquito	T2S43	503424	4810186	3/21/2017	Early	0	1	1	a
221	Mosquito	T2S44	502500	4810851	3/21/2017	Early	0	0	1	a
222	Mosquito	T2S41	504406	4809765	3/21/2017	Early	0	0	0	a
223	Mosquito	T2S40	504922	4809433	3/21/2017	Early	0	0	0	a
224	Red Top	T2S7	510934	4802608	3/28/2017	Early	1	0	0	a
225	Red Top	T2S8	510479	4802383	3/28/2017	Early	0	0	1	a
226	Red Top	T2S9	510921	4802026	3/28/2017	Early	1	1	1	a
227	Red Top	T2S10	511286	4801584	3/28/2017	Early	1	1	1	a
228	Butler N	T2S13	511080	4805045	3/28/2017	Early	1	0	1	a
229	Butler N	T2S12	510492	4804963	3/28/2017	Early	1	0	1	a
230	Butler N	T2S11	510012	4805200	3/28/2017	Early	1	0	1	a
231	Butler N	T2S14	511556	4805265	3/28/2017	Early	1	0	0	a
232	Butler N	T2S15	511717	4804904	3/28/2017	Early	0	0	0	a
234	Resor	T2S Resor North 2	511822	4807530	3/28/2017	Early	1	0	0	a
235	Resor	T2S Resor North 1	511685	4807687	3/28/2017	Early	0	0	0	a
236	Red Top	T2S1	512520	4801090	3/28/2017	Early	1	0	1	a
237	Red Top	T2S2	512258	4801378	3/28/2017	Early	1	0	0	a
238	Red Top	T2S NEW RT	512027	4801214	3/28/2017	Early	1	0	1	a
239	Red Top	T2S3	511939	4801690	3/28/2017	Early	1	0	1	a
241	Red Top	T2S4	512202	4801825	3/28/2017	Early	1	0	0	a
242	Red Top	T2S6	511265	4802465	3/28/2017	Early	1	0	0	a
243	Red Top	T2S5	511795	4802075	3/28/2017	Early	1	0	0	a
272	Red Top	T2S NEW RT2	510759	4802384	4/25/2017	Early	0	0	0	a

Appendix 2. Locations of Automated Recording Units deployed in the late season in 2017 and associated raptors detected at each location (0 = no detection, 1 = detection, a = not possible during survey period, b = already surveyed for in the early season period).

Deployment	General Location	Pt Num	UTM Lat	UTM Long	Start Date	Early_Late	GGOW	NOGO	BOOW	FLOW
277	Phillips	T2S_FLOW_4	510752	4821083	6/9/2017	Late	0	0	a	0
278	Phillips	T2S_FLOW_3	511074	4821391	6/9/2017	Late	0	0	a	0
279	Mosquito	T2S72	505827	4809960	6/6/2017	Late	0	0	a	0
280	Mosquito	T2S71	505712	4810385	6/6/2017	Late	0	0	a	0
281	Mosquito	T2S70	505721	4810952	6/6/2017	Late	0	0	a	0
282	Mosquito	T2S69	506110	4811344	6/6/2017	Late	0	0	a	0
283	Mosquito	T2S67	506364	4811647	6/6/2017	Late	0	0	a	0
284	Mosquito	T2S66	505673	4811774	6/12/2017	Late	0	0	a	0
285	Mosquito	T2S68	505587	4811500	6/12/2017	Late	0	0	a	0
286	Mosquito	T2S52	505031	4810629	6/12/2017	Late	0	0	a	0
287	Phillips	T2S_FLOW_6	509746	4820623	6/16/2017	Late	b	b	b	0
288	Phillips	T2S_FLOW_5	510232	4820917	6/16/2017	Late	b	b	b	0
289	Phillips	T2S_FLOW_2	510946	4821871	6/17/2017	Late	b	b	b	0
290	Phillips	T2S_FLOW_1	511064	4822203	6/17/2017	Late	b	b	b	0
291	Mosquito	T2S59	503672	4811131	6/19/2017	Late	0	0	a	0
292	Mosquito	T2S62	504472	4811213	6/19/2017	Late	0	0	a	0
293	Mosquito	T2S58	503542	4811474	6/19/2017	Late	0	0	a	0
294	Mosquito	T2S61	504736	4810472	6/19/2017	Late	0	0	a	0
295	Mosquito	T2S60	504186	4810829	6/19/2017	Late	0	0	a	0
296	Mosquito	T2S63	504323	4811987	6/19/2017	Late	0	0	a	1
297	Mosquito	T2S57	503838	4812232	6/19/2017	Late	0	0	a	1
298	Mosquito	T2S51	503407	4810989	6/26/2017	Late	0	0	a	0
299	Mosquito	T2S54	502868	4811525	6/26/2017	Late	0	0	a	0
302	Mosquito	T2S53	502406	4811648	6/26/2017	Late	0	0	a	0
303	Phillips	T2S_FLOW_7	508681	4820207	6/30/2017	Late	a	a	a	0
304	Phillips	T2S_FLOW_8	508188	4820313	6/30/2017	Late	a	a	a	0
305	Phillips	T2S_FLOW_9	507719	4820298	6/30/2017	Late	a	a	a	0
306	Phillips	T2S_FLOW_10	507947	4819939	6/30/2017	Late	a	a	a	0
307	Phillips	T2S_FLOW_11	508325	4819961	6/30/2017	Late	a	a	a	0
308	Mosquito	T2S_Mosq_New2	505812	4809462	7/5/2017	Late	0	0	a	0
309	Mosquito	T2S_Mosq_New1	504811	4810005	7/5/2017	Late	0	0	a	0
337	Mosquito	T2S55	502859	4812216	8/11/2017	Late	0	0	a	0
338	Mosquito	T2S56	503249	4812100	8/11/2017	Late	0	0	a	0
339	Mosquito	T2S64	504944	4812014	8/11/2017	Late	0	0	a	0
342	Mosquito	T2S65	504872	4811526	6/17/2017	Late	0	0	a	1

