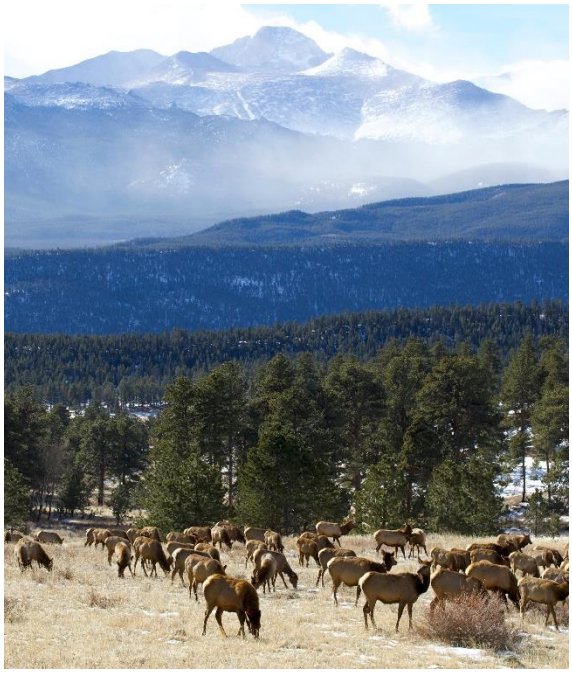
# **Brucellosis Surveillance** and Management Summary

**Natural resources and transportation appropriations subcommittee January 28, 2021**

## 1. What is brucellosis?



- A contagious, zoonotic disease caused by the bacterium *Brucella abortus.*
- *B. abortus* primarily affects cattle, bison, and elk and can also infect humans.
- Bacteria primarily localizes in reproductive organs and udder, shed in milk, aborted fetus, afterbirth, and other reproductive tract discharges.
- Transmission among animals is primarily via ingestion of contaminated fetal tissues or fluids expelled during abortion or calving.
    - Risk period is January through June when abortions are most likely.

## 2. When and how did brucellosis come into the U.S. and Montana?

- *B. abortus* is not native to North America but was introduced with the importation of European breeds of domestic cattle more than a century ago. Historical reports suggest the disease existed in cattle in Great Britain as early as the mid 1500's.
- First reported human case in U.S. was 1906.
- First report in wildlife in U.S. was two seropositive bison from Yellowstone National Park (YNP) in 1917.
- First report in wild elk in the U.S. was from samples collected from the National Elk Refuge in 1930.

## 3. What are the implications for wildlife?

- *B. abortus* is persisting in some free-ranging elk herds due to elk-elk transmission.
- Symptoms: aborted or weak calves (typically in the first pregnancy after infection), lower conception rates, and occasionally enlarged joints.
- Reduced tolerance for elk by private landowners who provide the majority of elk winter range.
- Subject to management actions, including hazing and lethal removal by hunters and landowners.

## 4. What role do bison play?

- *B. abortus* is maintained in some free-ranging elk herds due to elk-elk transmission.
- Elk are now recognized as the primary transmitter of *B. abortus* to livestock in the Greater Yellowstone Area (GYA).
- Interagency Bison Management Plan (IBMP) established in 2000 to cooperatively manage the risk of brucellosis transmission from Yellowstone bison to cattle.
    - Participants include the Animal and Plant Health Inspection Service (APHIS), U.S. Forest Service (USFS), Montana Department of Livestock (DOL), Montana Fish, Wildlife and Parks (FWP), The National Park Service (NPS), Confederated Salish and Kootenai Tribes (CSKT), Nez Perce Tribe (NPT), and InterTribal Buffalo Council (ITBC).
    - The purpose is to maintain a wild population of Yellowstone bison and address the risk of brucellosis transmission from bison to protect the economic interest and viability of the livestock industry in the state of Montana.
    - Not intended to eradicate brucellosis but to prevent transmission from bison to cattle and reduce prevalence of brucellosis in bison.
    - Tools include hunting, hazing, culling, quarantine, and education.
    - There have been no known cases of transmission of brucellosis from bison to cattle even with high seroprevalence in bison, likely due to effective separation.
- DOL has authority for management of bison regarding transmission of disease from bison to livestock.
- FWP is responsible for bison regarding property damage and public safety.

## 5. What has FWP done and what are they currently doing about brucellosis?

- Annually implement the Elk Management in Areas with Brucellosis Work Plan. This was developed by a citizen's work group in 2012 and requires annual approval by the Fish and Wildlife Commission.
    - Non-lethal actions include elk hazing, fence modification, stackyard fencing, and habitat modifications.
    - Lethal actions include removing elk using hunters or providing landowners with kill permits; removals may occur August 30-May 15.

