Greater Sage-grouse Responses to Livestock Grazing in Semi-Arid Sagebrush Rangelands

2021 Annual Report


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Introduction

Greater sage-grouse (*Centrocercus urophasianus*; sage-grouse) are an upland game bird species that inhabits the sagebrush (*Artemisia* spp.) rangelands of western North America. Over the past 60 years, sage-grouse populations have been in decline across their 173-million-acre range (Connelly et al. 2004). These declines have been largely attributed to habitat loss and fragmentation cause by anthropogenic land uses (U.S. Fish and Wildlife Service [USFWS] 2013).

Although livestock grazing occurs on over 80% of the current sage-grouse range (Knick and Connelly 2011), the USFWS has not implicated grazing as a range wide species conservation threat (USFWS 2013). The effects of livestock grazing on sage-grouse and their habitats has been related to the frequency and intensity of grazing (Beck and Mitchell 2000, Dettenmaier et al. 2017, Monroe et al. 2017). Previous studies have assessed sage-grouse responses to grazing over broad scales. More research is needed to monitor sage-grouse responses to grazing at a finer scale over a longer time periods (Dettenmaier et al. 2017).

In 2012 Utah State University (USU) began a collaborative study of sage-grouse in Rich County, Utah, to compare sage-grouse vital rates between areas managed under different grazing practices. This research compared sage-grouse responses to grazing on study sites. Deseret Land and Livestock (DLL) and the Three Creeks Allotment (3C) (Figure 2).

The DLL has been using a high-intensity, low-frequency (HILF) rest and deferred-rotation grazing system as well as implementing sagebrush treatments across their pastures (Dahlgren et al. 2015). The 3C, located north DLL has been following a traditional season-long grazing system where livestock continually graze the landscape with minimal pasture rotations. The initial research reported that sage-grouse nesting on DLL pastures had higher nest success than those nesting on 3C (Dettenmaier 2018). At the time this study was completed the 3C allotment is in the process of building more fences and adding water development across the landscape to implement HILF grazing, with intention of beginning this practice in 2022.

Our hypothesis is that sagebrush rangelands managed using site-specific and adaptive rotational grazing practices can facilitate grass and forb production, creating a “green wave” effect that can benefit sage-grouse in terms of increased nesting and brood success (Stoner et al. 2020). To test this relationship, we are radio-marking female sage-grouse to study and compare their movements, vital rates, habitat selection and brood success, as well as sampling vegetation from both grazed and ungrazed pastures across the study area to follow growth/regrowth in those pastures. We are documenting changes in plant phenology with the use of the Normalized Difference Vegetation Index (NDVI). The NDVI is a satellite-derived index of the photosynthetic biomass, or ‘greenness’, of an area (Stoner et al. 2020).

We will be using these data to track the green-up across the landscape, and rate change between the different grazing methods on our two study areas, as well as within each area between grazed and rested pastures. Public land stakeholders, sage-grouse, and other sagebrush species will benefit from research defining the direct link between sage-grouse and grazing management, as well as how grazing may influence a continual green-wave through their movements similar to other herbivore migrations.

This study is evaluating the affect livestock grazing has on sage-grouse habitat use and brood success. Sage-grouse vital rates have been collected over the past 10 years in Rich County, and those will be analyzed to compare the two study sites, DLL and 3C. Completion of this project will provide new information regarding sage-grouse vital rates and brood survival success over a long-term study on two areas practicing different grazing techniques. This research will also provide more insight to the relationship between sage-grouse and grazing livestock, including habitat use, movement, and survival.

Study Area

Research is being conducted in Rich County, located in northeastern Utah (Figure 2). The study area includes the southwestern portion of the Wyoming Basin Sage-Grouse Management Zone II, and is comprised of two research areas, Deseret Land and Livestock (DLL) and the Three Creeks Allotment (3C). The DLL unit is a 200,000-acre privately-owned ranch, of which 160,000 acres are privately-owned and 40,000 acres are Bureau of Land Management (BLM) land grazed under a federal grazing allotment. DLL has maintained rotational prescribed grazing practices since 1979 and has implemented sagebrush treatments throughout lower elevation pastures. The 3C unit is a 146,000-acre consolidation of 29 individual BLM and USFS (U.S. Forest Service) grazing allotments and private lands. The 3C consolidation has begun to implement prescribed rotational grazing management, which will begin to be in effect over the 2022 season.

