Annual Interim Report: F19AP00849 Ungulate Movements and Spatial Ecology in Montana
Reporting Period: October 1, 2021 – September 30, 2022
State: Montana
Agency: Montana Fish, Wildlife and Parks

Background and Purpose

In 2019, Montana Fish, Wildlife and Parks (MFWP) Statewide and Regional Wildlife Program Managers identified two priority ungulate populations where movement data were needed to inform ungulate habitat management. The purpose of this project is to collect ungulate movement data in these two populations, the Devils Kitchen elk and Carbon County mule deer. This information will inform ungulate habitat and management decisions, and enhance the management of Montana's ungulate populations, their habitats, and the public's opportunity to enjoy them.

The primary information need for elk in the Devil's Kitchen area is to delineate current seasonal ranges and movement corridors, and document elk movements during the hunting seasons. The elk population far exceeds numerical population objectives, and recent observations regarding changing elk distributions and timing of seasonal movements has resulted in local conflict and controversy, challenging the community's ability to develop effective harvest and habitat management strategies. Recent elk GPS movement data do not exist in this area, and the only existing movement data are from VHF collars deployed in 1990, making decisions regarding elk habitat and harvest management challenging. Fine-scale location data will identify important seasonal habitats and movement corridors, as well as provide information regarding the timing of movements to refine harvest management strategies that maximize the effectiveness of harvest regulations in achieving harvest objectives in this area.

The primary information need for mule deer in Carbon County is to delineate current seasonal ranges and movement corridors, identify connections between this population and adjacent mule deer populations, and to better inform conservation and management of mule deer in this area. The recent detection of Chronic Wasting Disease (CWD) in the southern Carbon County area raises questions about movement patterns of mule deer in this area. No telemetry data have ever been collected for mule deer in this area, and seasonal observations of deer numbers suggest that a portion of the population is migratory. While summer ranges of these deer are unknown, local knowledge suggests that some of these deer migrate south into Wyoming where mule deer herds are infected with CWD, north into areas with higher-density, uninfected populations of mule deer and white-tailed deer in Montana, and west into higher-elevation areas in or near Yellowstone National Park (YNP). With an emphasis on reducing the spread of CWD, it is important to understand the movement patterns of these mule deer, and how their movements overlap with adjacent infected mule deer populations in Wyoming and presumably uninfected mule deer populations in Montana. Seasonal location and movement data will contribute to our knowledge of the potential avenues for CWD spread across this region of Montana and Wyoming.

Specific goals for this reporting period include:

1. Collect elk movement data in the Devils Kitchen area.
2. Capture and collar an additional 30 mule deer in southern Carbon County and continue mule deer movement data collection.

Location

The Devils Kitchen elk data collection is occurring in Cascade and Meagher Counties, and the Carbon County mule deer data is being collected in Carbon County, Montana.

Objective 1: *Collect elk movement data in the Devils Kitchen area.*

We used a combination of helicopter netgunning and chemical immobilization to capture 50 female elk in the Devil's Kitchen study area during February 2020 and 15 female elk during February 2021. During both capture operations, we collected blood samples to test for pregnancy and for disease surveillance, and we collected a tooth for aging animals. Blood serum was obtained from 49 of 50 elk in 2020 and from 15 of 15 elk in 2021. We estimated a pregnancy rate of 88% (n=49) in 2020 and 87% (n = 15) in 2021. Serum collected in 2020 was tested for antibodies of infectious agents including *Brucella abortus*, Bovine Herpes Virus (BHV-1 aka IBR), Anaplasmosis, Epizootic Hemorrhagic Disease (EHD), Bluetongue Virus (BTV), Parainfluenza-3 (PI3), Leptospirosis (5 serovars), Bovine Respiratory Syncytial Virus (BRSV), and Bovine Viral Diarrhea I and II (BVD I and II). A positive result on these serological tests indicates exposure to an infectious agent but does not confirm infection status. All elk tested negative for exposure to *Brucella abortus*. Results from serological testing were generally similar to other herds in Montana. None of the elk tested had evidence of exposure to BTV, BRSV, or BVD I and II. Elk showed evidence of exposure to BHV (n=1, 2.0%), Anaplasmosis (n=40, 81.6%), EHD (n=1,2.0%), Leptospirosis (n=3, 6.1%) and Parainfluenza-3 (n=48, 98.0%). Exposure to Anaplasmosis and PI3 is quite variable among elk herds in Montana, but high seroprevalence is not uncommon. Serum collected in 2021 was tested for antibodies of *Brucela abortus* only, and all elk tested negative for exposure. Elk ages ranged from 1.5 to 17.5 (mean = 6.5) in 2020 and from 2.5 to 9.5 (mean = 6.5) in 2021.

Each elk was outfitted with a Lotek LiteTrack collar programmed to collect hourly locations until February 2023. Location data are uploaded daily through the Iridium satellite service. Collars transmit a mortality notice if the collar is stationary for more than 10 hours. We have gathered 1,015,857 locations from 65 individuals in the Devil's Kitchen study area (Figure 1) for an average of 15,629 (range = 214-22,003) locations per individual. We have recovered collars from 16 mortalities in the area and an additional 6 collars have malfunctioned for unknown reasons. We are currently monitoring 43 female elk in the area. The core of the elk winter range was located on the Beartooth Wildlife Management Area and nearby private ranchlands in the center of the study area (Figure 2). In spring (Figure 3) and summer (Figure 4), elk dispersed eastward to summer ranges. During fall, many elk dispersed westwards toward winter range (Figure 5).

Preliminary estimates of seasonal ranges (Figures 6 and 7) and movement corridors (Figure 8) were compiled using two full years of data collection (2020-2022) and will be finalized when data collection is complete. This information was synthesized from GPS location data using the Migration Mapper application (Merkle et al. 2022) to visually classify migratory behaviors and movement periods using maps of GPS locations and associated net-squared displacement (NSD) curves for each individual. We used kernel density estimates (KDE) to delineate seasonal range distributions and population-level movement corridors were outlined using two variations of the Brownian bridge movement model (Horne et al. 2007).

