Targeted Elk Brucellosis Surveillance Project
2021 Post-Capture Report
Horseshoe Hills & Ashland

BRUCELLOSIS SURVEILLANCE

To increase understanding of brucellosis in elk herds, MFWP initiated a targeted elk brucellosis surveillance project in 2011. Sampling efforts are focused on 1 – 2 elk herds every year. Elk in targeted herds are captured and sampled to evaluate the prevalence and spatial extent of brucellosis exposure in elk herds. GPS radio collars are deployed on a subset of elk to document elk movements, the extent of spatial overlap with livestock, and interchange between elk herds. Elk capture and sampling efforts for the project occurred January 27th through February 1st in the Ashland area (HD704) and February 25-27th in the Horseshoe Hills (HD312; Figure 1).

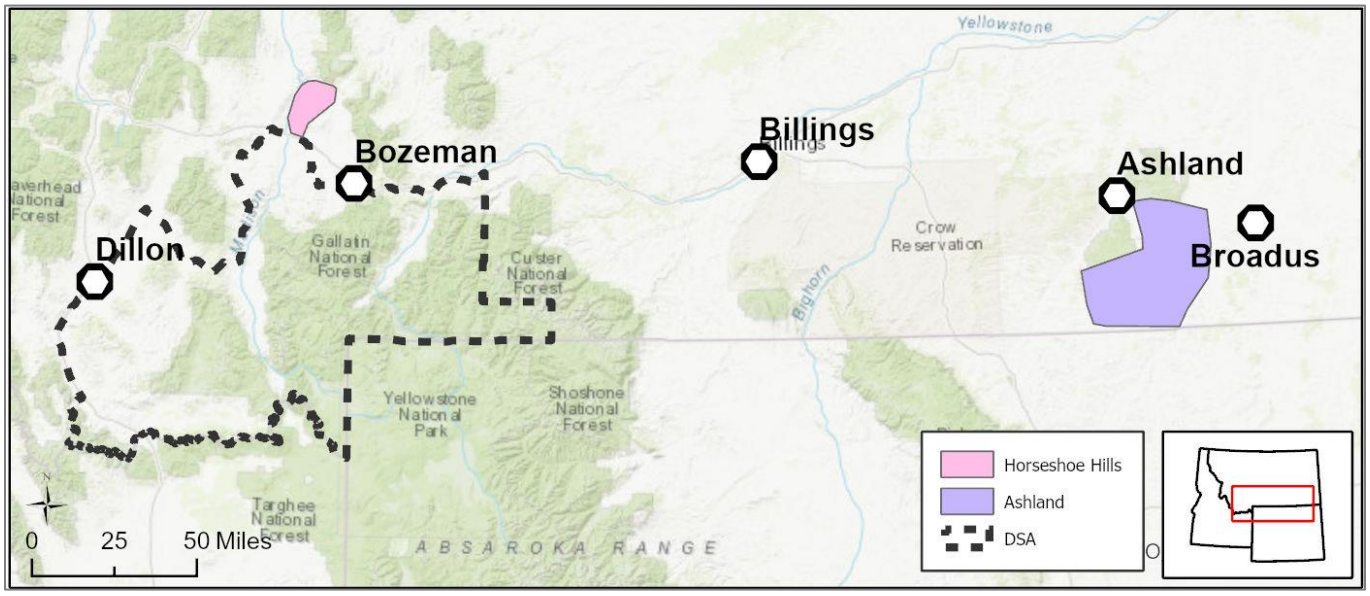


Figure 1. Elk brucellosis surveillance was conducted in the Horseshoe Hills (HD312) and Ashland area (HD704). The Montana Department of Livestock brucellosis designated surveillance area (DSA) is shown as a black dotted line.

Horseshoe Hills

A total of **100 female elk** were captured and sampled in the Horseshoe Hills study area (HD312) from February 25-27th (Figure 2). During captures, we obtained blood serum samples from 100 female elk for brucellosis testing. Of these, **0 tested seropositive for exposure to brucellosis**, giving the herd an estimated seroprevalence of 0 (95% confidence interval:0 - 0.037; Table 1).

