



Targeted Elk Brucellosis Surveillance Project 2022 Post-Capture Report Tobacco Root Mountains

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 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. This winter, elk capture and sampling efforts for the project occurred January 27–29th in the northern portion of the Tobacco Root Mountains (HD333) and February 1–4th in the southern portion (HD320; Figure 1).

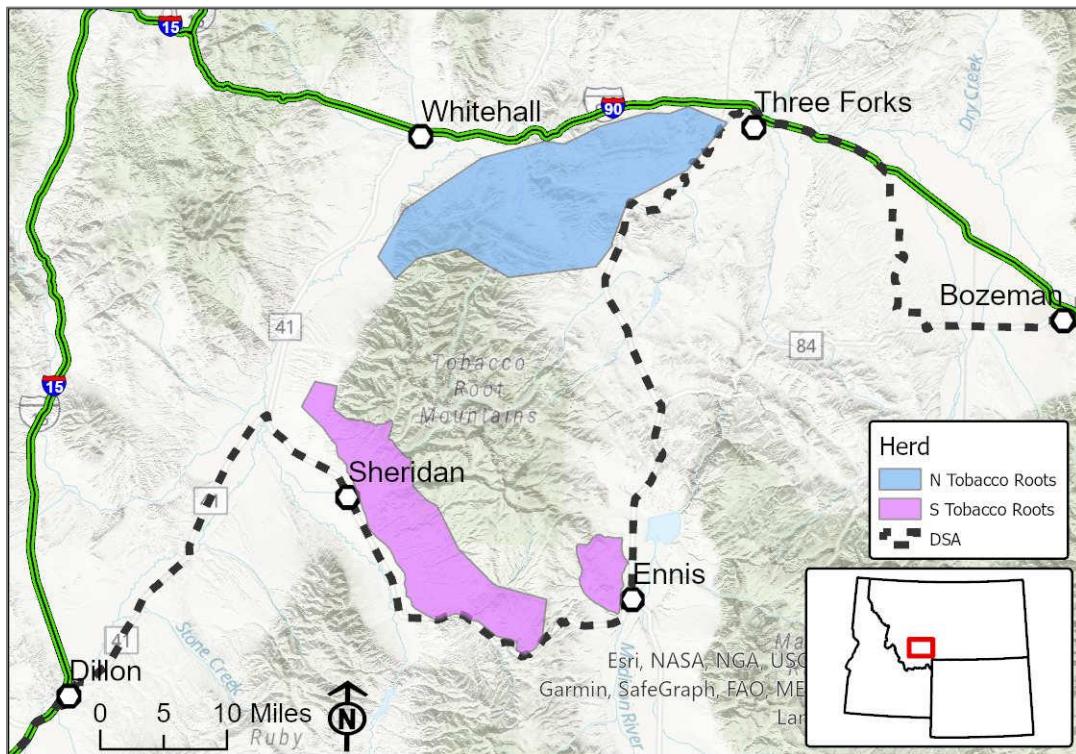


Figure 1. Elk brucellosis surveillance was conducted in the northern (HD333) and southern (HD320) portions of the Tobacco Root Mountains. The Montana Department of Livestock brucellosis designated surveillance area (DSA) is shown as a black dotted line.

Northern Tobacco Root Mountains

A total of 100 female elk were captured and sampled in the northern Tobacco Root Mountains study area (HD333) from January 27-29th (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 – 3.7%; Table 1).

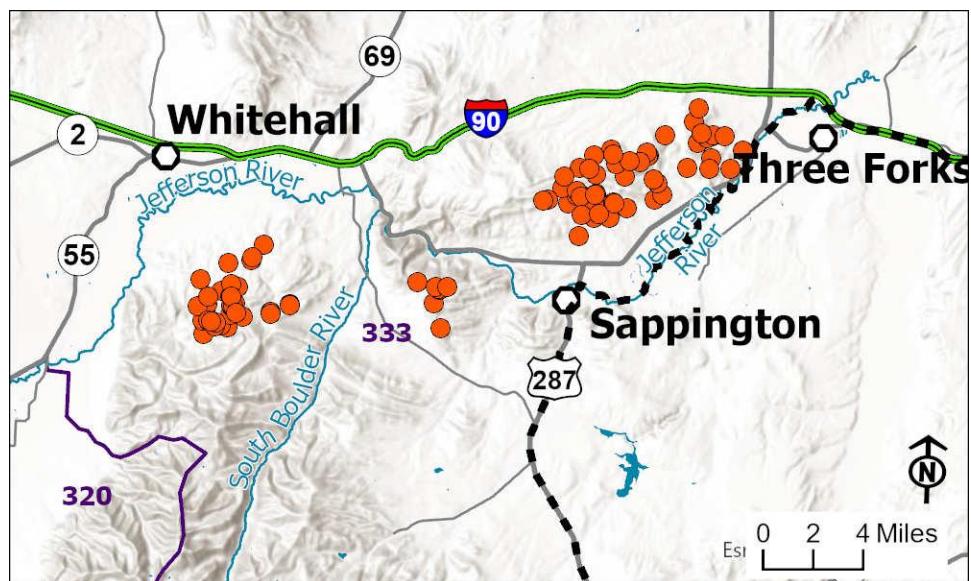


Figure 2. Capture locations of elk in the northern Tobacco Root Mountains south of Whitehall, MT during January 2022.