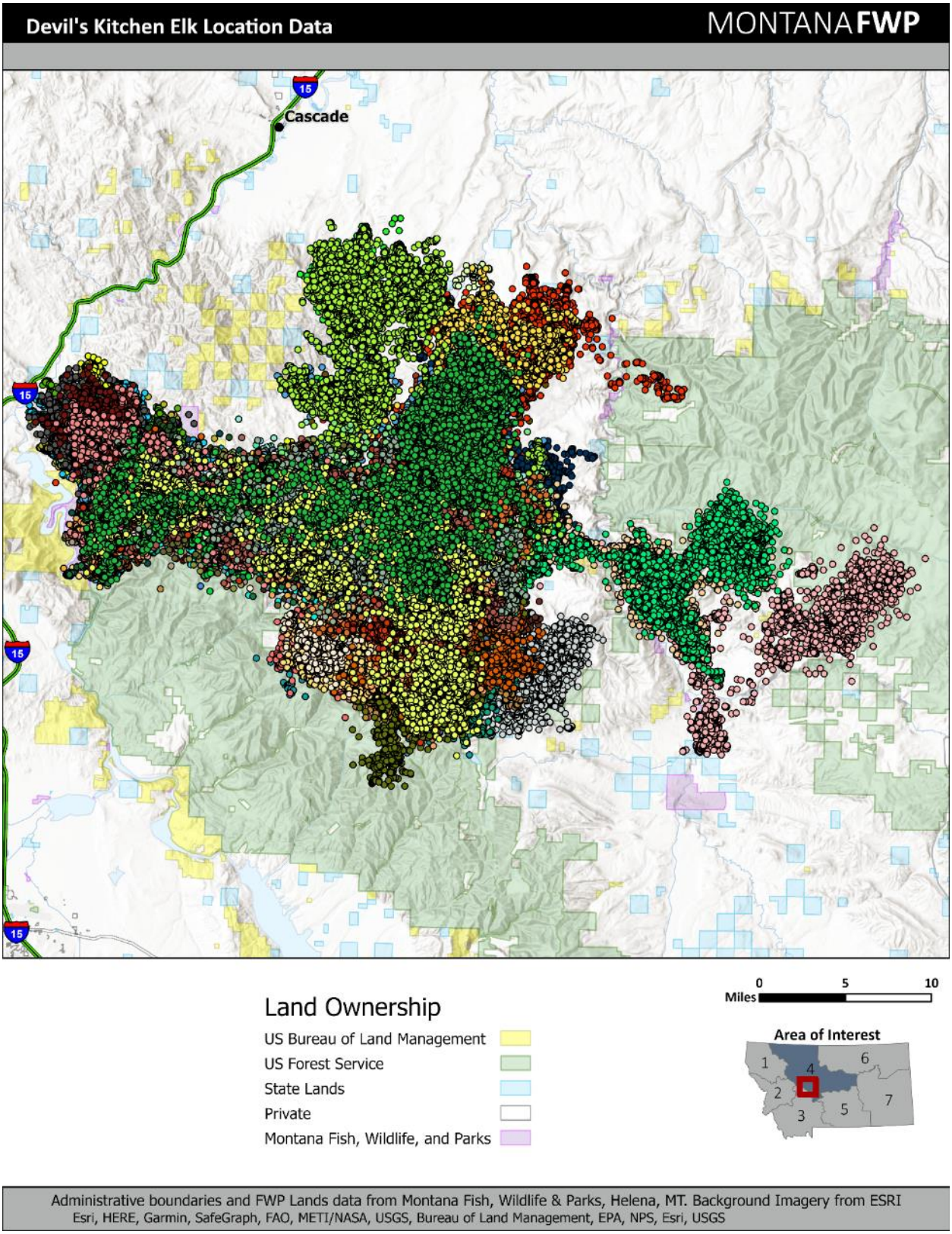

Figure 1. Location data collected from 65 collared female elk in the Devil's Kitchen area northeast of Helena, MT (January 2020-September 2022).

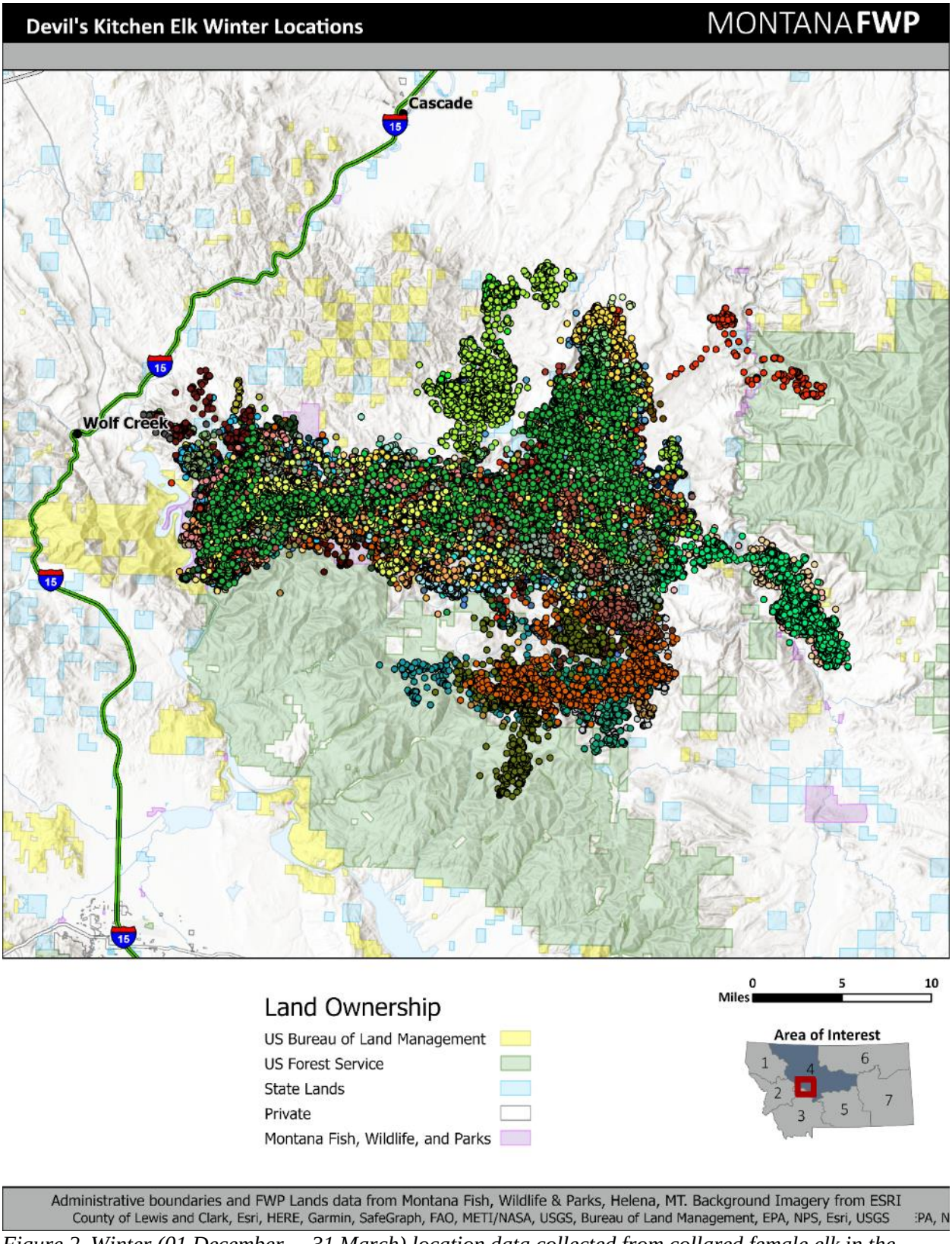

Figure 2. Winter (01 December – 31 March) location data collected from collared female elk in the Devil's Kitchen area northeast of Helena, MT (2020-2022).

