Greater Sage-grouse Movements and Geophagy Study in Western Wyoming

2015 Annual Report

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In 2014, we initiated a highly collaborative study on Greater Sage-grouse (*Centrocercus urophasianus*; hereafter sage-grouse) in western Wyoming involving federal, state, non-profit, and private sector stakeholders. This on-going project is multifaceted and maximizes information gathered from radio-marked sage-grouse. The principle investigators include the authors of this report but key collaborators include A. Roberts, K. Murphy, G. Hanvey and L. Yandow from Bridger-Teton National Forest, J. Dahlke and G. Shedd from Wyoming Wildlife Consultants, LLC, and D. Clause from Wyoming Game and Fish Department. B. Bedrosian and the associated logistics of part of this project moved from Craighead Beringia South to the Teton Raptor Center and M. Holloran moved from Wyoming Wildlife Consultants, LLC to Wildlife Management Research Support during 2015 but data collection remained unchanged. Research during 2015 was conducted under WGFD chapter 33 permits 572 and 613.

Data from sage-grouse marked as part of this research are being used in two different ways. First, GPS movement data are being compiled to investigate geophagy of sage-grouse on winter range in the Pinedale/Big Piney regions of the Upper Green River Drainage. Geophagy is a newly discovered phenomenon where sage-grouse congregate at specific locations on winter range for the purpose of soil ingestion. Long-term questions on this behavior include where these sites are, frequency of use, why the behavior occurs, and how it affects movements and fitness. GPS data collected from marked sage-grouse in 2014-2016 are helping locate these sites and determine the frequency of use as the first part of this investigation.

Secondly, location data from sage-grouse in this study are being used to help define occupied breeding and brood rearing habitat in the Hoback and Upper Green areas on the Bridger-Teton National Forest. These areas may be key connectivity corridors between the large core sage-grouse populations in the Pinedale region to the genetically-isolated core population in the Jackson Hole region.

Marking and tracking

We collectively marked 30 sage-grouse in 2015 to add to our sample of 22 sage-grouse marked in 2014 (Appendix 1). For these studies, we have been custom designing remote-downloadable, solar GPS transmitters with integrated Very High Frequency (VHF) transmitter units. These transmitters are designed to gather GPS locations and store them indefinitely on the unit until it is

downloaded by the field crew via a laptop computer. The VHF transmitters are used to locate radio-equipped sage-grouse so that GPS data can be downloaded. In 2014, we added the VHF transmitter into the solar charging circuit in an attempt to maximize longevity of the unit while decreasing total mass of the unit. Unfortunately, the VHF components on most of these transmitters did not work correctly and we are currently unable to locate most of the individuals equipped with this design. Regardless, we were able to locate a large portion of those sage-grouse during 2014 and earlier in 2015 and retrieve the GPS data from the units. In 2015, we incorporated independent, battery powered VHF components into all transmitters to alleviate this issue. We continue to monitor for sage-grouse with solar powered VHF units and hope to intermittently locate these individuals and download all of the stored data from the units.

GEOPHAGY

To date, we have gathered 45,584 GPS locations from 27 sage-grouse (Figure 1). Of the remaining sage-grouse from which we do not have locations yet, we are hopeful that we will be able locate the individuals to download their transmitters during the course of this study. Several sage-grouse outfitted on summer range in 2015 have yet to be located on winter range via VHF telemetry. Two telemetry flights have been conducted in December 2015 and January 2016 and two additional flights are scheduled for this winter. In the event we are unable to locate them this winter, we will be able to download their transmitters after they return to known summer ranges in 2016.

We are currently still collecting GPS data from sage-grouse on winter range and exploring possible geophagy sites based on aerial imagery and individual locations (Figure 2). Potential geophagy locations identified from telemetry data are monitored with infrared-triggered cameras to verify geophagy behavior at those sites. From our preliminary remote camera work, we have found that sage-grouse typically utilize these geophagy sites at first light and discontinue use for the day an hour or two after sunrise. Because of this, we have preset the transmitters to gather locations every 30min from 6am-9am. We then plot the morning locations and look for grouped or consistently used sites (often associated with alkaline soils and cutbanks) that could potential host a geophagy site. Using this methodology, in addition to opportunistically locating sites, we have thus far located 21 geophagy sites during the 2014/15 and 2015/16 winters (Figure 3). At each geophagy location, we have been collecting soil samples in a paired design. We collect a sample from a site that has been actively used (Figure 4) and another comparison sample within 100 m in a random direction. Having paired, random samples will allow us to better determine the minerals or compounds being sought after by the sage-grouse.