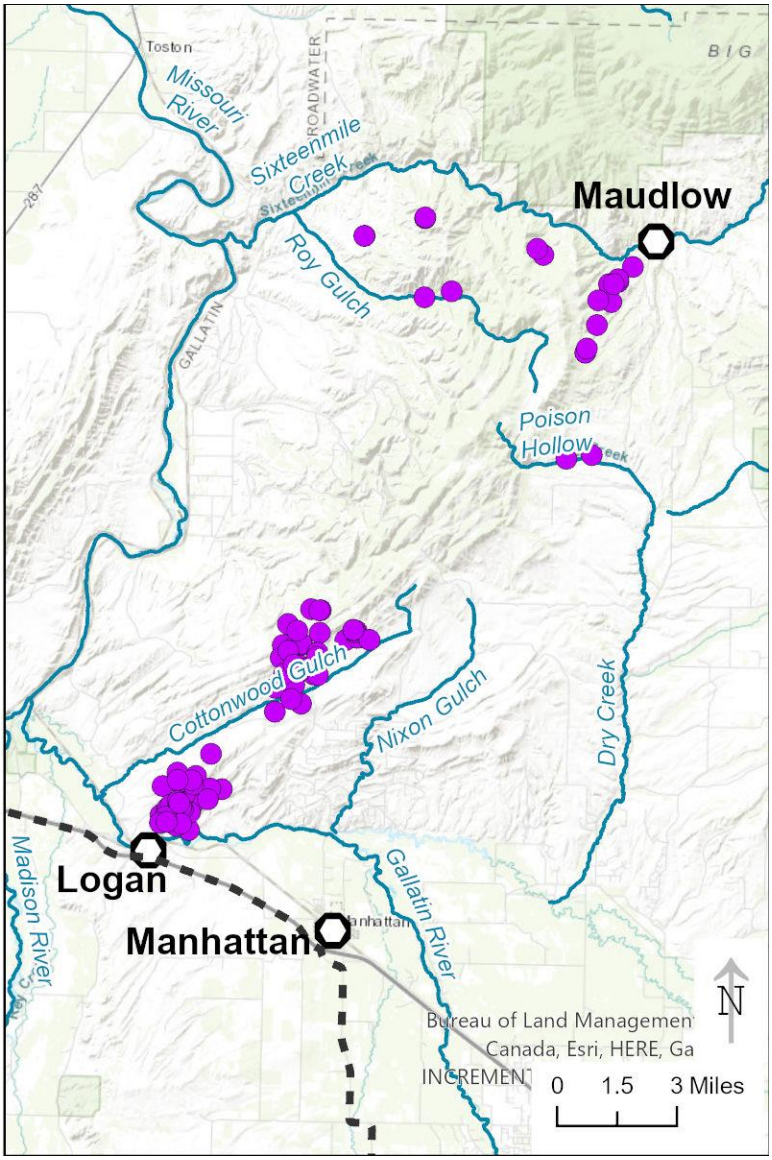


Figure 2. Capture locations of elk in the Horseshoe Hills north of Manhattan, MT during February 2021.

Of the captured animals, 29 female elk were fitted with GPS collars programmed to collect hourly locations for the next year (Figure 3). An automatic release mechanism will drop the collars for retrieval on 5/2/2022. Blood serum from 29 of these collared females was available to submit for pregnancy testing and blood serum from 28 was available to submit for a full serology screening to look at exposure to different diseases. We collared 2 female yearlings, of which 1 was pregnant. Of the 27 adult females collared and sampled for pregnancy, 24 were classified as pregnant based on the level of PSPB (a pregnancy-specific protein which is released in higher quantities when a fetus is present) found in their blood. The percentage of pregnant adults in the Horseshoe Hills study area (89%) is slightly above the state-wide average (86%).

We estimated a body condition score for 29 females based on manual inspection of the spine and hips to estimate fat deposits. Body condition scores can range from 1 (very poor) to 5 (very high). We also measured the maximum rump fat thickness in centimeters (Maxfat) of these 29 females using a portable ultrasound. The average body condition score was 3.8 (range:3.25 - 4.25). Maxfat measurements averaged 0.61 cm (range: 0.24 - 1.09), coming in below the state-wide average of 0.73 cm. Using well-established relationships (Cook et al. 2010, Cook et al. 2013), we also estimated the percent ingesta-free body fat (IFBF). The average IFBF value for the 29 sampled females in the Horseshoe Hills study area was 7.54%, similar to the state-wide average of 7.79%.

Serology

Blood serum samples from 28 adult female elk were assayed for evidence of exposure to pathogens including *Brucella abortus*, Anaplasma bacteria, Leptospirosis, parainfluenza-3 (PI-3), bovine respiratory syncytial virus (BRSV), bovine viral diarrhea type 1, bovine viral diarrhea type 2 (BVD 1 and 2), bovine herpesvirus-1 (BHV-1), and epizootic hemorrhagic disease. These pathogens were selected for screening because of their potential to influence individual or herd health in wildlife and/or livestock. All assays were conducted by the Montana Veterinary Diagnostic Laboratory (MVDL; Bozeman, Montana) except for EHD which was conducted by National Veterinary Services Laboratories (NVSL; Ames, Iowa).