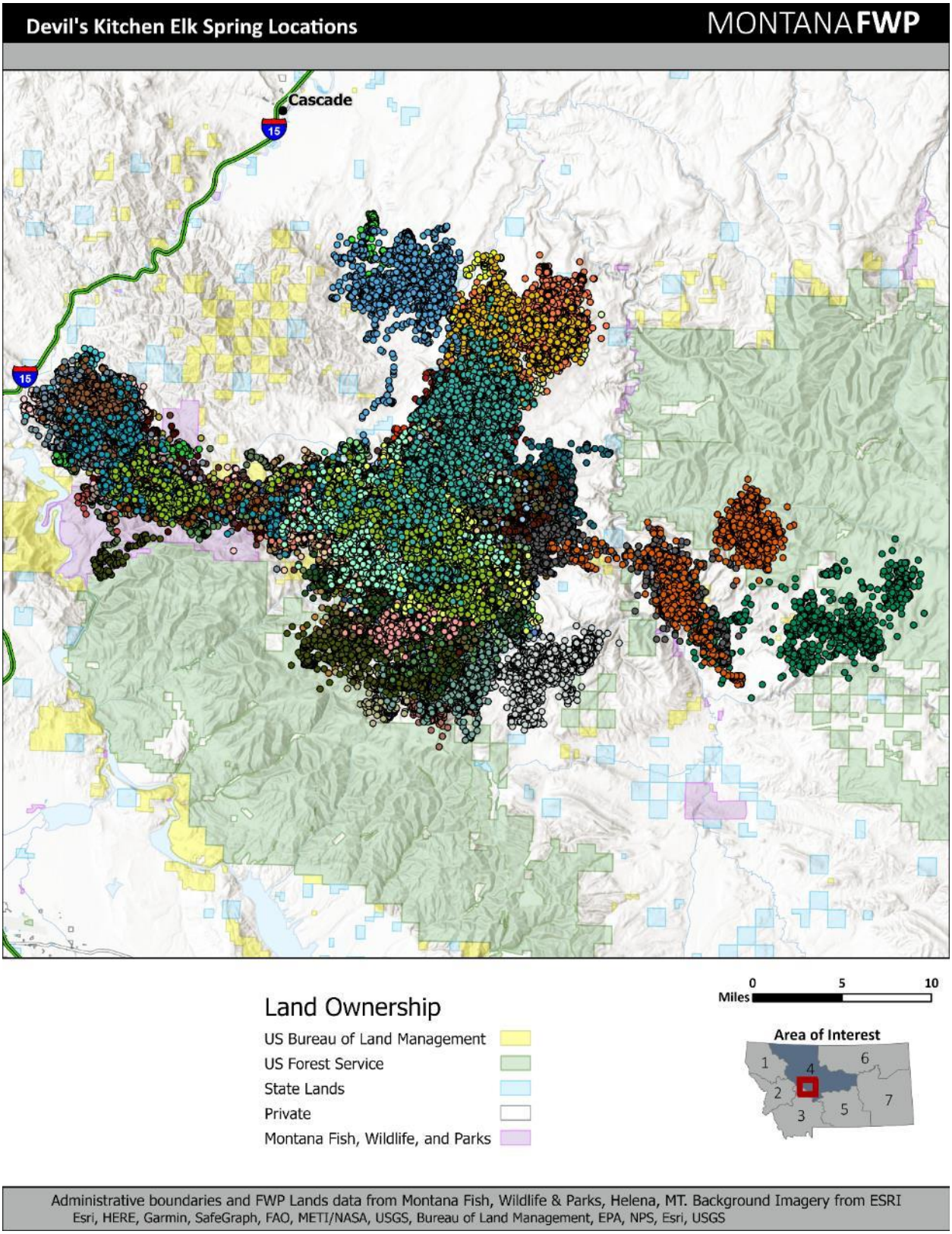

Figure 3. Spring (01 April – 30 June) location data collected from collared female elk in the Devil's Kitchen area northeast of Helena, MT (2020- 2022).

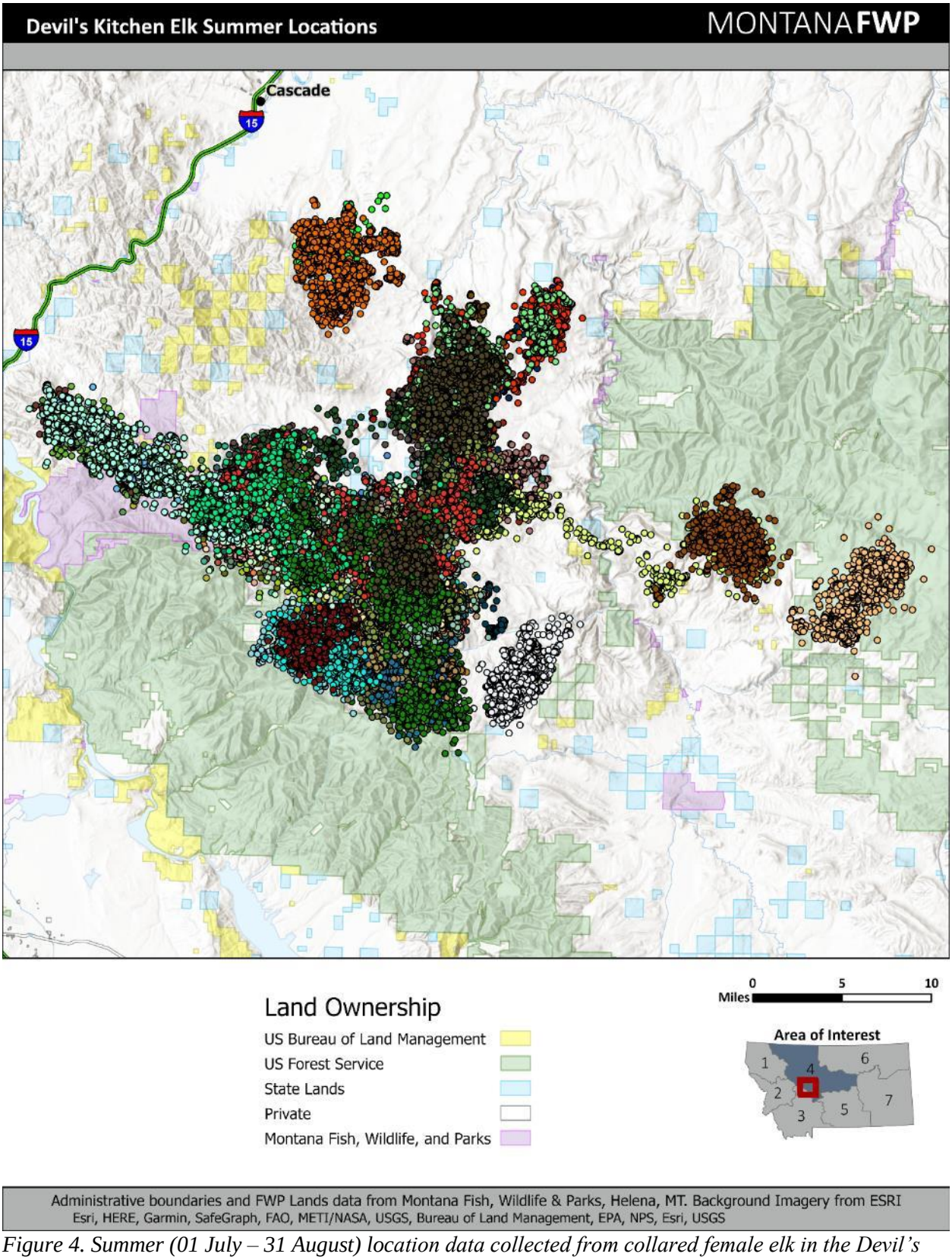

Figure 4. Summer (01 July – 31 August) location data collected from collared female elk in the Devil's Kitchen area northeast of Helena, MT (2020-2022).