For the remainder of this winter, we are actively collecting data, searching potential locations for signs of geophagy, and deploying remote cameras to document use by sage-grouse and other species. We are still collecting soil samples and will send those samples in for batch processing spring 2016. Further, we will begin investigating GPS location data in relation to confirmed geophagy locations to determine frequency of use throughout the winter season and distance traveled to these sites.

We have also been developing a relationship and proposals for the second phase of this work with Dr. Dave Dalhgren at Utah State University. The goals of phase 2 of the project would be to begin investigating the influence of geophagy locations on sage-grouse winter distributions and winter habitat selection, and fitness benefits of geophagy. Phase 2 would incorporate one or two graduate students.

MOVEMENTS

We found that all sage-grouse marked on Bridger-Teton National Forest migrated to lower elevations for the winter (Figure 5). On average, sage-grouse migrated an average of 60 km (range = 43-73 km) from the core of their summer range to the core of their winter range. Sage-grouse left the forest from October 30 – November 12 in 2014 and from November 13 – 21 in 2015. We were able to follow three sage-grouse marked in 2014 in the Upper Green River valley back to summer range in 2015. Of these, one male returned on March 28 to a newly discovered lek (discovered because of this marked individual) south of the BTNF boundary by 3.5 km (Figure 6). Females returned later; on the 6th and 14th of April.

We created preliminary kernel density estimates of summer ranges of sage-grouse utilizing the Coyote Gulch and Upper Green areas of Bridger-Teton National Forest (Figure 8, 9). Sage-grouse in Coyote Gulch were followed from June through migration but sage-grouse in the Upper Green were marked in September, so kernels do not encompass full breeding seasons for the first year of capture. We were able to gather full breeding season data in 2015 from three sage-grouse captured in 2014. We were unable to access the Coyote Gulch and Mosquito Lake areas prior to the first week of June in 2015 due to snow. One female in the Coyote Gulch was captured on 5 June 2015 while brooding six 1-2 week old chicks and another was captured alone with a full brood patch indicating a lost nest/brood. Two females initiated nests on their summer range in the Upper Green (Figure 7). These observations confirm that active breeding habitat (as defined in the sage-grouse management guidelines) in both areas of Bridger-Teton National Forest. There was no indication of large movements to late brood-rearing areas by sage-grouse in either region. We also captured a young sage-grouse (late brood rearing age and likely from a second nest of the season) in September 2015 in the Mosquito Lake region that was too small to outfit with a transmitter, suggesting the area is, at a minimum, late brood rearing habitat.

We will continue to monitor for marked sage-grouse and update movements, home ranges, and nesting status as we download more data from the transmitters. We will continue to monitor through the breeding season of 2016 to gather the maximum amount of data possible before sage-grouse leave for winter range in 2016. Tracking marked individuals back onto summer range should increase sample size of stored migration and winter data, which in conjunction with new summer data will help address the movement and geophagy objectives.