Serology Results

Evidence for exposure varied by pathogen (Table 1). We found no serological evidence of exposure to *B. abortus*, leptospirosis, BRSV, BVD-1, BVD-2 or EHD. We did find evidence of exposure to Anaplasma (96% seroprevalence), PI-3 (100% seroprevalence), and BHV-1 (18% seroprevalence). A brief description of each pathogen and its influence (if known) on individual or herd health can be found below.

Table 1: Seroprevalence of brucellosis (BRUC), anaplasmosis (ANAPL), leptospirosis (LEPTO), parainfluenza-3 (PI3), bovine respiratory syncytial virus (BRSV), bovine viral diarrhea type 1 (BVD 1), bovine viral diarrhea type 2 (BVD 2), bovine herpesvirus-1 (BHV-1), and epizootic hemorrhagic disease (EHD) based on serological screening of adult female elk in the Horseshoe Hills study area during the winter of 2021.

Statistic	BRUC	ANAPL	LEPTO	PI3	BRSV	BVD-1	BVD-2	BHV-1	EHD
# Sampled	28	28	28	28	28	28	28	28	28
# Exposed	0	27	0	28	0	0	0	5	0
% Exposed	0	96	0	100	0	0	0	18	0

Brucellosis

Brucellosis is an infectious disease caused by the *Brucella abortus* bacterium affecting some elk herds in the Greater Yellowstone Area. The presence of this disease in Montana elk herds is primarily a concern because infected elk can act as a reservoir for transmission to livestock. Naive elk and cattle may experience a high rate of abortion (Thorne et al. 1978); however, brucellosis is not considered a direct threat to the sustainability of elk herds in Montana. We found no serological evidence of exposure to *B. abortus* in female elk sampled in the Horseshoe Hills study area.

Anaplasmosis

Anaplasmosis, a sickness caused by bacteria of the genus *Anaplasmaisa*, is a vector-borne disease primarily affecting domestic cattle. *Anaplasma marginale*, the species most commonly involved with infections in cattle, affects red blood cells resulting in severe anemia and sometimes death. Elk are susceptible to Anaplasma infection; however, serious clinical signs have not been recorded and there is little evidence suggesting elk are important carriers or reservoirs of the disease (Kuttler 1984; Zaugg et al. 1996). We found serological evidence of exposure to Anaplasmosis in 96% of female elk sampled in the Horseshoe Hills study area. However, the specific Anaplasma species the elk were exposed to are unknown, because the test detects antibodies for multiple species. This pathogen is not expected to impact individual or herd health in elk.

Leptospirosis

Leptospira spp. are a group of several closely related bacteria that can infect nearly all mammals. Infection varies in severity from asymptomatic to fatal depending on the host and the serological variant of Leptospira. Naturally occurring Leptospira infections in wildlife are usually asymptomatic, but may result in renal failure, lysis of red blood cells, fever, inappetence, hemorrhages on mucous membranes, jaundice, dehydration, infertility, abortion, stillbirths, or weakened neonates. Leptospira infection is generally not considered to be of concern in herds of free-ranging elk, but has been widely studied in wildlife due to the possibility of transmission to domestic livestock (Thorne et al. 2002). Leptospira spp. infection may cause some mortality; however, clinical disease in wildlife is rare and not likely a major limiting factor in free-ranging elk herds (Thorne et al. 2002). We found no serological evidence of exposure to Leptospira spp. in female elk sampled in the Horseshoe Hills study area.

Parainfluenza-3

Parainfluenza-3 is a common virus that can be involved in respiratory disease in domestic ungulates. The disease associated with PI-3 is usually mild or subclinical, but under severe stress, the virus may predispose animals to coinfection with other respiratory pathogens resulting in development of secondary bacterial pneumonia. It is unknown whether exposure to this virus leads to clinical symptoms in free-ranging elk (Barber-Meyer et al. 2007). Evidence of exposure on serological testing is common in wildlife, but documented clinical cases of disease are not. We found a seroprevelance of 100% in female elk sampled in the Horseshoe Hills study area; however, exposure to this virus is not expected to impact individual or herd health.

Bovine respiratory syncytial virus

Bovine respiratory syncytial virus can be a primary pathogen causing varying degrees of pneumonia, especially in young calves. Disease is often most severe when secondary bacterial infection occurs. Elk are susceptible to infection by the virus, which is most likely transmitted from cattle; however, serious clinical symptoms may not occur in wild elk (Barber-Meyer et al. 2007). We found no serological evidence of exposure to bovine respiratory syncytial virus in female elk sampled in the Horseshoe Hills study area.