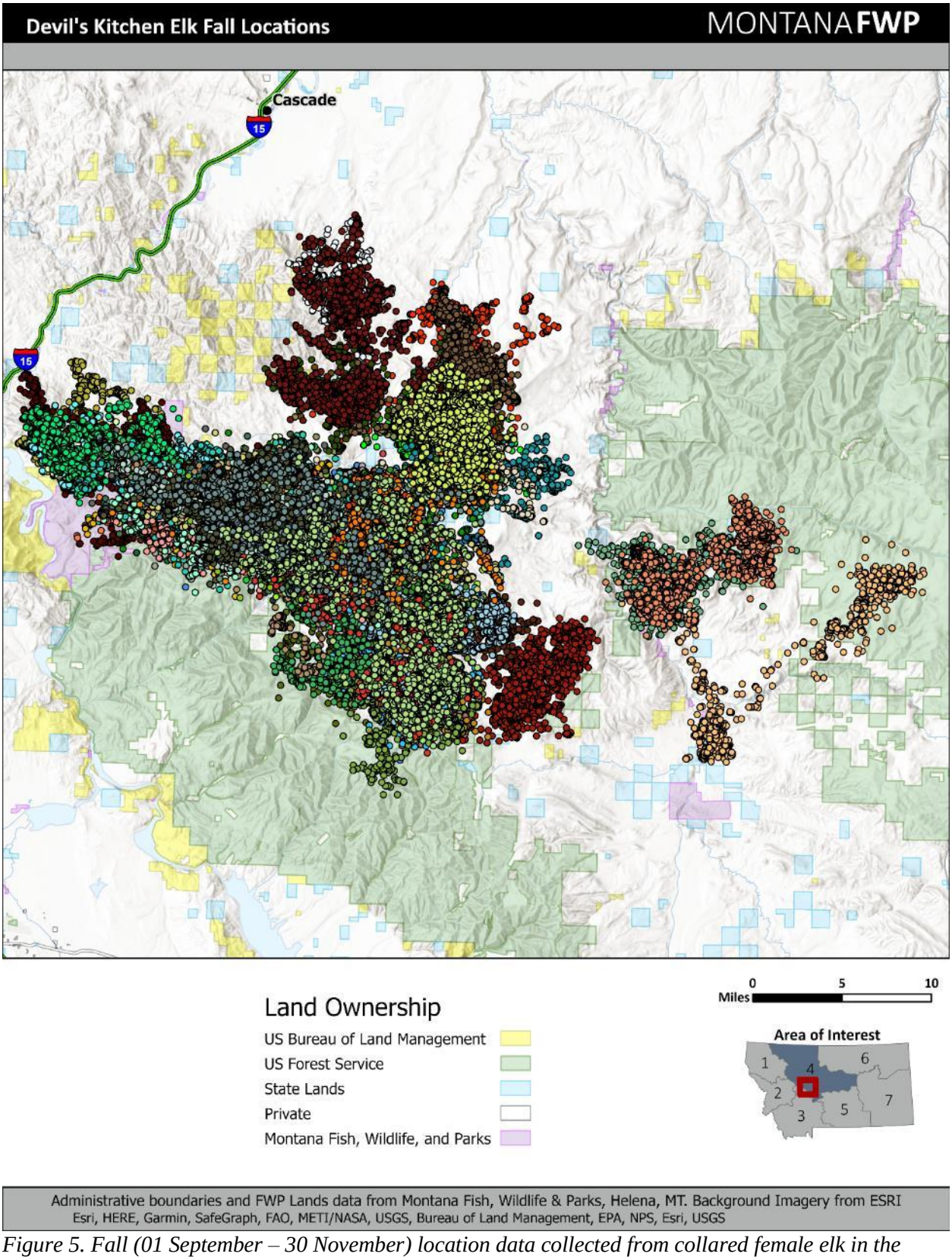

Figure 5. Fall (01 September – 30 November) location data collected from collared female elk in the Devil's Kitchen area northeast of Helena, MT (2020-2022).