We estimated a body condition score for 30 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). The average body condition score was 3.9 (range: 3.25 - 4.5). We also measured the maximum rump fat thickness in centimeters (Maxfat) of 31 females using a portable ultrasound. 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 31 sampled females in the Tobacco Root Mountains study area was 8.4%, higher than the state-wide average of 7.78%.

Of the captured animals, 40 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 4/2/2022. Blood serum from 40 of these collared females was available to submit for pregnancy testing and a full serology screening to look at exposure to different diseases. We collared 6 female yearlings, of which 3 were pregnant. Of the 34 adult females collared and sampled for pregnancy, 29 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 northern Tobacco Root Mountains study area (85%), similar to the state-wide average (86%).



Serology

Blood serum samples from 40 adult female elk were assayed for evidence of exposure to pathogens including *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 (EHD). 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). Evidence for exposure varied by pathogen (Table 1). 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 Tobacco Root Mountains study area during the winter of 2022.

Statistic	BRUC	ANAPL	LEPTO	PI3	BRSV	BVD 1	BVD 2	BHV-1	EHD
# Sampled	100	40	40	40	40	40	40	40	40
# Exposed	0	24	5	23	10	0	0	4	0
% Exposed	0	60	13	58	25	0	0	10	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 Tobacco Root Mountains study area.

Anaplasmosis

Anaplasmosis, a sickness caused by bacteria of the genus *Anaplasma*, 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 60% of female elk sampled in the northern Tobacco Root Mountains study area. 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 a seroprevalence of 13% in female elk sampled in the Tobacco Roots study area. Serovar *L. pomona* was detected in 5 elk, and serovar *L. grippo* was also detected in 1 of those 5 elk. These results are not expected to impact individual or herd health.

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 seroprevalence of 58% in female elk sampled in the northern Tobacco Root Mountains 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 a seroprevalence of 25% in female elk sampled in the northern Tobacco Root Mountains study area; however, these results are not expected to impact individual or herd health.

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

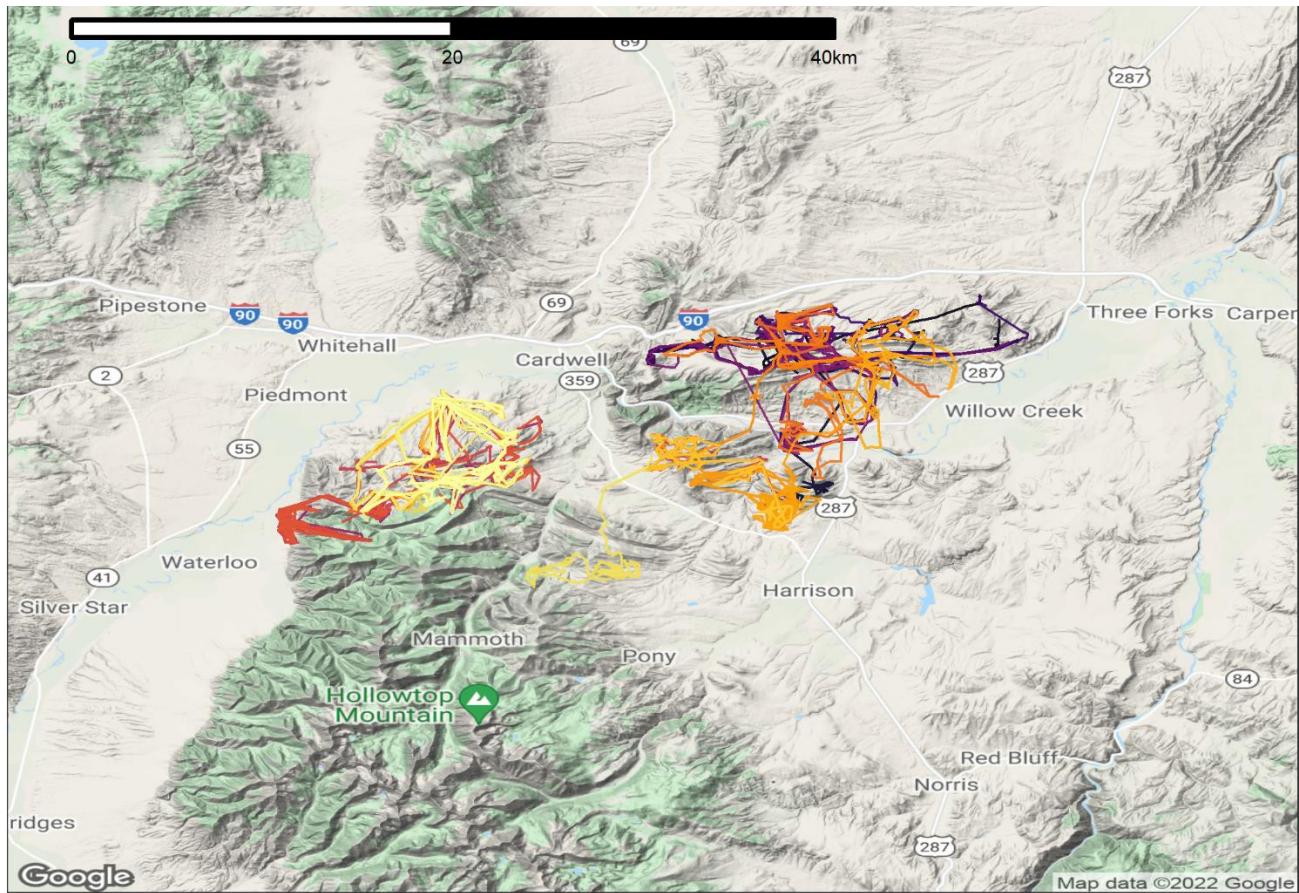
Bovine herpes virus-1 is a common virus in cattle and can cause rhinotracheitis, fever, conjunctivitis, a drop in milk production, abortion, encephalitis, and lesions of the mucous membranes of the genital tract. The virus is transmitted most effectively by respiratory infections (Wentink et al. 1993). 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 10% of female elk sampled; 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 northern Tobacco Root Mountains study area.