GOLDEN EAGLE LEAD INGESTION IN THUNDER BASIN NATIONAL GRASSLAND

2017 Annual Report

Project Collaborators:

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Andrea Orabona – Wyoming Game and Fish Department
Kim Dickerson – U.S. Fish and Wildlife Service

Statement of Study Purpose & Objectives:

It has been well established from many studies that raptors are poisoned from ingesting lead fragments that remain in gutpiles of big-game that are harvested with lead-based bullets. Several studies have directly linked lead exposure from this source to California Condors, Bald Eagles, Golden Eagles, and Common Ravens. While the connection between lead-based ammunition for big-game hunting and blood lead levels in raptors is well established, there are several other sources of hunting for which data are lacking, including upland game and varmint hunting.

The Thunder Basin National Grasslands (TBNG) in eastern Wyoming hosts large populations of black-tailed prairie dogs, golden eagles, and ferruginous hawks. Because of several management objectives, the TBNG has been closed to prairie dog shooting for over ten years. In 2017, TBNG temporarily lifted hunting restrictions in order to reduce prairie dog populations for the year and shooting is anticipated to continue in 2018. The initiation of hunting prairie dogs in TBNG provides a unique opportunity to investigate the lead exposure risk from prairie dogs to nestling eagles and hawks in Wyoming, with a few key objectives:

- Determine the extent to which nestling raptors are exposed to lead from recreation prairie dog shooting in TBNG
- Understand the lead fragmentation rates in shot prairie dogs
- Determine bi-monthy rates of lead ingestion through feather deposition and blood lead levels
- Examine the liklihood that lead ammunition collected from from prairie dogs is the source of eleveated blood lead levels in nestlings using stable lead isotopic analysis
- Relative nesting density in Thunder Basin in relation to prairie dog colonies

Results

In 2017, we collected blood and feather samples within Thunder Basin National Grassland throughout the later stages of the 2017 nesting season (Table 1, Figure 1). Teton Raptor Center collected data using a framework of nests provided by Thunder Basin National Grassland and the Wyoming Game and Fish Department, but also augmented additional nests to the dataset by nest searching with our crews. We were able to collect blood samples from 10 nestlings in seven different nests and feather samples from all but one of the nestlings. Along with the nestling data, we deployed SoundScout audio recorders in the areas surrounding nesting sites during the nestling period to assess the number of shots fired at prairie dogs. In addition to sampling the nestlings and assessing shots fired, we collected 12 shot prairie dogs from near nest sites and x-rayed the carcasses to determine the presence of lead. We extracted visible metal fragments from within the prairie dogs to determine if the fragments were Pb and their lead isotopic composition.

Thirteen blood samples and 25 feather sections (from 12 feathers) were analyzed for lead isotopic composition and concentrations. Potential lead fragments collected from 12 prairie dogs were also leached, tested to determine if they were lead-based (based on our prior analysis of lead-based ammunition leachate concentrations). We found that 11 of the 12 fragment samples collected from prairie dogs were lead-based and thus these samples were also analyzed for lead isotopic composition. All samples were analyzed using inductively coupled mass spectrometry and processed using trace-metal clean techniques.