Methods

Radio-marking

We began radio-marking sage-grouse in 2021 on March 20th. The date was well before the peak lek counts this year. Peak lek attendance occurred on the night of April 12, 2021.We completed our radio-making on April 23, 2021.

We captured and radio-marked 44 female sage-grouse across the two study areas. On DLL, we deployed 14 global positioning system (GPS) transmitters and 10 very-high frequency (VHF) collars. On 3C, we deployed 17 GPS transmitters and 3 VHF collars. Including birds from previous seasons, we are monitoring a total of 59 female sage-grouse; 19 GPS and 16 VHF on DLL, and 18 GPS and 6 VHF on 3C.

We conducted our trapping at night with the use of spot lights, dip nets, and traveling across the leks on all-terrain vehicles (ATVs). Female sage-grouse are first spotted with the spot light and binoculars, and we followed the capture procedures described by Connelly et al. (2003). Once

each female sage-grouse was caught and removed from the net, they were fitted with either a 22g VHF necklace collar or a 22g PTT rump-mounted GPS transmitter.

Before their release, location of capture, age (adult/juvenile), and weight were recorded, as well as any comments regarding the behavior or health of the bird. A metal leg band was placed around the bird's tarsus for identification purposes. After processing each female sage-grouse they were released as quickly as possible in the same location of capture to reduce chances of capture myopathy.

Monitoring

We located female sage-grouse that were equipped with a VHF transmitters 1-3 times per week until confirmed nesting. Nesting females were located twice per week to confirm nesting status until the week of the projected hatch day (28 days after nest initiation). During the hatch week, we monitored nests every other day to determine the exact hatch date.

The GPS/PTT units have a built in VHF or UHF radio transmitter which enabled us to record precise location data. Each individual PTT unit recorded three to eight locations of the radio-marked sage-grouse throughout the day and were uploaded to ARGOS (http://www.argos-system.org/) every three to five days. We visually located sage-grouse equipped with PTT units twice per week until nesting was confirmed. Once we confirmed a nest, we continued to visually monitor the nest until the projected hatch day. Nests that were abandoned or predated throughout nesting were immediately checked to determine fate of nest, and the female was located to determine her status. We then monitored the female weekly due to the low rate of re-nesting (Cook 2015).

After a nest hatched, we recorded the exact nest location using a Universal Transverse Mercator (UTMs) with use of a handheld GPS unit. Female grouse equipped with UHF and VHF units and their broods were located twice a week to track their movements across the landscape (Figure 3 and 4), and to conduct brood vegetation surveys.

Vegetation surveys

At each nest site, both failed and successful, as well as one random site, we completed a vegetation survey to record habitat vegetation cover and structure. We also completed vegetation surveys at one of each bird's brood locations per week until the brood reached 50 days of age.

The vegetation surveys consisted of 4-15 meter transects were set up at each location in each of the cardinal directions. On these transects, we used the Daubenmire quadrat method to measure and identify grass and forb species and abundance, and the point line intercept method to identify and measure shrub species, height and length.

Utilization surveys

We also completed vegetation utilization vegetation surveys across both study areas. Methods for this survey were adapted from Utilization Studies and Residual Measurements by the BLM (1984). We documented changes in plant phenology using NVDI. We are comparing the vegetation utilization surveys to NVDI (which measures the amount of photosynthetic capacity

of a landscape) to the types of vegetation across the landscape to account for natural plant senescence as compared to changes in vegetation cover and structure caused by cattle grazing.