- Multi-year Targeted Elk Brucellosis Surveillance Project ongoing since 2011, in close collaboration with DOL (Figure 1)
    - Evaluate spatial distribution and prevalence of brucellosis exposure in elk (Figure 2)
    - Evaluate elk spatial overlap with livestock, interchange between elk populations, and risk of elk-livestock transmission. (Figure 3)
    - Evaluate effects of brucellosis management hazing and lethal removal on elk distributions and spatial overlap with livestock, to determine effects on transmission risk.
    - Evaluate birthing and bacterial shedding risk of seropositive elk and the relationship between positive tests (seropositive) and infection.

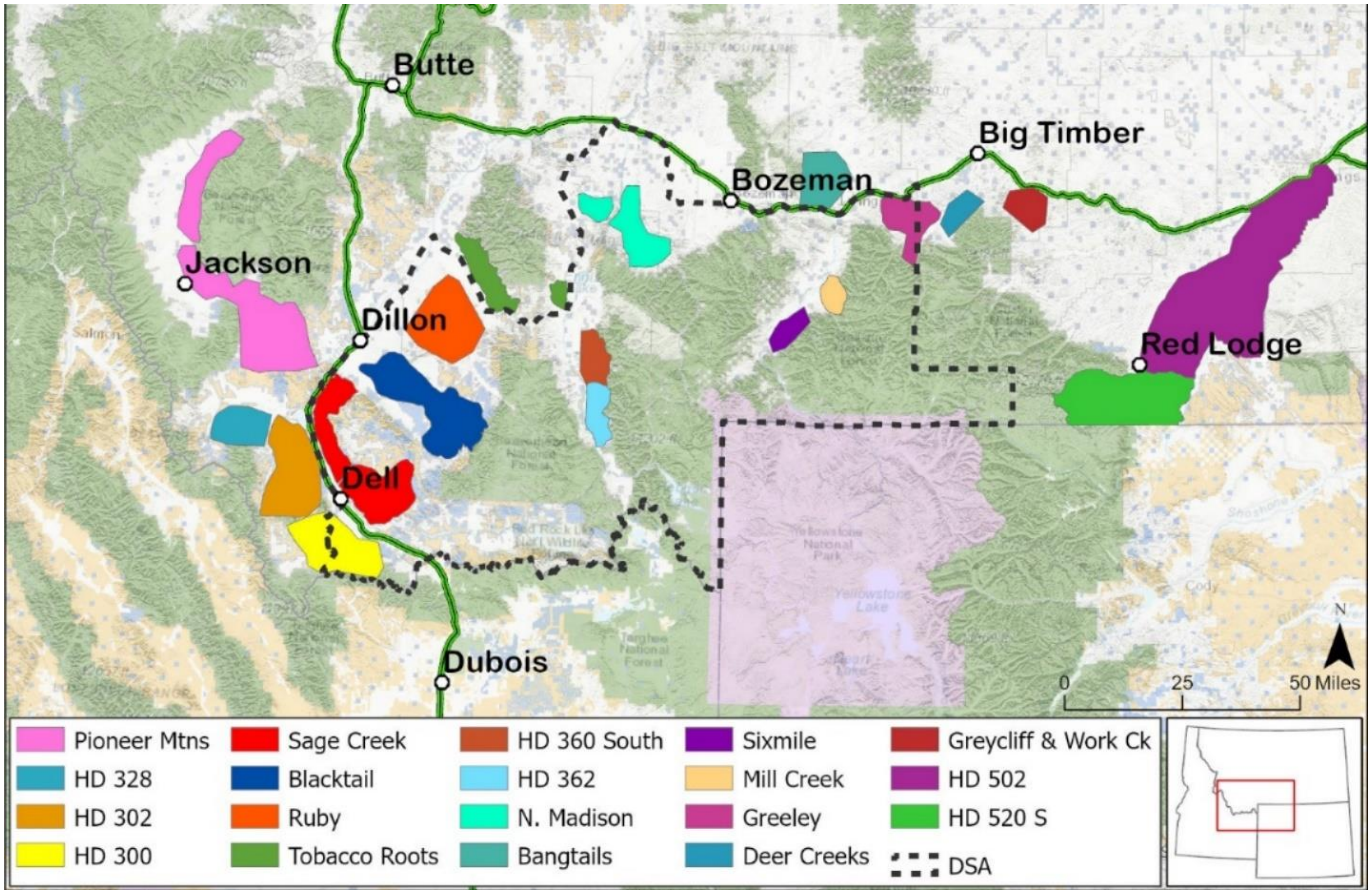



**Figure 1**. Populations sampled during the 2011 –2020 targeted elk brucellosis surveillance project. The area inside the black dashed line is the Montana brucellosis DSA.