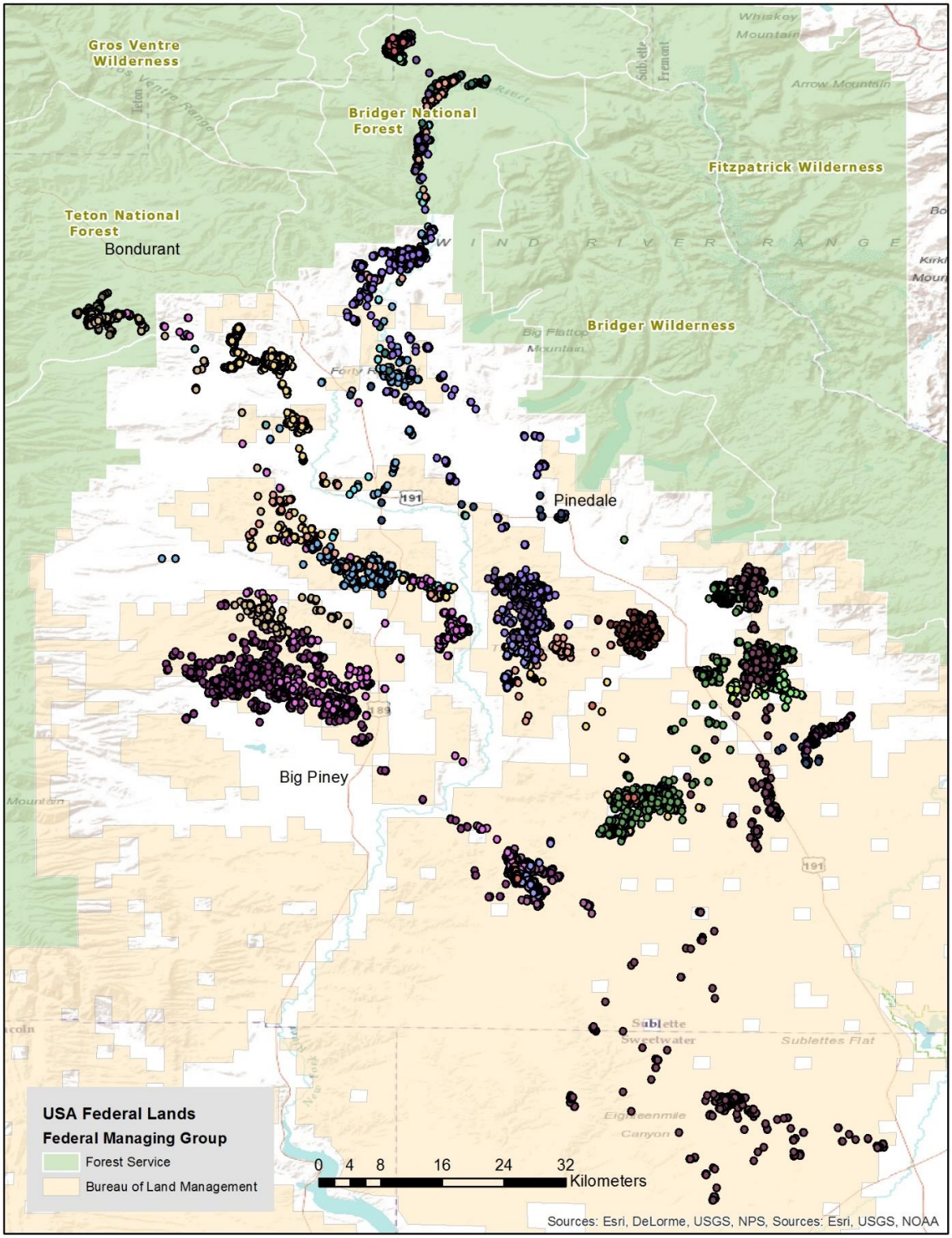

Figure 1. 2014-2015 sage-grouse GPS locations in the Upper Green River Basin of western Wyoming.

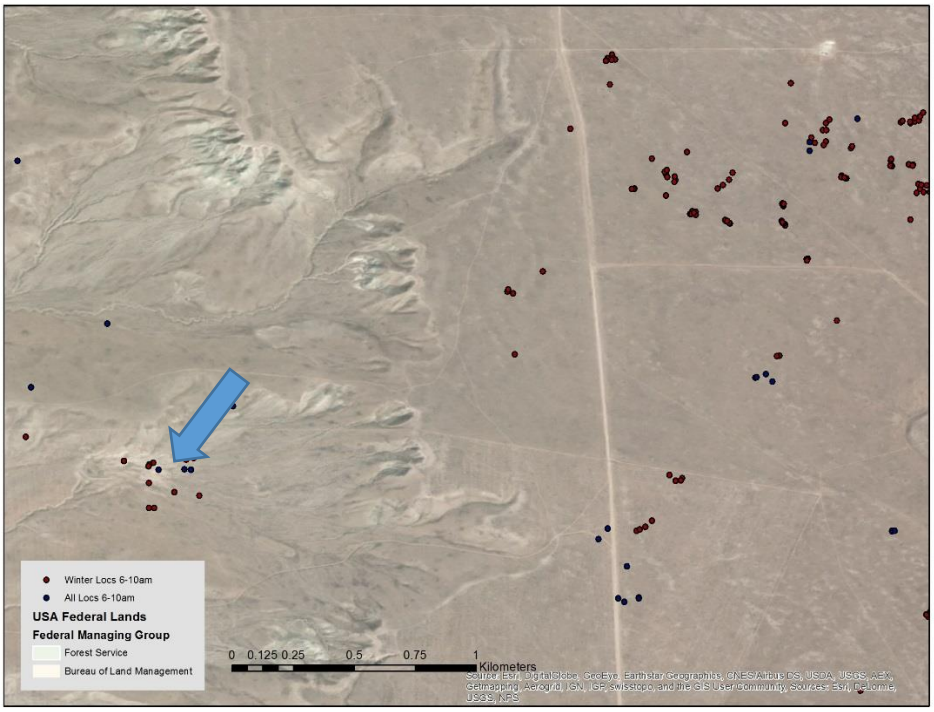

Figure 2. Example of using GPS data to identify potential geophagy sites. Clustered early morning locations generally associated with alkaline soils and cutbanks often lead to sites.