To do this, we overland the NVDI pixels on DLL and 3C pastures. Any pixel that went over the pasture boundary was eliminated. We ended up with 3,800-pixel units that are available to compare to utilization surveys. These pixel units were randomized across each study area and given a random heading, to ensure spatial and temporal randomization in the surveys and to reduce survey bias.

Each survey consisted of a 100m transect, which the middle of crossed the center of the pixel, and every 10 meters a Daubenmire frame was used to record the stubble height (grass only), height of tallest plant, as well as the percent of herbaceous (grasses and forbs) woody (trees and shrubs) and bare (soil, rocks, dead plants) ground.

Preliminary Results

We documented 29 sage-grouse initiating nests from April 22 - May 17, 2021 (Table 1). All nests were either hatched (14 total) or predated (15 total) by June 8th. Across both study areas we monitored 12 broods. On 3C we were monitoring two broods, both failing before they reached 5 weeks post-hatch. On DLL we were monitoring 10 broods, three which made it to their 50-day post-hatch brood check. One female had two chicks survive, while the other two each had four chicks (Figure 1).

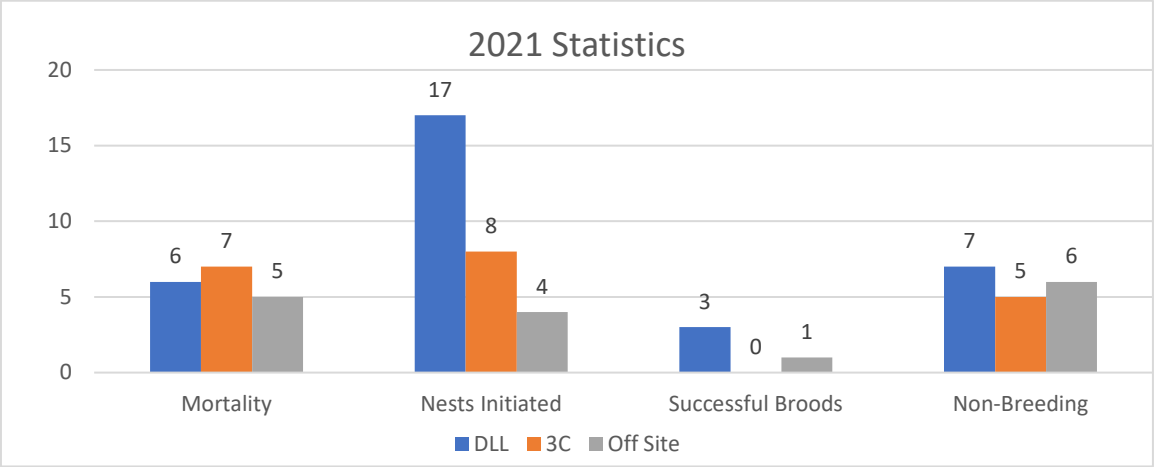
We also monitored non-brooding grouse that were outfitted with either a GPS radio transmitter backpack or a necklace-style VHF radio transmitter throughout the season at least once per week. Six GPS marked sage-grouse moved off the study areas. From DLL (Figure 5), one bird went east to Wyoming, two south of I-80, and one north to west of Woodruff, Utah. From 3C, one bird went north to the east side of Bear Lake, Utah, while two more went south, and are now west of Woodruff, Utah.

2022 Plan of Work

Throughout the winter months, we will monitor radio-marked sage-grouse periodically with the use of telemetry equipped planes. The winter months make on-the-ground tracking difficult. During the lekking season (March-April) we will begin trapping female sage-grouse. Our objective is to deploy 6 GPS and 12 VHF devices. Radio-marked female sage-grouse will be tracked and vital rates recorded throughout the breeding, nesting, and brood rearing seasons. This data will be combined with previous years' data and used to determine vital rates between the two sites as well as evaluate the relationship between brood survival and cattle grazing practices.

Table 1. Female greater sage-grouse (*Centrocercus urophasianus*) nest initiation and hatching rates for Desert Land and Livestock (DLL), the Three Creeks Allotment, and off-site, Rich County, Utah, 2021.