Bovine viral diarrhea (types 1 & 2)

Bovine viral diarrhea virus (types 1 & 2) can cause bloody diarrhea and can induce immunosuppression resulting in development of secondary bacterial pneumonia in domestic and wild ungulates. The different types (1 & 2) reflect differences in the antigens found on the viral surface protein and do not relate to the virulence of the virus. Elk are susceptible to infection with BVD, but there is little evidence of serious clinical effects (Tessaro et al. 1999). There is potential for wildlife herds to serve as reservoirs of this virus (Duncan et al. 2008). We found no serological evidence of exposure to BVD type 1 or BVD type 2.

Bovine herpes virus-1

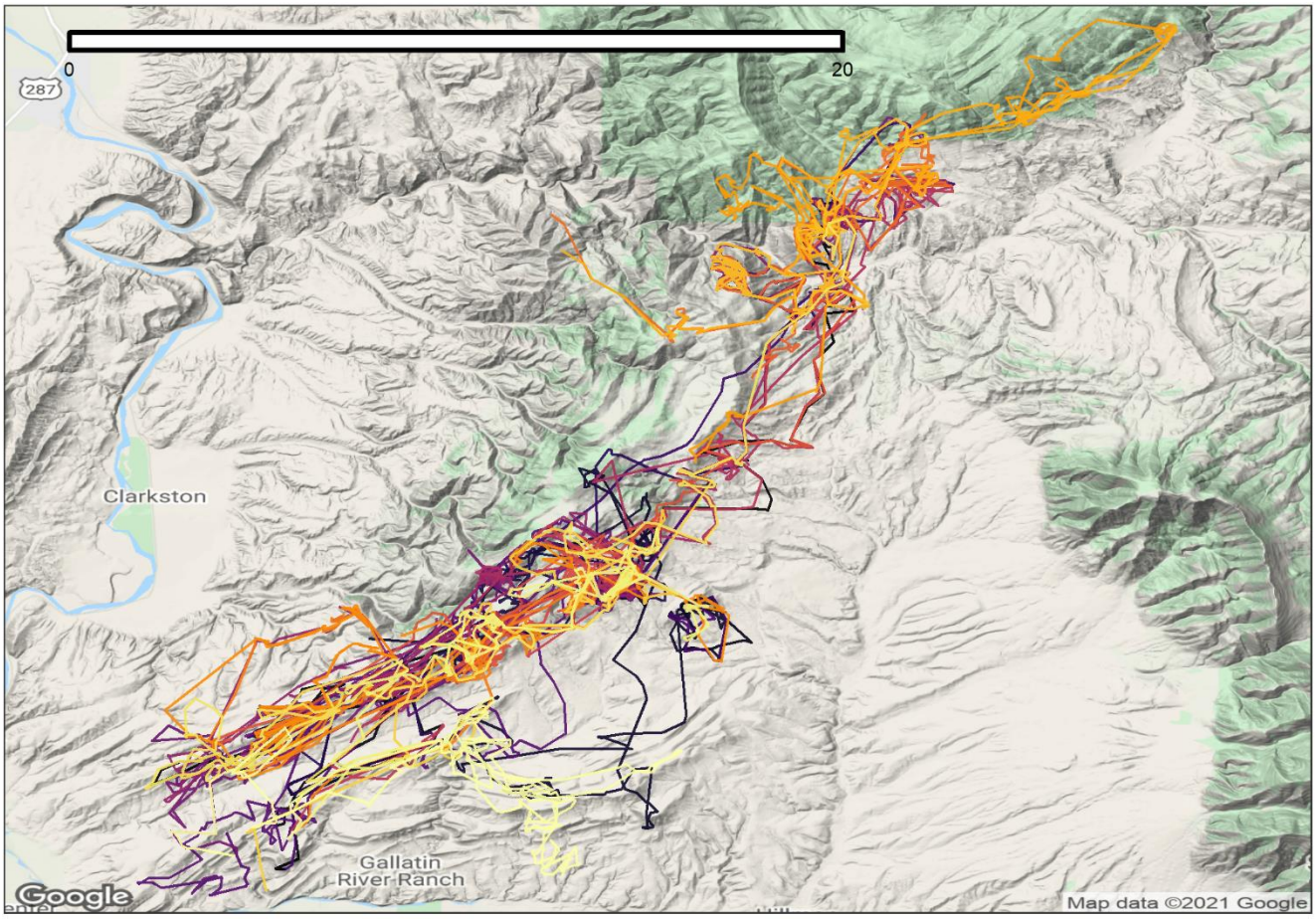
Bovine herpes virus-1 is a common virus in cattle and can cause rhinotracheitis, fever, conjunctivitis, a drop in milk production, abortion, encephalitis, and lesions of the mucous membranes of the genital tract. The virus is transmitted most effectively by respiratory infections (Wentink et al. 1993). While most BHV-1 infections in cattle are mild, the virus can predispose animals to secondary bacterial pneumonia. BHV-1 can undergo long periods of latency before being reactivated, when it can again be shed and infect new hosts. We found serological evidence of exposure to Bovine herpes virus-1 in 18% of female elk sampled in the Horseshoe Hills study area; however, exposure to this virus is not expected to impact individual or herd health.