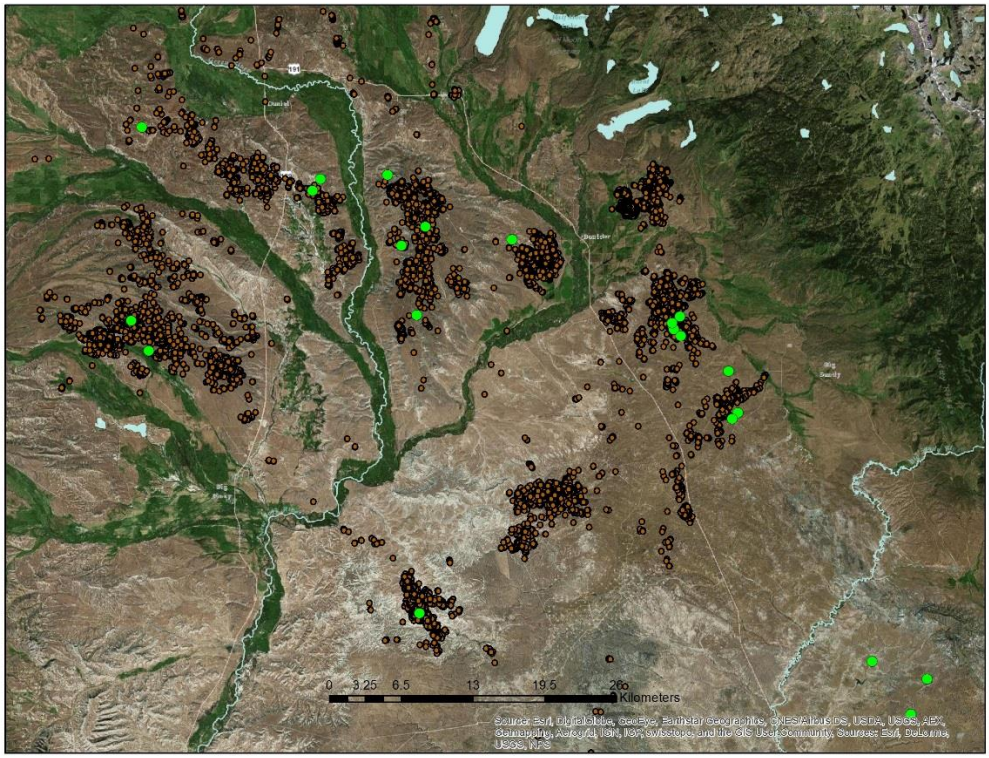

Figure 3. All 21 confirmed geophagy sites (green) with all GPS locations from marked sage-grouse; Upper Green River Basin, western Wyoming 2014-15.

Figure 4. Actively used geophagy site near Boulder, WY 2014. Note the large amount of tracks and exposed soil location where sampling would occur.