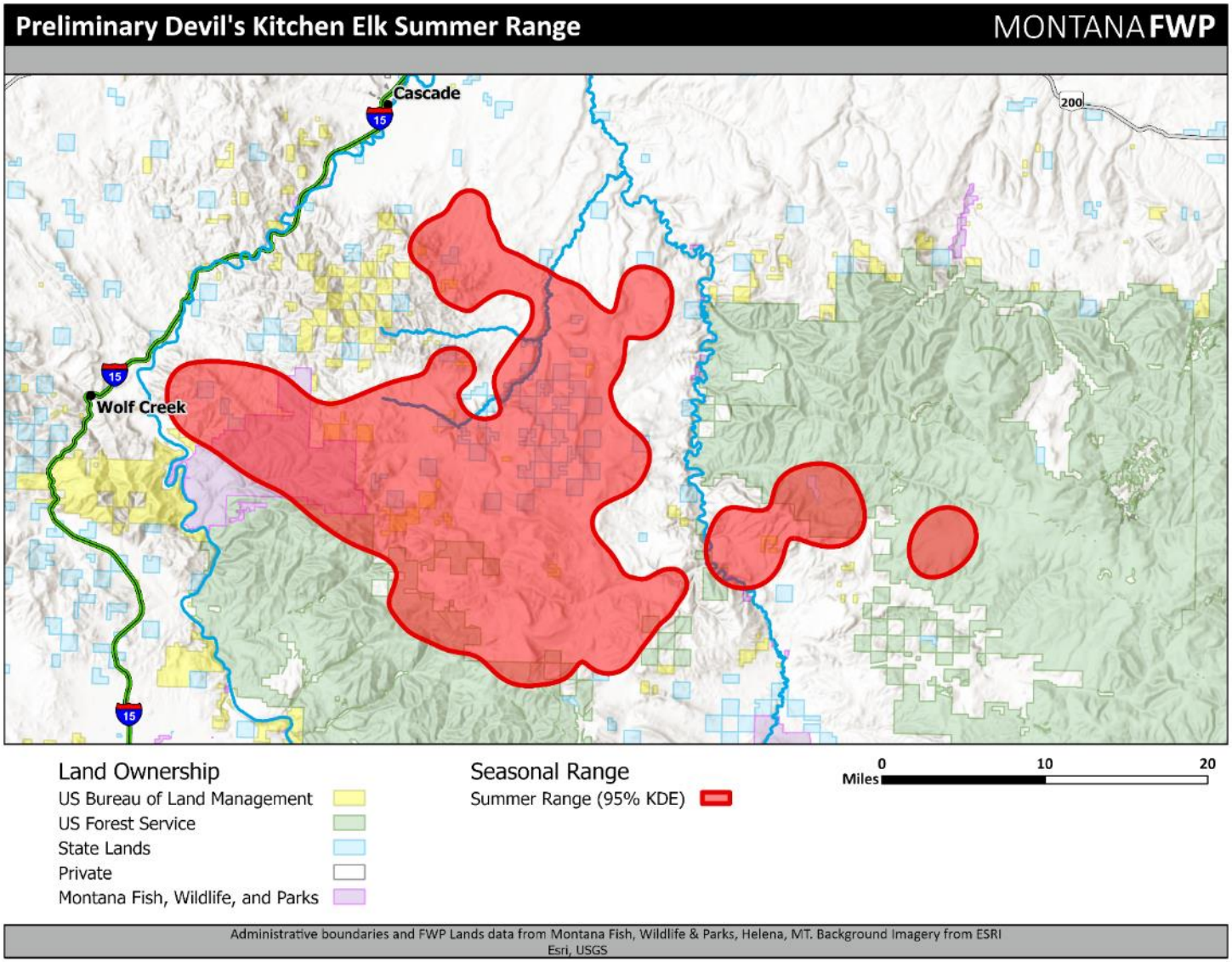

Figure 6. Estimated summer range for elk collared in the Devil's Kitchen area based on locations gathered through May 2022. Seasonal ranges were delineated using 95% kernel density estimates (KDE).

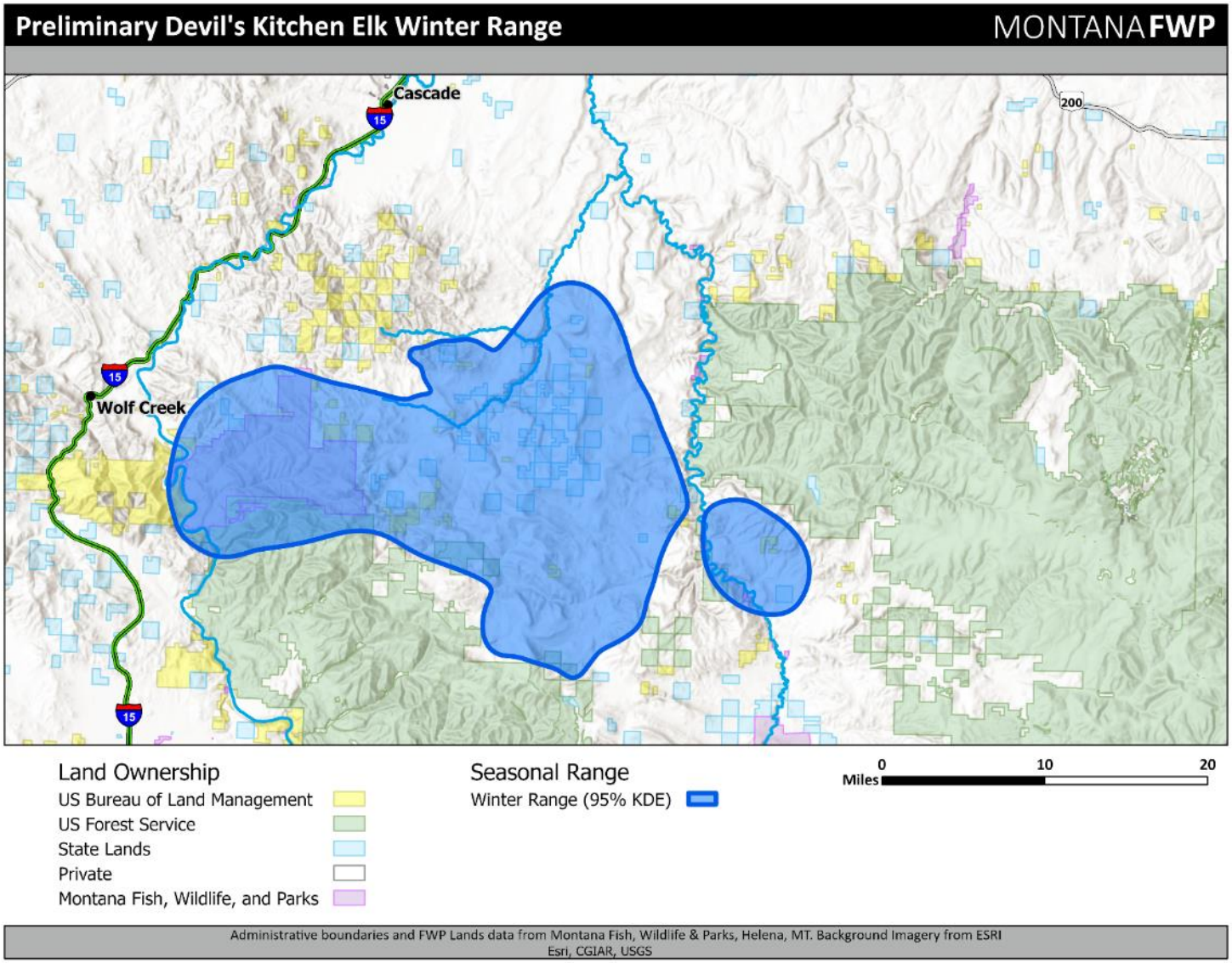

Figure 7. Estimated winter range for elk collared in the Devil's Kitchen area based on locations gathered through May 2022. Seasonal ranges were delineated using 95% kernel density estimates (KDE).