Epizootic hemorrhagic disease

Epizootic hemorrhagic disease (EHD) is caused by a virus that is transmitted by biting midges in the *Culicoides* genus and other arthropods. EHD can cause acute and frequently fatal hemorrhagic disease in domestic and wild ungulates. Recurrent outbreaks of EHD-associated mortality occur in white-tailed deer and mule deer, primarily in southeastern Montana (Montana Fish, Wildlife and Parks Wildlife Health Lab, unpublished data). Elk are susceptible to epizootic hemorrhagic disease, but generally do not suffer high rates of mortality or show clinical symptoms (Hoff and Trainer 1973; Nol et al. 2010). There is some concern that elk could act as reservoirs of EHD and transmit the virus to other wildlife (Thorne et al. 2002), but such relationships are not well studied. We found no serological evidence of exposure to epizootic hemorrhagic disease virus in sampled female elk in the Horseshoe Hills study area.

Monitoring Efforts

We are currently monitoring **29** elk on air. A map of animal movements to date is shown below.



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Ashland

A total of **100 female** and **20 male** elk were captured and sampled in the Ashland study area as part of the Targeted Elk Brucellosis Surveillance Project and the Eastern Montana Elk Habitat Use Project from January 27th to February 1st, 2021 (Figure 4). During captures, we obtained blood serum samples from all 100 female elk for brucellosis testing. Of these, **0 tested seropositive for exposure to brucellosis**, giving the herd an estimated seroprevalence of 0 (95% confidence interval: 0 - 0.037).

Of the captured animals, **40 female** and **20 male** elk were fitted with GPS collars programmed to collect hourly locations for the next 3 years. An automatic release mechanism will drop the collars for retrieval on January 22, 2024. Blood serum from 39 of these collared females was available to submit for pregnancy testing and a full serology screening. We collared 5 female yearlings, of which 0 were pregnant. Of the 34 adult females collared and sampled for pregnancy, 18 were classified as pregnant based on the level of PSPB (a pregnancy-specific protein which is released in higher quantities when a fetus is present) found in their blood. The percentage of pregnant adults in the Ashland study area (53%) is well-below the state-wide average (87%).

We estimated a body condition score for 36 females based on manual inspection of the spine and hips to estimate fat deposits. Body condition scores can range from 1 (very poor) to 5 (very high). We also measured the maximum rump fat thickness in centimeters (Maxfat) of these 36 females using a portable ultrasound. The average body condition score was 3.79 (range: 3.5 - 4.6). This average is slightly higher than the statewide average of 3.51. Maxfat measurements averaged 0.54 cm (range: 0.26 - 1.13), coming in under the state-wide average of 0.74 cm. Using well-established relationships (Cook et al. 2010, Cook et al. 2013), we also estimated the percent ingesta-free body fat (IFBF). The average IFBF value for the 36 sampled females in the Ashland study area was 7.48%, coming in below the state-wide average of 7.80%.