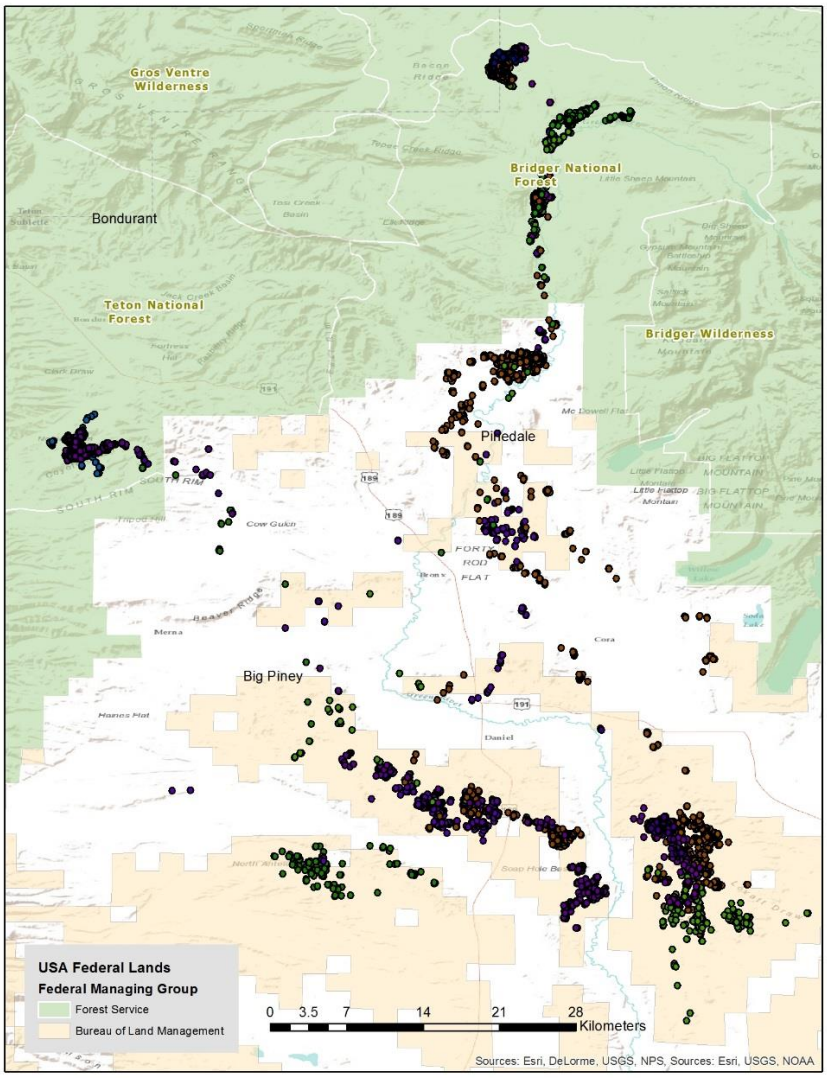

Figure 5. Sage-grouse marked on Bridger-Teton National Forest and their movements to winter range; Upper Green River Basin, western Wyoming 2014-15. No known sage-grouse wintered on forest lands.

