GOLDEN EAGLE LEAD INGESTION IN THUNDER BASIN NATIONAL GRASSLAND

2017 Annual Report

Project Collaborators:

Bryan Bedrosian – Teton Raptor Center bryan@tetonraptorcenter.org
Myra Finkelstein – University of California – Santa Cruz
Tim Byer – U.S. Forest Service
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 and 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; 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). Furthermore, 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 territories in 2017, both historical and new, 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 from 2017. We are planning a more extensive search of the study site for nests in the 2018 season. Andrea Orabona is scheduled to fly much of the study area in a fized-wing aircraft in May 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 National Grasslands.

Literature Cited

Finkelstein, M.E.; D. George; S. Scherbinski, R. Gwiazda, M. Johnson, J. Burnett, J. Brandt, S. Lawrey, A.P. Pessier, M. Clark, J. Wynne, J. Grantham; D.R. Smith. 2010. Feather lead concentrations and 207Pb/206Pb ratios reveal lead exposure history in California condors (Gymnogyps californianus). Environmental Science and Technology. 44, 2639–2647.

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).

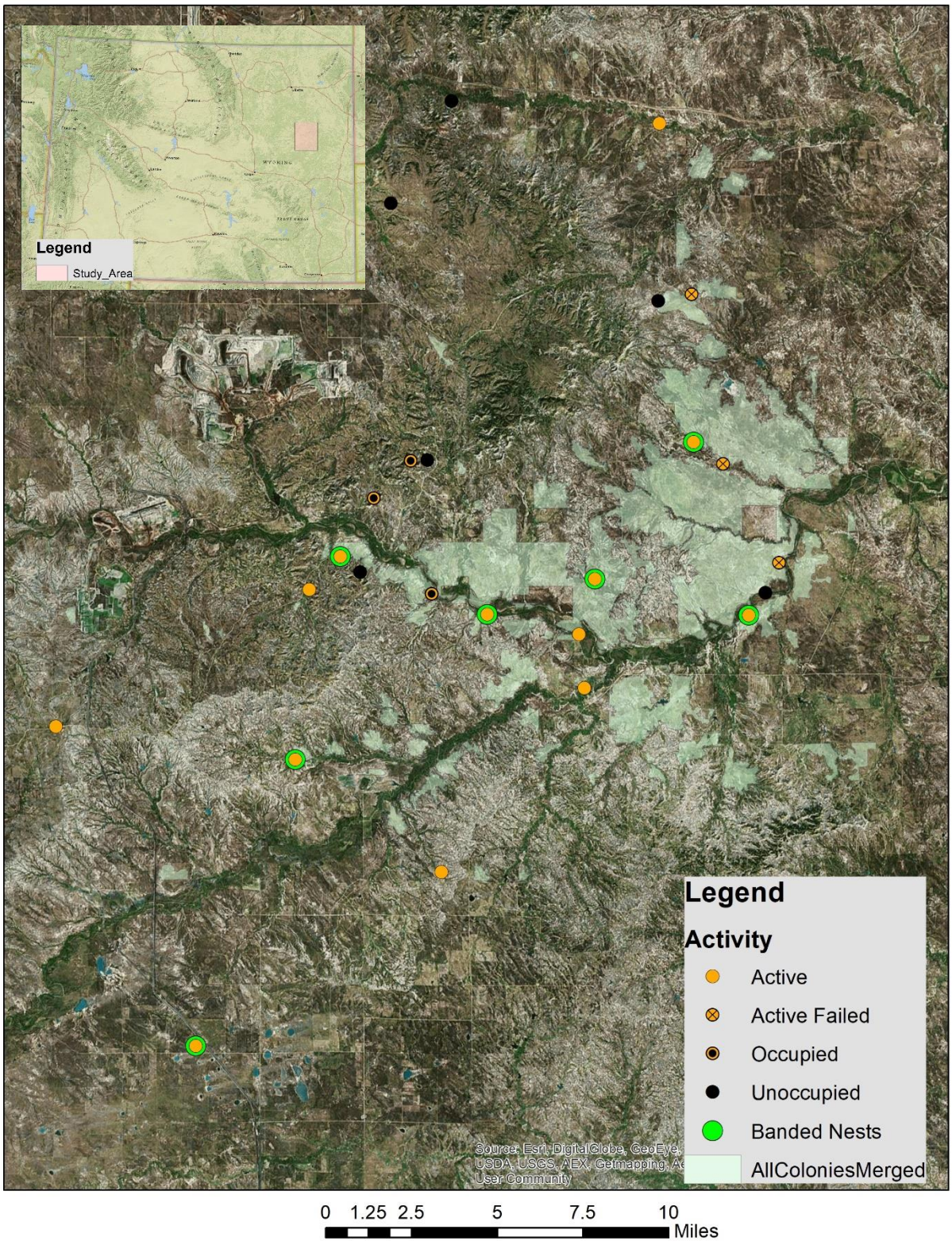
Legend
Study_Area
Legend
Activity
Active
Active Failed
Occupied
Unoccupied
Banded Nests
AllColoniesMerged
Source: Esri, DigitalGlobe, GeoEye, USDA, USGS, AEX, Getmapping, A User Community
0 1.25 2.5 5 7.5 10
Miles