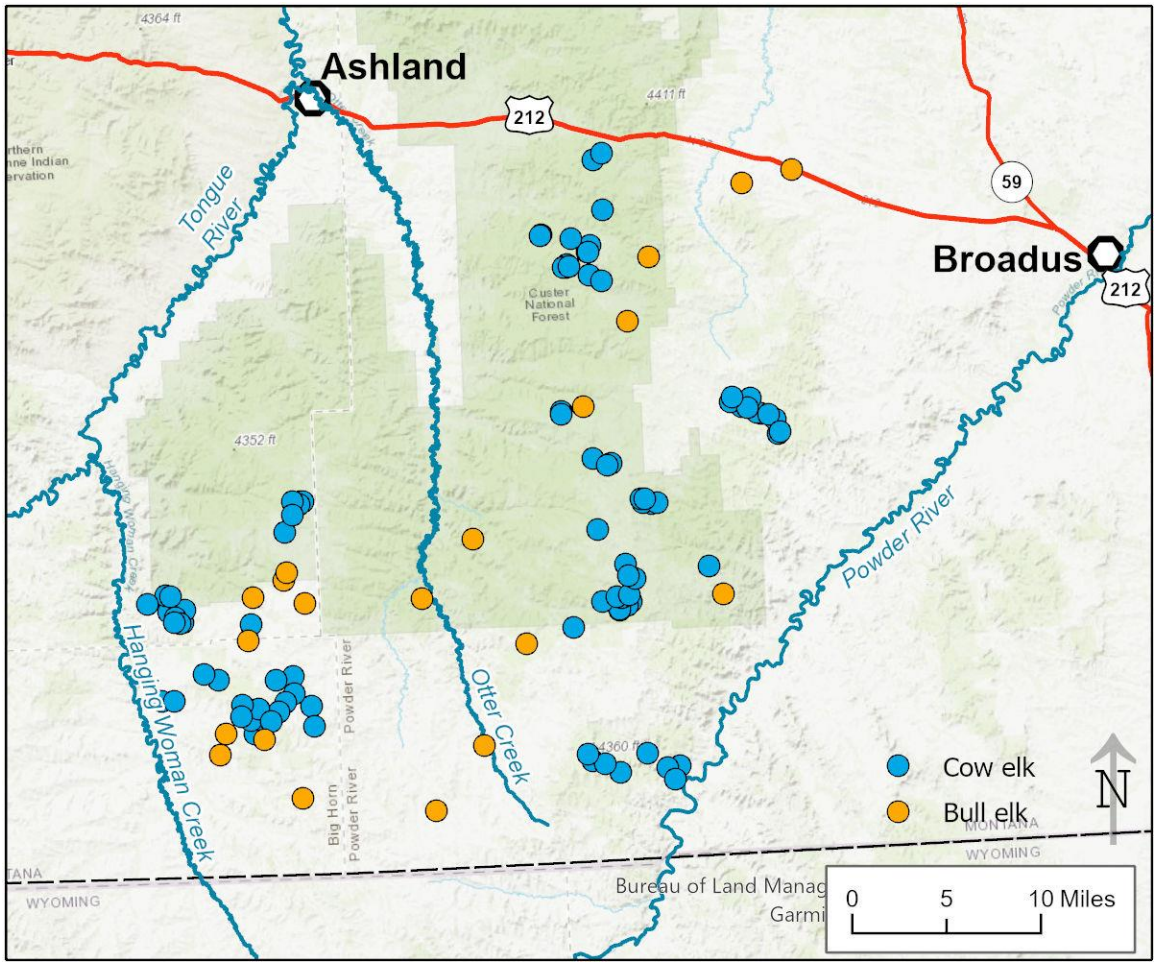

Figure 4. Capture locations of cow elk (blue) and bull elk (orange) in the Ashland area in HD704 southeast of Ashland, MT.

Serology Results

Blood serum samples from 39 adult female elk were assayed for evidence of exposure to pathogens including *Brucella abortus*, Anaplasma bacteria, Leptospirosis, parainfluenza-3 (PI-3), bovine respiratory syncytial virus (BRSV), bovine viral diarrhea type 1, bovine viral diarrhea type 2 (BVD I and II), bovine herpesvirus-1 (BHV-1), and epizootic hemorrhagic disease. Evidence for exposure varied by pathogen (Table 2). We found no serological evidence of exposure to *B. abortus*, leptospirosis, BRSV, or BHV-1. We did find evidence of exposure to Anaplasma (72% seroprevalence), PI-3 (82% seroprevalence), BVD II (3% seroprevalence), and EHD (62% seroprevalence). Exposure to Anaplasma and PI-3 is not expected to impact individual or herd health in elk. Elk are susceptible to infection with BVD, but there is little evidence of serious clinical effects (Tessaro et al. 1999). There is potential for wildlife herds to serve as reservoirs of BVD (Duncan et al. 2008). There is some concern that elk could act as reservoirs of EHD and transmit the virus to other wildlife (Thorne et al. 2002), but such relationships are not well studied. A brief description of each pathogen and its influence (if known) on individual or herd health can be found in the Horseshoe Hills serology section above.

Table 2: Seroprevalence of brucellosis (BRUC), anaplasmosis (ANAPL), leptospirosis (LEPTO), parainfluenza-3 (PI3), bovine respiratory syncytial virus (BRSV), bovine viral diarrhea type 1 (BVD 1), bovine viral diarrhea type 2 (BVD 2), bovine herpesvirus-1 (BHV-1), and epizootic hemorrhagic disease (EHD) based on serological screening of adult female elk in the Ashland study area during the winter of 2021.