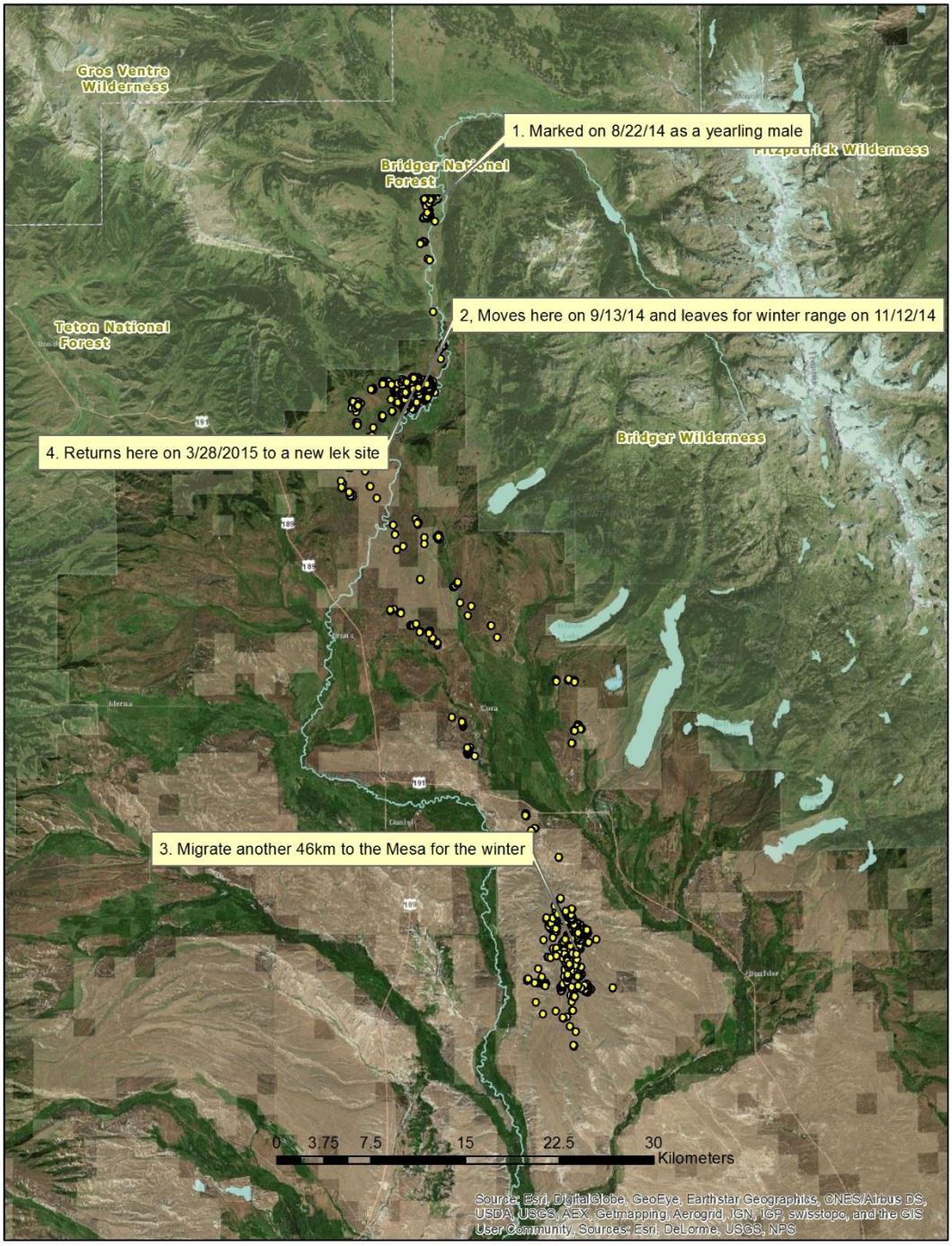

Figure 6. Movements of sage-grouse male 187 depicting summer range, winter, range and a lek newly discovered because of his movements; Upper Green River Basin, western Wyoming 2014-15.