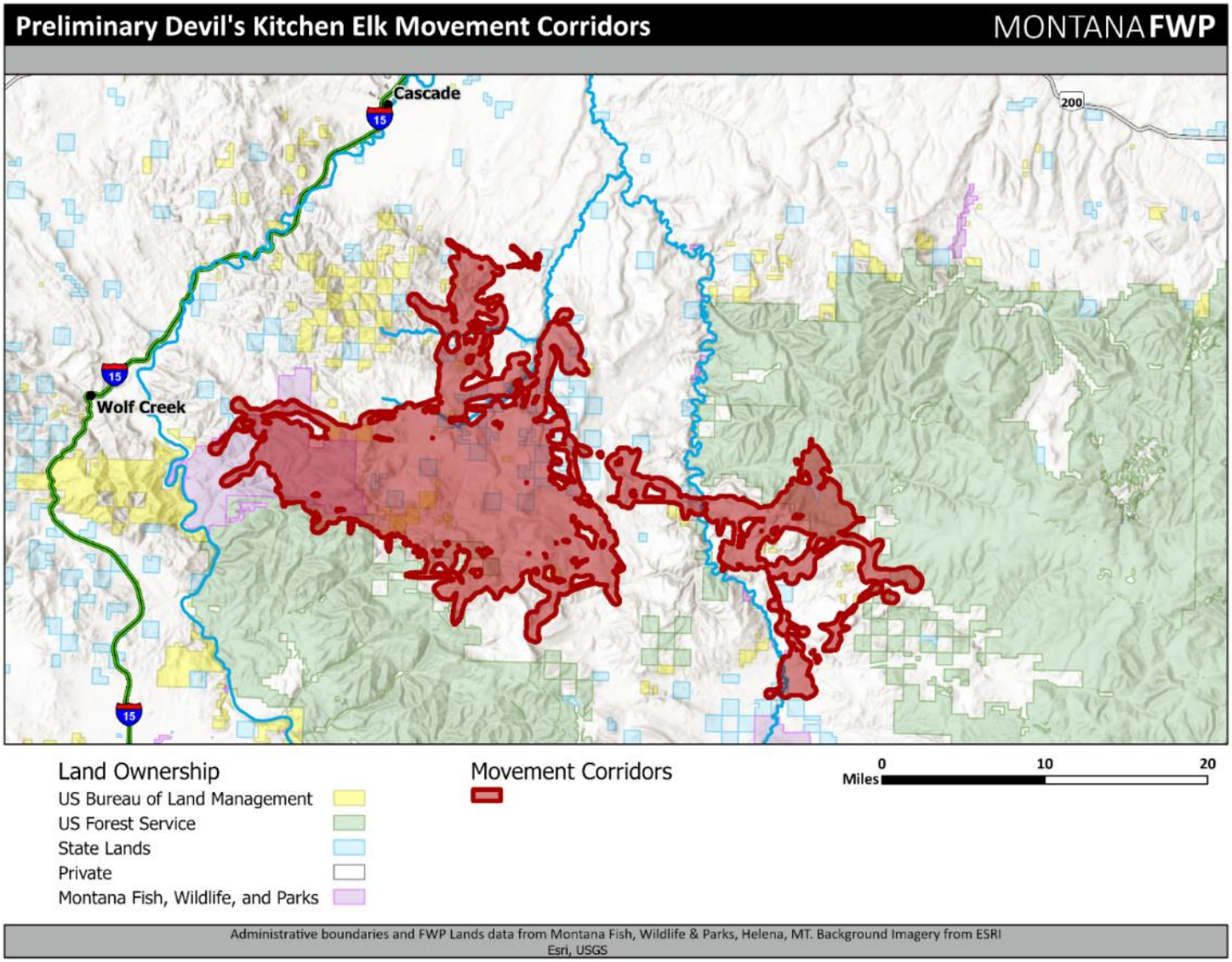

Figure 8. Movement corridors delineated for elk collared in the Devil's Kitchen area based on locations gathered through May 2022. Corridors were constructed using the Migration Mapper application and Brownian bridge movement models.

Movement data from the Devil's Kitchen area reinforces local reports of a seasonally occurring migratory behavior exhibited by a portion of this population. This movement takes place between the Beartooth Wildlife Management Area (BWMA) and private ranchlands in the valley bottom, with movements onto the BWMA occurring most often in the late fall and early winter months. Seasonal migratory movements occur in other portions of the study area as well. We have also observed movement patterns that appear typical of resident animals dispersed throughout the study area. Individual elk land use in the Devil's Kitchen area shows high proportional use of private lands across all seasons with an increase in proportional use of the BWMA in the fall and winter (Figure 9).

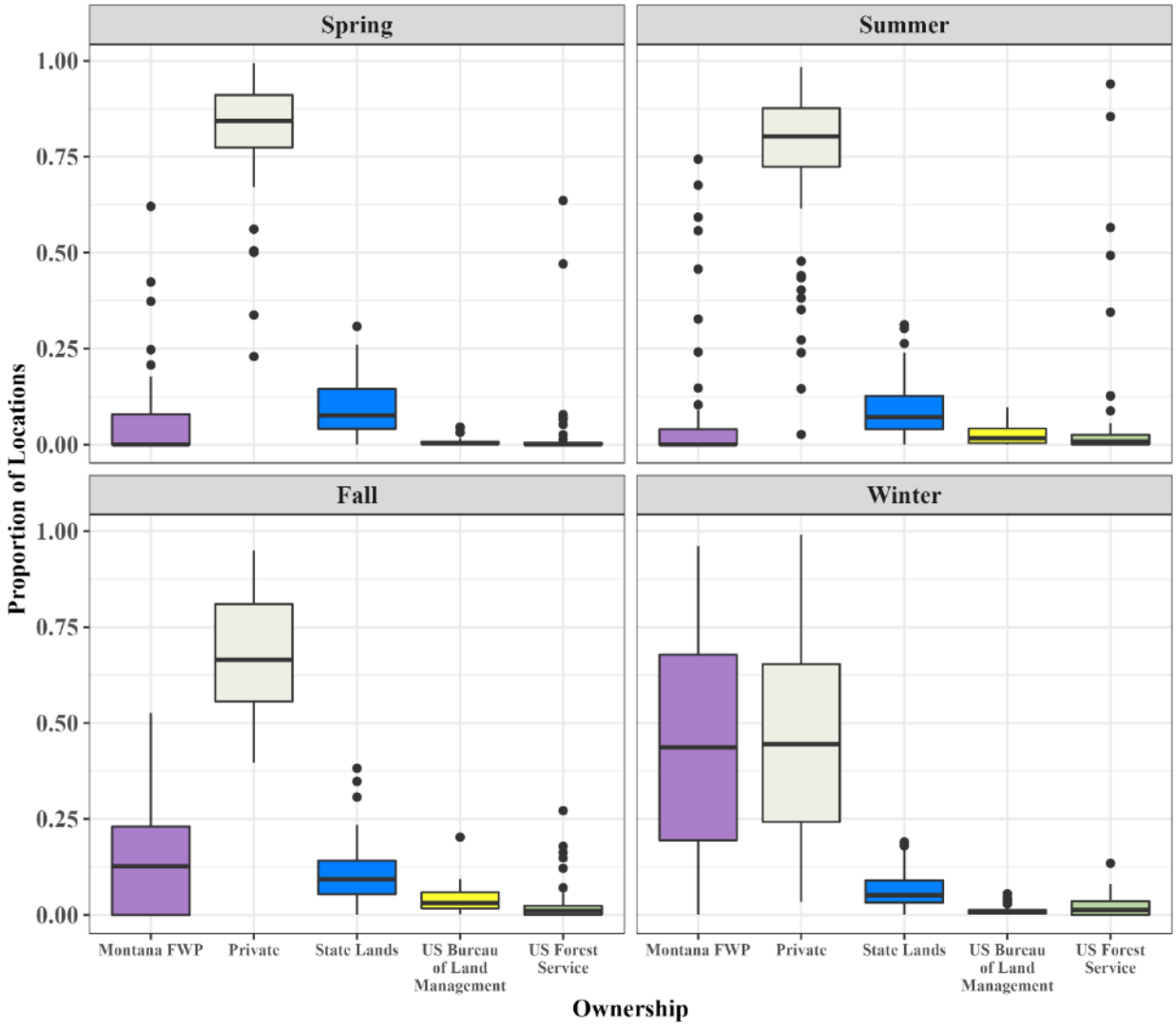

Figure 9. The proportion of individual elk locations occurring on Montana Fish, Wildlife and Parks, Montana State Trust, Private, Bureau of Land Management and Forest Service lands during winter, spring, summer, and fall. The median proportional land use across all individuals in a given season is shown by the horizontal black bar. Outlying points are shown by black dots. Montana State Trust and BLM lands in this study area are mostly inaccessible to the public.