	Nest Initiated	Nesting Rate	Nests Hatched	Hatching Rate	Successful Broods	Brood Success Rate
DLL	17	77.2%	10	58.8%	3	30%
3C	8	47.7%	2	25%	0	0%
Off Site	4	66.6%	2	50%	1	50%
Total	29	38.7%	14	48.2%	4	29%



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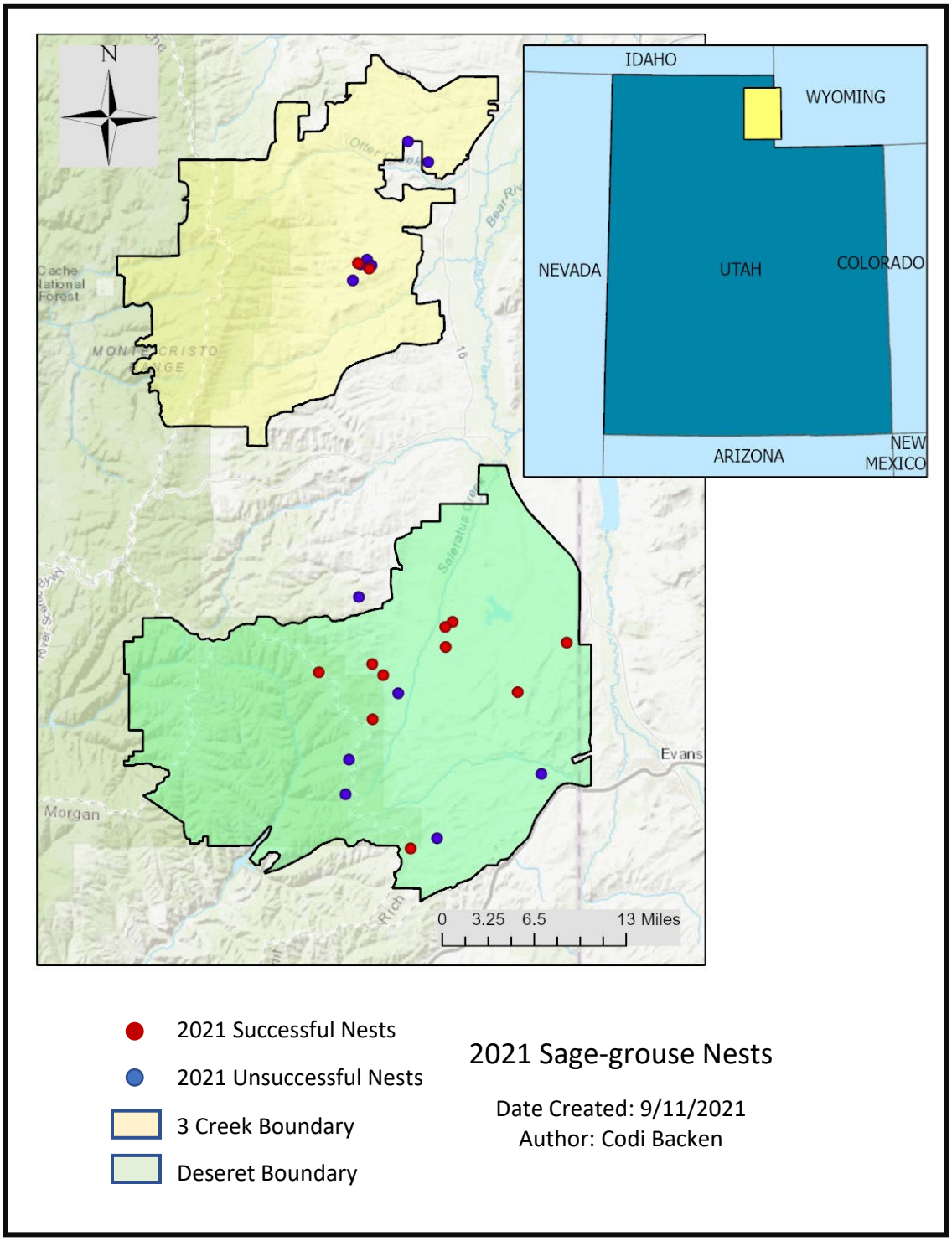