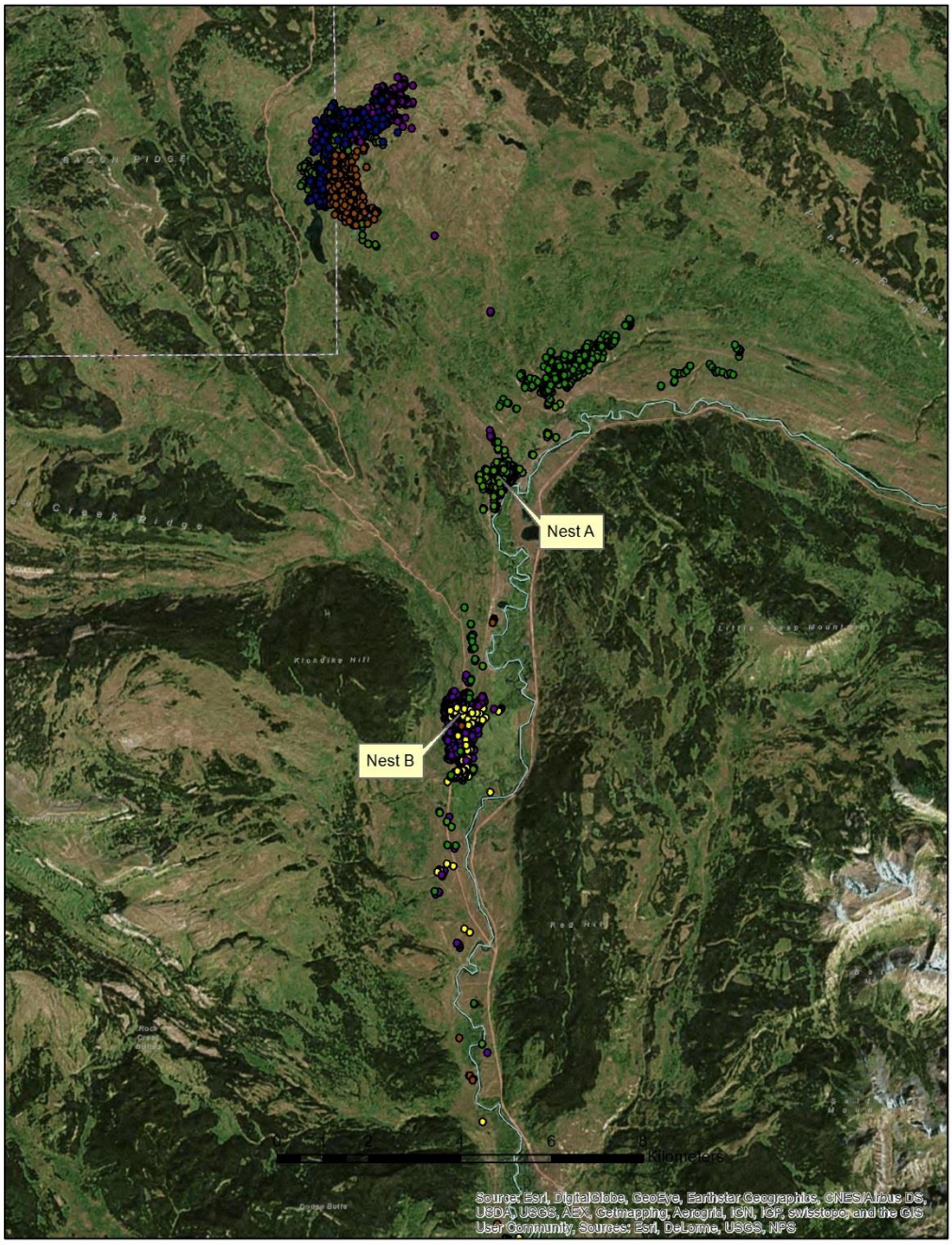

Figure 7. Two sage-grouse nests on Bridger-Teton National Forest in the Upper Green River Basin (western Wyoming 2014-15) located due to GPS movements of marked females.

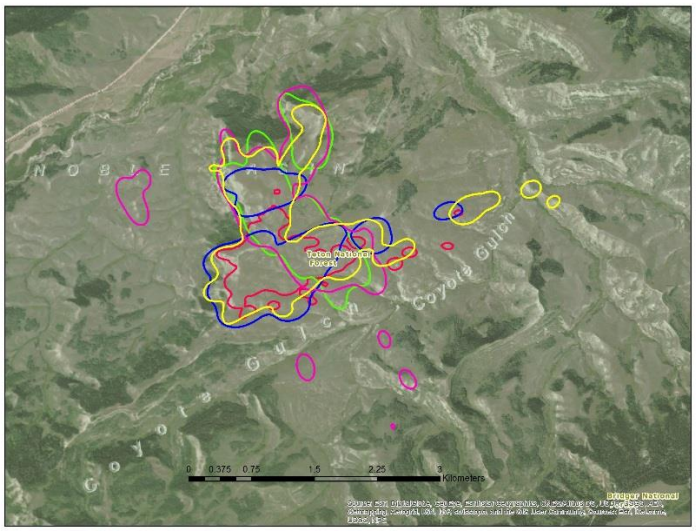

Figure 8. 95% Kernel density estimates from sage-grouse during June-November in the Coyote Gulch area of Bridger-Teton National Forest (western Wyoming 2014-2015). Each color represents a different individual.

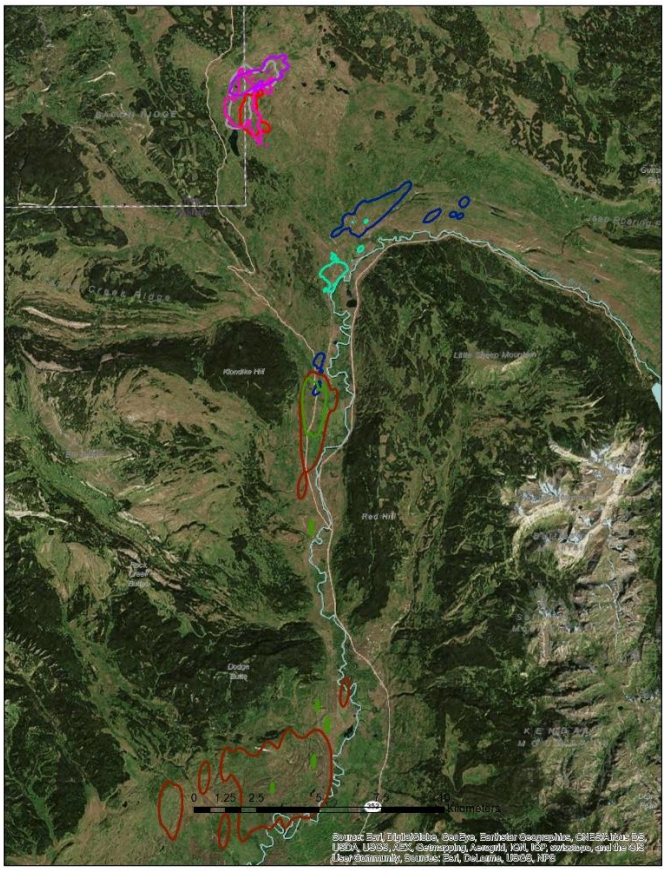

Figure 9. 95% Kernel density estimates from sage-grouse during June-November in the Upper Green area of Bridger-Teton National Forest (western Wyoming 2014-2015). Each color represents a different individual. Brown, green and teal home ranges were estimated from data collected both 2014 and 2015, the remainder were estimated from one season's data.