Statistic	BRUC	ANAPL	LEPTO	PI3	BRSV	BVD-1	BVD-2	BHV-1	EHD
# Sampled	39	39	39	39	39	39	39	39	39
# Exposed	0	28	0	32	0	0	1	0	24
% Exposed	0	72	0	82	0	0	3	0	62

Monitoring Efforts

We are currently monitoring **40** females and **20** males for a total of **60** elk on air. The following maps show the movements to date of collared bulls and cows respectively.

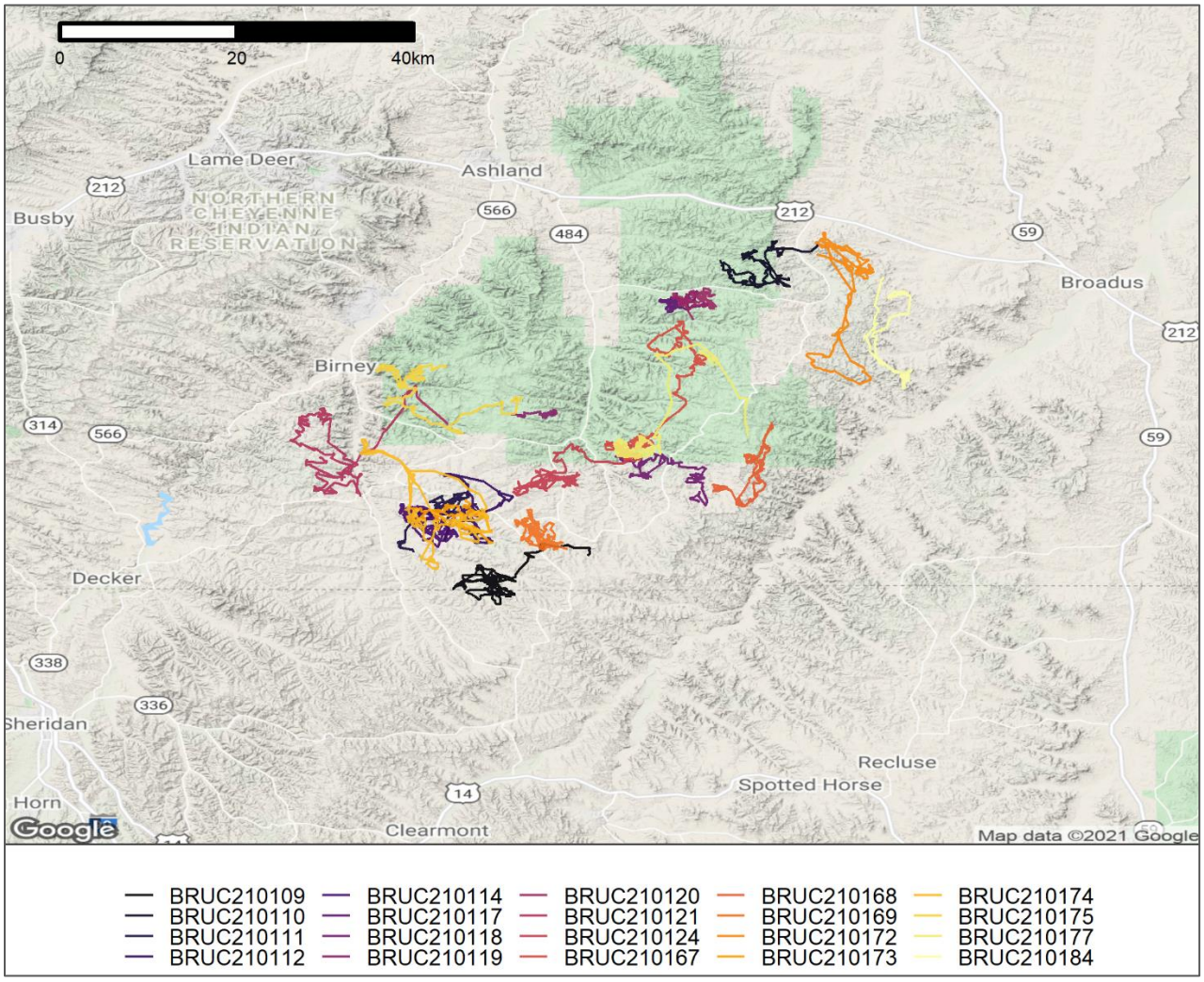

Figure 5. Lines showing movement since capture of collared BULL elk in the Ashland area.