Lead concentrations in blood samples ranged from 1.0 to 69 ng/mL while feather lead concentrations ranged from 7.4 to 660 ng/g. Thus, we found significant variation in lead exposure within both blood and feather samples analyzed. Lead isotopic compositions suggest that the ‘background’ lead signature for the nestlings is different than the lead isotopic composition of the fragments from prairie dogs (Figure 1). Further, the samples that show elevated lead exposure (compared to background) have an isotopic signature similar to the lead fragments recovered from the prairie dogs (Figure 1). We also found that the ferruginous hawk samples (n = 3 bloods and 3 feathers) had similar lead concentration and isotopic compositions to the golden eagle samples analyzed.

Teton Raptor Center crew checked 33 of territories, both historical and new in 2017, to determine activity and climbability. Primary observers were Nathan Hough, Bryan Bedrosian, and Nick Ciarvella (TRC) with significant logistical help from Tim Byer (FS).

Future Work

The lift on the shooting ban is set to continue during the 2018 nesting season, and we will augment sample sizes in 2017. We are planning a more extensive search of the study site for nests in the 2018 season. A. Orabona is scheduled to fly much of the study area in a fized-wing aircraft in March/April to document active nests. We will also conduct ground-based searches and work with local mining companies to increase the number of nests sampled.

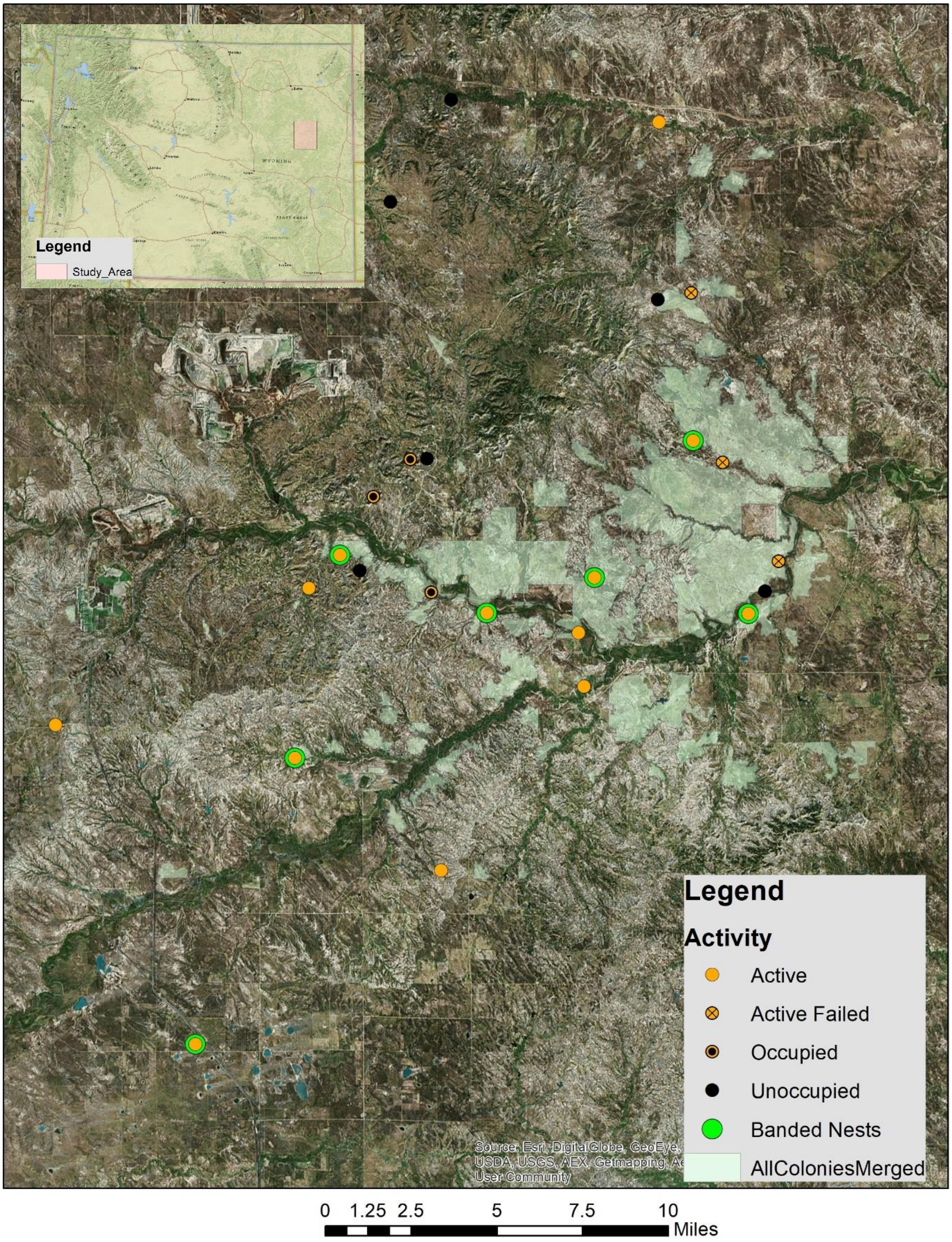
We plan to continue collecting prairie dogs for x-ray, retrival of possible lead fragments, and, if lead-based, lead isotope analysis. One question that arose from the 2017 data is how blood lead levels correlate to lead deposition in feathers. In 2018, we will take a sub-sample of nests and collect blood samples three times during the nestling season. During blood collection, we will also mark growing feathers to determine the mean daily growth rate. We can then determine the section of feather that was grown during the time that corresponds to the blood sample collected to better understand the relationship between blood lead and feather lead values.