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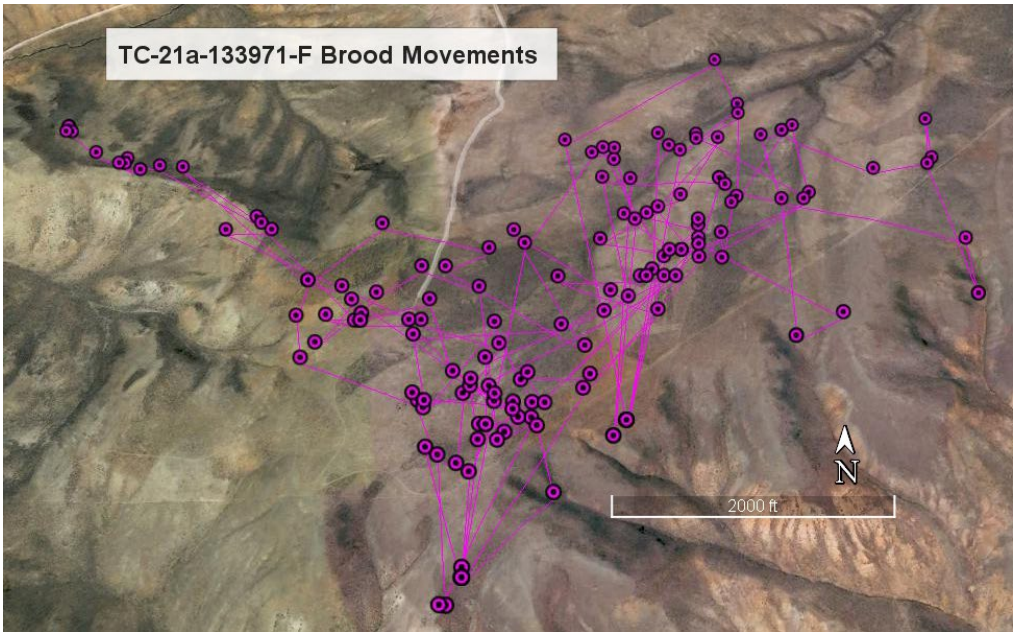

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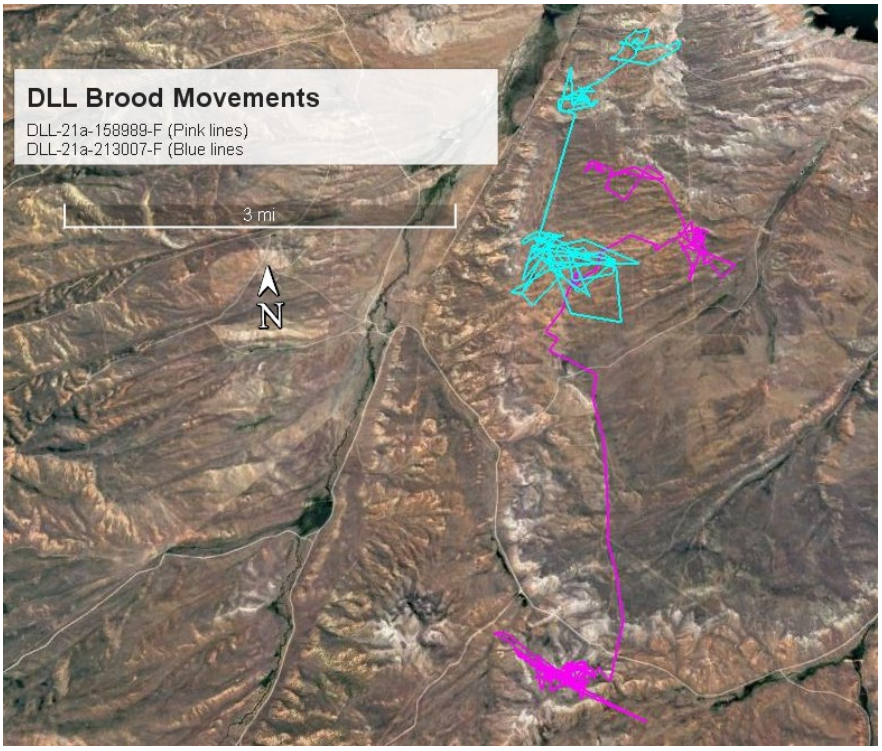