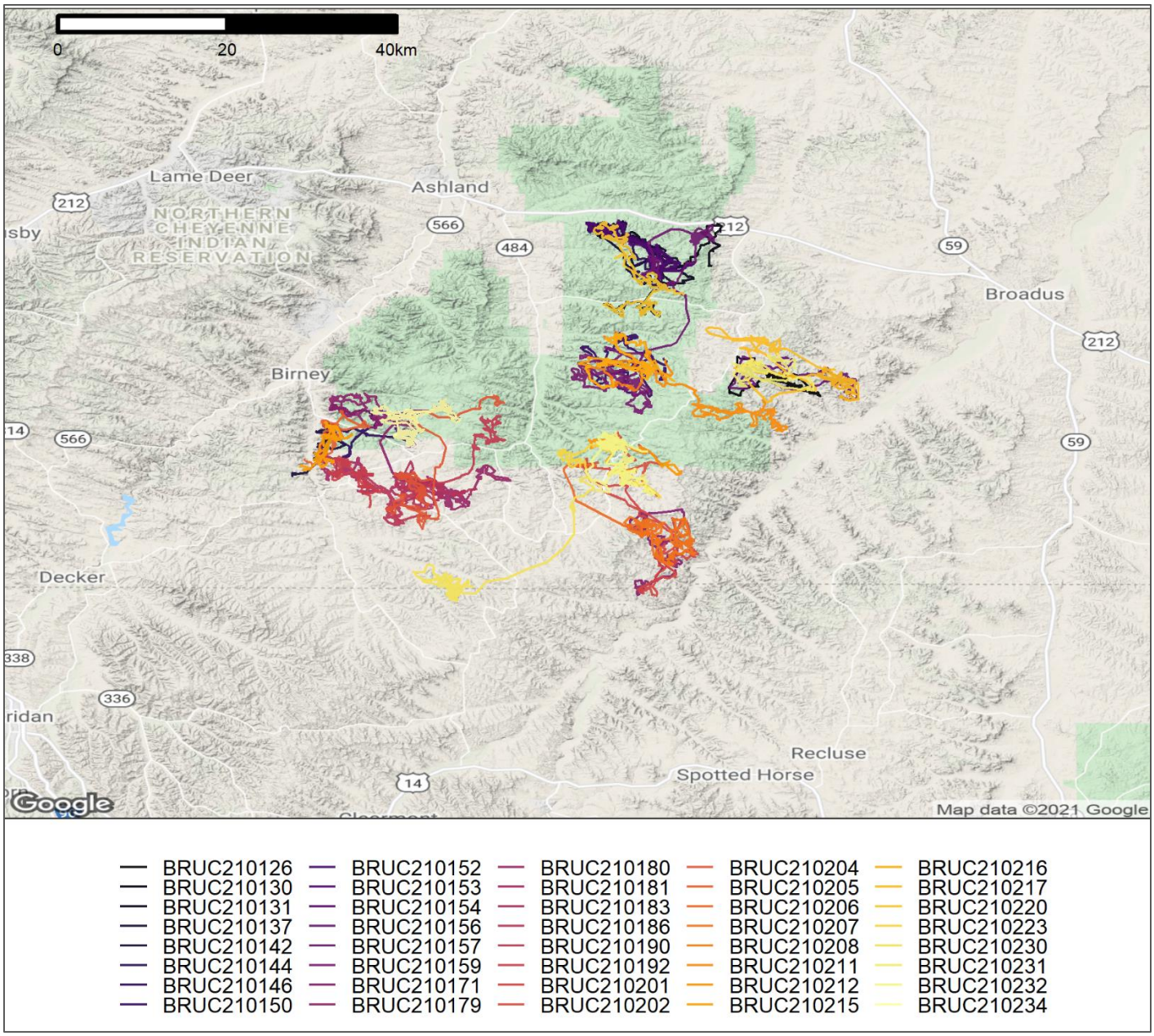

Figure 6. Lines showing movement since capture of collared COW elk in the Ashland area.

A sincere thank you to all FWP personnel, the Quicksilver helicopter capture crew, and landowners within the study areas. Funding was provided by Montana Fish, Wildlife and Parks, Montana Department of Livestock, and the Rocky Mountain Elk Foundation. This project would not be possible without your efforts and support. For additional information regarding the Targeted Elk Brucellosis Surveillance Project, please contact Jenny Jones: 406-868-2637, jennyjones@mt.gov. For additional information regarding the Eastern Montana Elk Habitat Use Project (Ashland area) please contact Shane Petch: 970-712-6284, shane.petch@mt.gov.

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