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

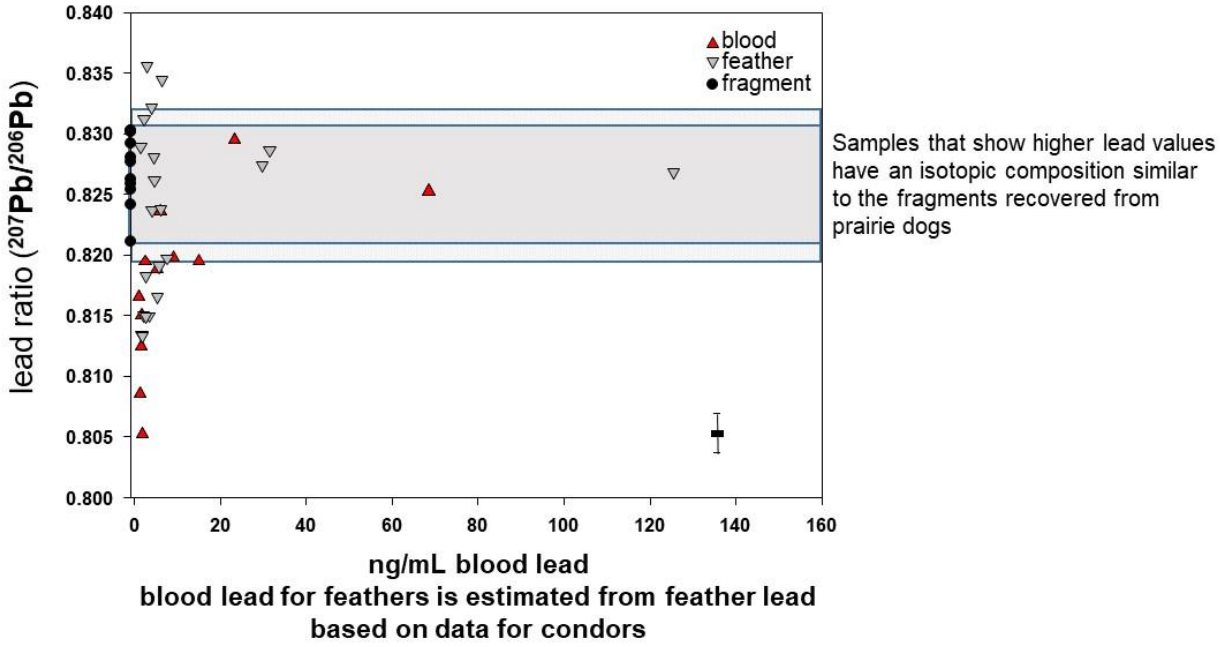

Figure 2. Lead concentration and isotopic composition data suggest: 1) birds with 'low' lead have a different isotopic signature than birds with higher lead and these low birds might be reflective of the 'background' lead signature in the study system; 2) blood and feather samples that are 'higher' in 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 Grasslands, 2017. Left was shot with a .17 caliber rifle and right was shot with a .223 caliber rifle.