Objective 2: ***Capture and collar an additional 30 mule deer in southern Carbon County and continue mule deer movement data collection.***

We used helicopter netgunning to capture 49 female and 21 male mule deer in the Carbon County study area during winters of 2020 and 2021 (Figure 10). Each mule deer was outfitted with a Lotek LiteTrack collar programmed to collect locations every 2-hours for 3-years. Location data are uploaded daily through the Iridium satellite service. Collars transmit a mortality notice if the collar is stationary for more than 6 hours.

As of October, 2022, 24 of 49 female and 3 of 21 male deer remained alive with functioning collars for continued movement monitoring.

Figure 10. Net-gunning mule deer in the Carbon County study area, January, 2021. Photo by Shawn Stewart.

We have collected a total of 355,600 GPS locations from collared mule deer to date (Figures 11, 12). Mule deer were captured on winter range within 1–4km of the Clark's Fork of the Yellowstone River near Belfry, Montana and south to the Wyoming border. In the subsequent summers of 2020–2022, mule deer in this population were partially migratory. Some deer remained resident in the same area with overlapping winter and summer ranges (Figure 11, 12, 13). However, many others migrated to distinct summer ranges, predominately to the west and northwest, with the longest migrations being approximately 40–45km straight-line distance (Figure 11, 12, 13). Generally, there was no clear distinction in migration patterns between males and females. There appeared to be variation in the proportionate use of migration paths, such that some areas were used by a single deer while others by multiple deer during migration (Figure 13).

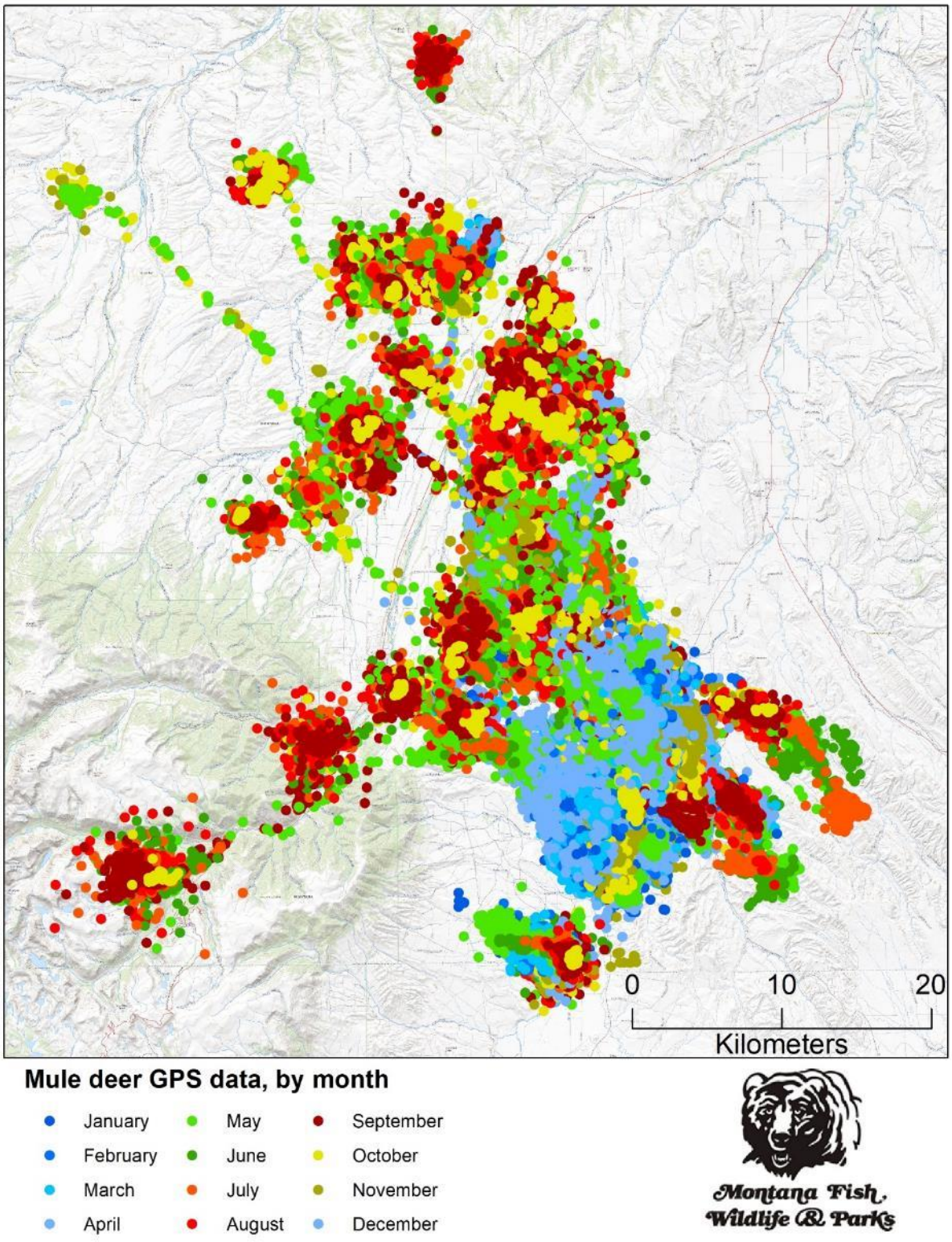

Figure 11. GPS location data spanning March 2020–October 2022, color-coded by month, collected from collared 49 female and 21 male mule deer in the Carbon County study area, near Red Lodge, MT.