Appendix 1. Capture records for sage-grouse in the Upper Green River Basin in western Wyoming during 2014-2015. Red indicates known mortality or slipped transmitter.

GPS ID	Sex	Capture Date	Capture Loc	Landowner	VHF
179	Female	8/10/2014	Elk Meadows(Lower)	BLM	Solar VHF
180	Female	8/10/2014	Elk Meadows(Upper)	BLM	Solar VHF
177	Female	8/11/2014	South 2 Buttes	BLM	Solar VHF
183A	Female	8/11/2014	South Zembo	BLM	Solar VHF
182	Female	8/13/2014	Noble Pasture	USFS	Solar VHF
189	Female	8/18/2014	Mosquito Lk	USFS	Solar VHF
181	Female	8/19/2014	Deer Hills	BLM	Solar VHF
184	Male	8/19/2014	Reed Ridge	BLM	Solar VHF
188	Female	8/19/2014	Big Bend	USFS	Solar VHF
174	Female	8/20/2014	Big Bend	USFS	Solar VHF
193	Female	8/20/2014	Big Bend	USFS	Solar VHF
190	Male	8/22/2014	O Bar Y	BLM	Solar VHF
187	Male	8/22/2014	Noble Pasture	USFS	Solar VHF
196	Male	8/24/2014	Mosquito Lk	USFS	Solar VHF
197	Male	8/24/2014	Mosquito Lk	USFS	Solar VHF
198	Female	8/24/2014	Mosquito Lk	USFS	Solar VHF
178	Male	8/24/2014	Coyote Gulch	USFS	Solar VHF
178	Female	8/26/2014	Muddy Bench	BLM	Solar VHF
183B	Female	11/6/2014	Billy Canyon	BLM	Solar VHF
030A	Female	12/23/14	Alkali Creek	BLM	Solar VHF
152A	Female	12/23/14	Alkali Creek	BLM	Solar VHF
201A	Male	12/23/14	Alkali Creek	BLM	Solar VHF
152B	Female	01/22/15	Alkali Draw	BLM	Battery VHF
122A	Female	01/22/15	Alkali Draw	BLM	Battery VHF
051A	Female	01/22/15	Alkali Draw	BLM	Battery VHF
131A	Female	01/28/15	Speedway/State section	BLM	Battery VHF
670A	Female	5/20/2015	Coyote Gulch	USFS	Battery VHF
530A	Male	5/20/2015	Coyote Gulch	USFS	Battery VHF
200A	Male	5/20/2015	Coyote Gulch	USFS	Solar VHF
091A	Male	5/20/2015	Coyote Gulch	USFS	Battery VHF
030A	Male	5/20/2015	Coyote Gulch	USFS	Battery VHF
162A	Female	6/5/2015	Coyote Gulch	USFS	Battery VHF
182A	Female	6/5/2015	Coyote Gulch	USFS	Battery VHF
062A	Male	9/22/2015	Mud Lake	USFS	Battery VHF
431A	Female	9/22/2015	Noble Pasture	USFS	Battery VHF
341A	Female	9/22/2015	Mosquito Lk	USFS	Battery VHF
010A	Female	9/24/2015	Noble Pasture	USFS	Battery VHF
312A	Female	9/24/2015	Noble Pasture	USFS	Battery VHF
001A	Female	9/24/2015	Mosquito Lk	USFS	Battery VHF
351A	Female	9/24/2015	Mosquito Lk	USFS	Battery VHF
321A	Male	9/25/2015	Noble Pasture	USFS	Battery VHF
070B	Female	9/25/2015	Noble Pasture	USFS	Battery VHF
051B	Female	11/16/2015	Blown Out	BLM	Battery VHF
070C	Female	11/16/2015	Blown Out	BLM	Battery VHF
121A	Male	11/16/2015	Blown Out	BLM	Battery VHF
241A	Female	11/16/2015	Desert Res	BLM	Battery VHF
022A	Male	11/16/2015	Desert Res	BLM	Battery VHF
292A	Female	11/16/2015	Desert Res	BLM	Battery VHF
301A	Female	11/17/2015	Alkali Creek	BLM	Battery VHF
333A	Male	11/17/2015	Alkali Creek	BLM	Battery VHF
391A	Female	11/17/2015	Alkali Creek	BLM	Battery VHF
480A	Female	11/17/2015	Alkali Creek	BLM	Battery VHF