Data Access

Data on nests visited, location, nest status, and productivity (when known) will be provided to the Forest Service managers at Thunder Basin.

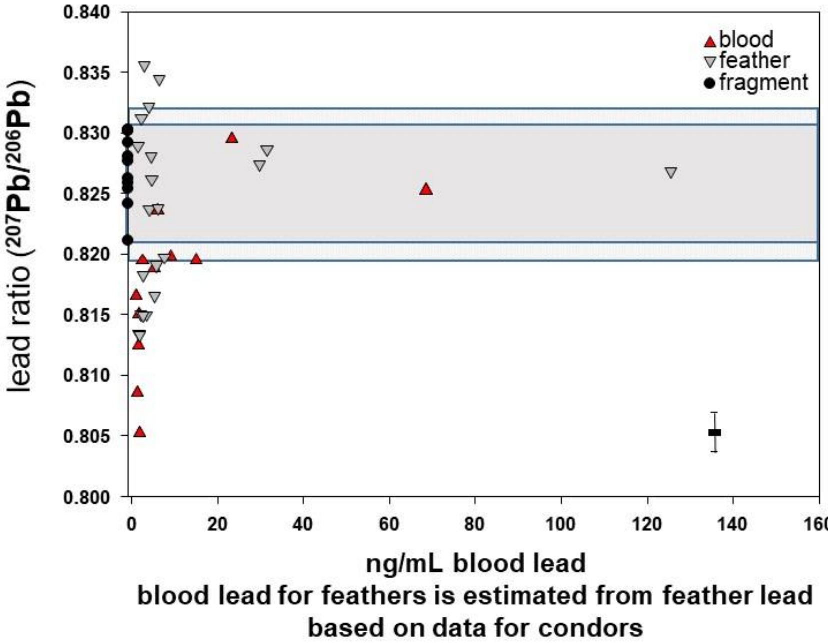
Date Collected	Location	USGS Band	Latitude	Longitude
5/31/2017	Antelope Creek	799-01011	43.4461620	-105.129087
6/13/2017	Keyton Nest	799-01014	43.470576	-105.214201
6/13/2017	Red Hills	799-01013	43.470576	-105.214201
6/13/2017	Red Hills	799-01012	43.519550	-105.010149
6/14/2017	Old Nails	719-01519	43.446429	-104.978189
6/14/2017	Old Nails	799-01520	43.446429	-104.979189
6/26/2017	Woody Creek	799-01016	43.385001	-105.24013
6/26/2017	Bill Control	709-08413	43.263999	-105.2971221
6/26/2017	Bill Control	0799-01016	43.263999	-105.2971221
6/27/2017	Sauerkraut	799-01017	43.461292	-105.0296925

Table 1. Banding records for Teton Raptor Center 2017 (Permit #33-1122)



Source: Esri, DigitalGlobe, GeoEye,
USDA, USGS, AEX, Getmapping, Ae
User Community

Figure 1. 2017 Golden Eagle nests located or checked within Thunder Basin Naitonal Grasslands



Samples that show higher lead values have an isotopic composition similar to the fragments recovered from prairie dogs

Figure 2. Lead concentration and isotopic composition data suggest: 1) birds with ‘low’ lead have a different isotopic signature than birds with higher lead and these low birds might be reflective of the ‘background’ lead signature in the study system; 2) blood and feather samples that are ‘higher’ in lead than background have an isotopic signature similar to the fragments recovered from prairie dogs suggesting that these elevated exposures are due to exposure of lead from sources similar to the recovered prairie dog fragments. Blood lead (ng/mL) was estimated from feather lead (ng/g) using and an estimated blood:feather lead concentration ratio of 0.19 (Finkelstein et al. 2010). Error bars (-) on lower right represents long-term analytical precision for the ^{207}Pb/^{206}Pb ratio measurements (±0.2%, 2 relative SD) and the lighter shaded area represents the upper and lower ^{207}Pb/^{206}Pb ratio measurement error (0.2%) for the lead fragments recovered from prairie dogs.

Figure 3. Examples of x-rays of shot prairie dogs in Thunder Basin National Grassland, 2017. Left was shot with a .17 caliber rifle and right was shot with a .223 caliber rifle.