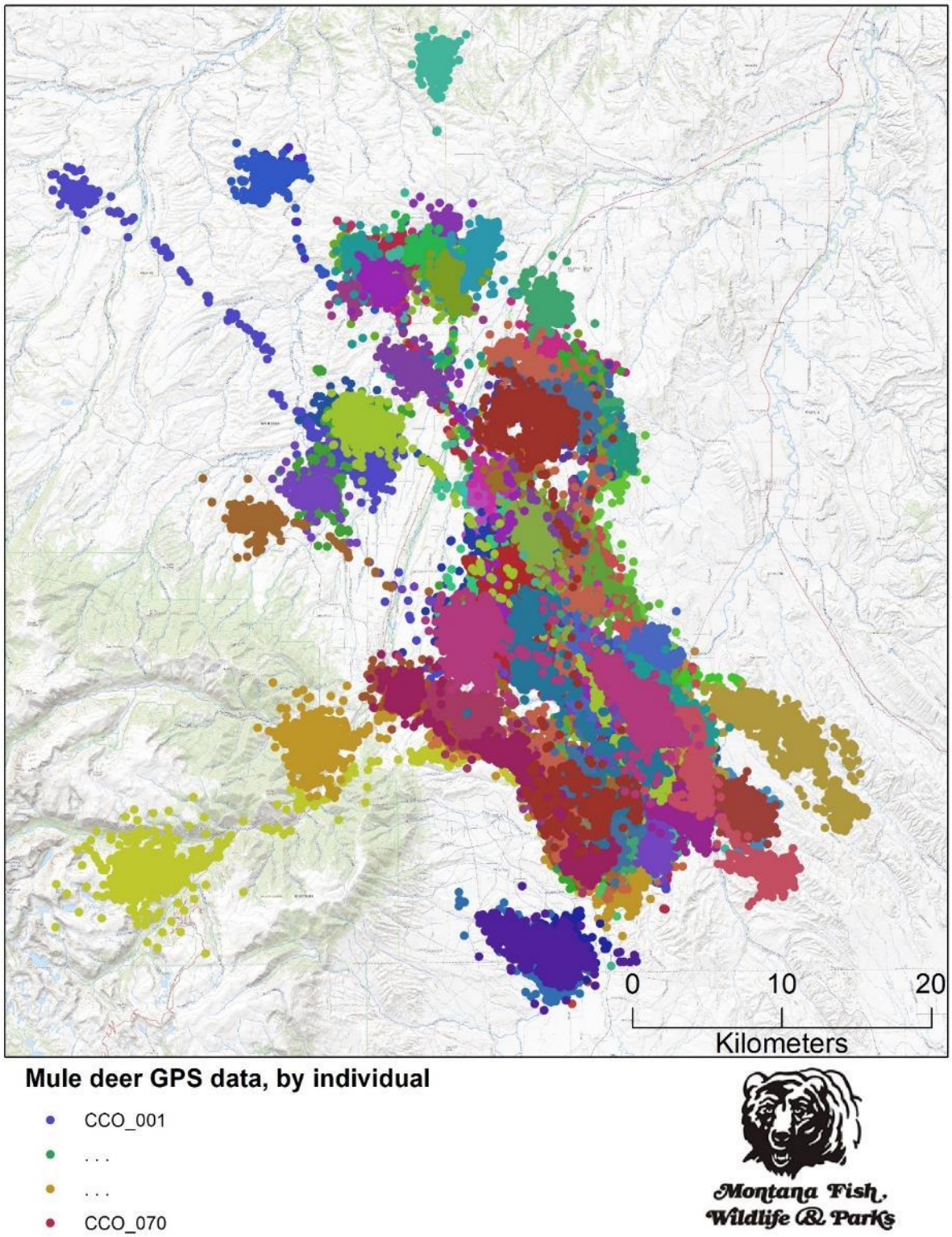

Figure 12. GPS location data spanning March 2020–October 2022, color-coded by individual deer, collected from collared 49 female and 21 male mule deer in the Carbon County study area, near Red Lodge, MT.

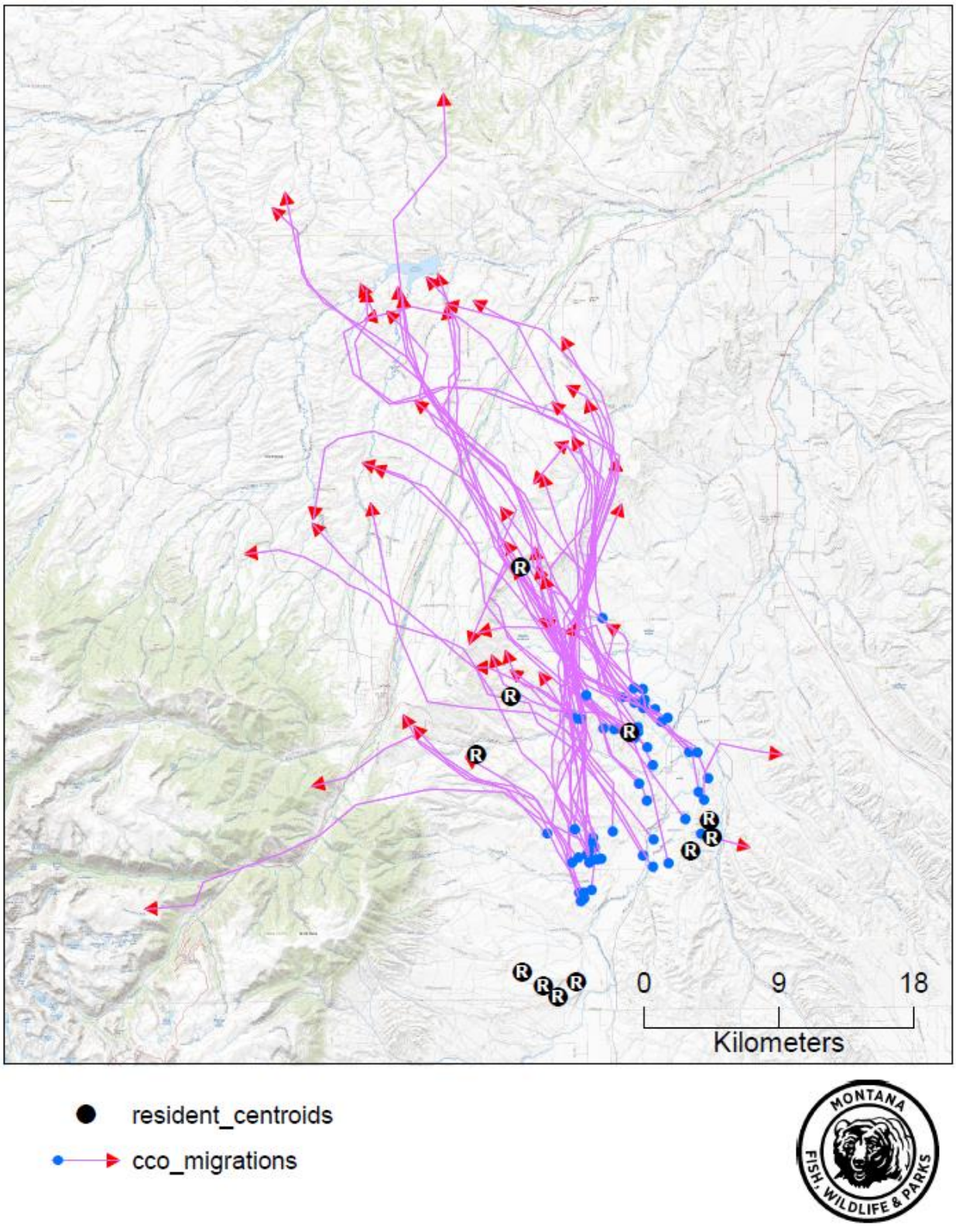

Figure 13. Hand-sketched (informal) spring migration paths following mule deer GPS location data, March 2020–December, 2021, in the Carbon County study area, near Red Lodge, MT. Summer range centroids for deer that did not migrate are shown in black dots, labelled "R".