Monitoring Efforts

We are currently monitoring **40** collared elk in the northern Tobacco Root Mountains. A map of animal movements to date is shown below.



— TR21100	— TR21108	— TR21116	— TR21124	— TR21132
— TR21101	— TR21109	— TR21117	— TR21125	— TR21133
— TR21102	— TR21110	— TR21118	— TR21126	— TR21134
— TR21103	— TR21111	— TR21119	— TR21127	— TR21135
— TR21104	— TR21112	— TR21120	— TR21128	— TR21136
— TR21105	— TR21113	— TR21121	— TR21129	— TR21137
— TR21106	— TR21114	— TR21122	— TR21130	— TR21138
— TR21107	— TR21115	— TR21123	— TR21131	— TR21139

Figure 3. Lines showing movement since capture of collared female elk in the northern Tobacco Root Mountains.

Southern Tobacco Root Mountains

A total of **63** female elk were captured and sampled in the southern Tobacco Root Mountains study area (HD320) from February 1-4th (Figure 4). During captures, we obtained blood serum samples from 63 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 – 6.0%; Table 1).

In 2014 we sampled 70 elk from the Southern Tobacco Root Mountains and all elk tested seronegative for brucellosis at that time. We re-sampled this area because 2 elk from the Ruby Mountains to the south tested seropositive in 2020 and movement data suggested some potential mixing between these two herds. We did not fit any elk with GPS collars during this capture because sufficient movement data was collected as part of the 2014 capture effort.

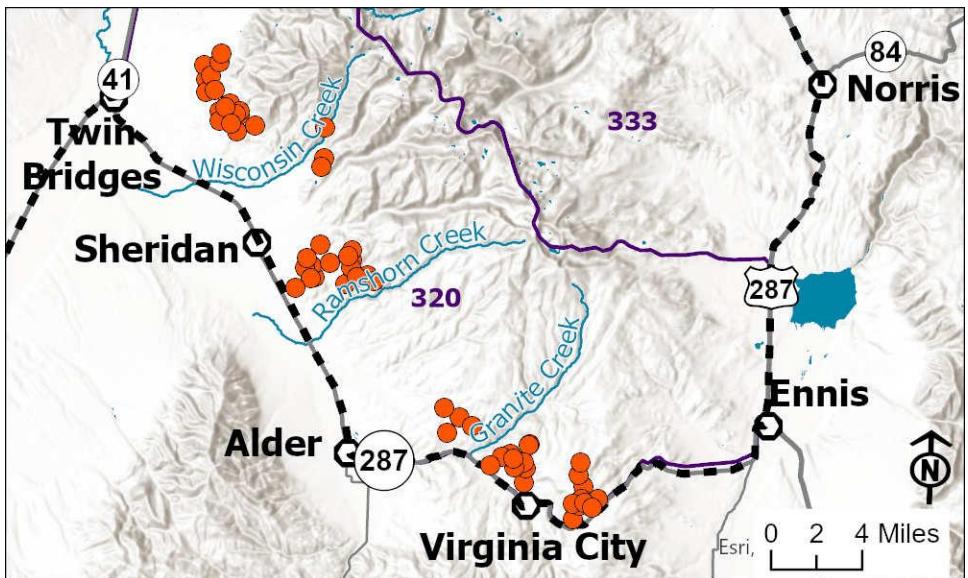


Figure 4. Capture locations of elk in the southern Tobacco Root Mountains near Sheridan, MT during February 2022.



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