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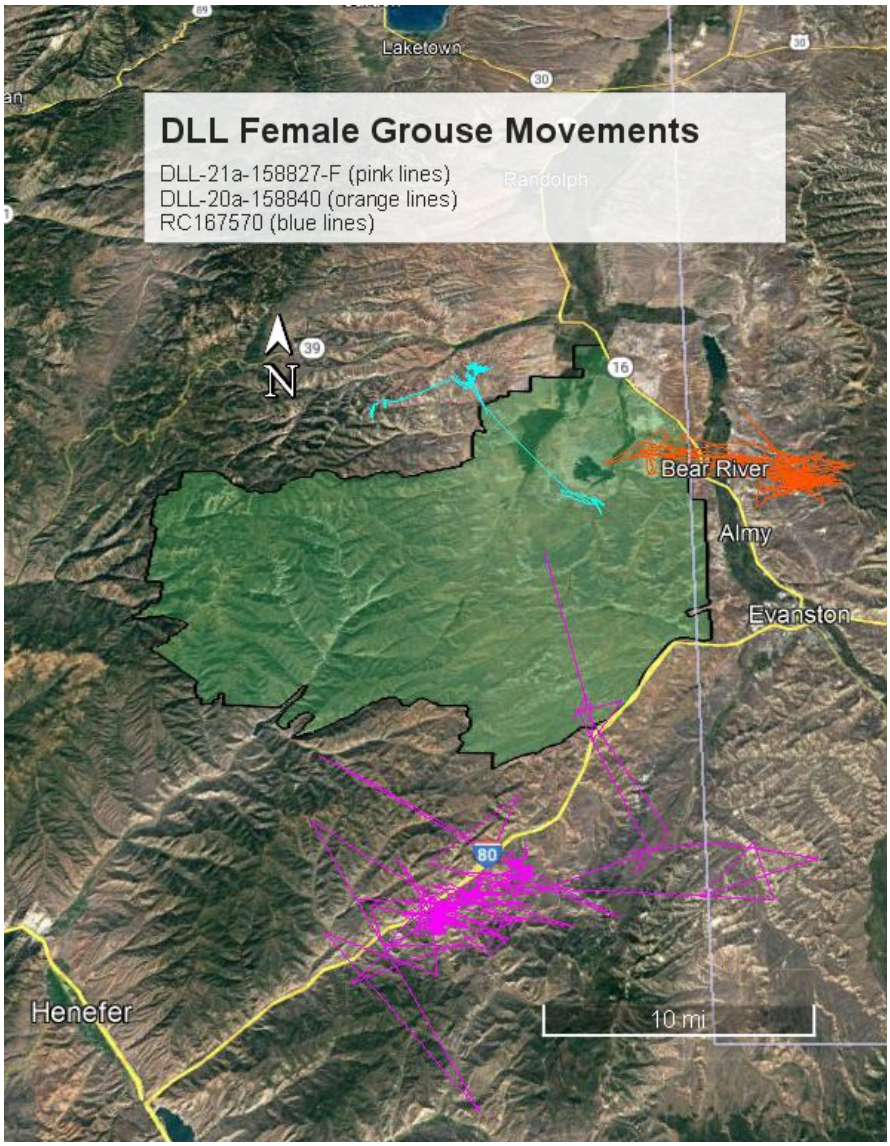

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