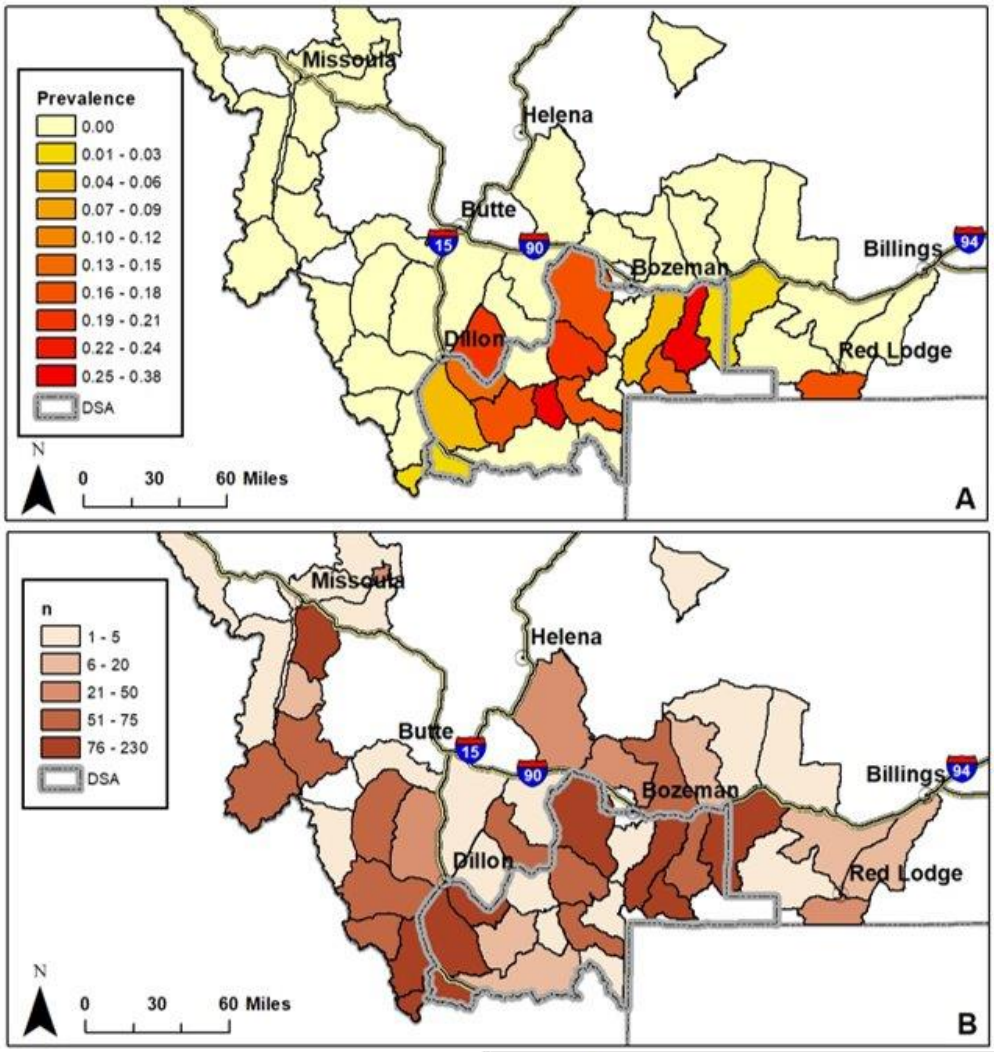



**Figure 2** (Top Left) The estimated brucellosis seroprevalence (Panel A) and number of samples screened (n, Panel B) for adult female elk by hunting district* during 2009 – 2018. Samples include those collected during winter research captures and fall hunter harvest. Note some seroprevalence estimates are derived from a low number of samples. The gray line denotes the boundary of the Montana DSA. *Hunt district 520, west of Red Lodge, is divided in two along a legally defined sub-district boundary to reflect the limited sampling in the northwestern portion of the district.

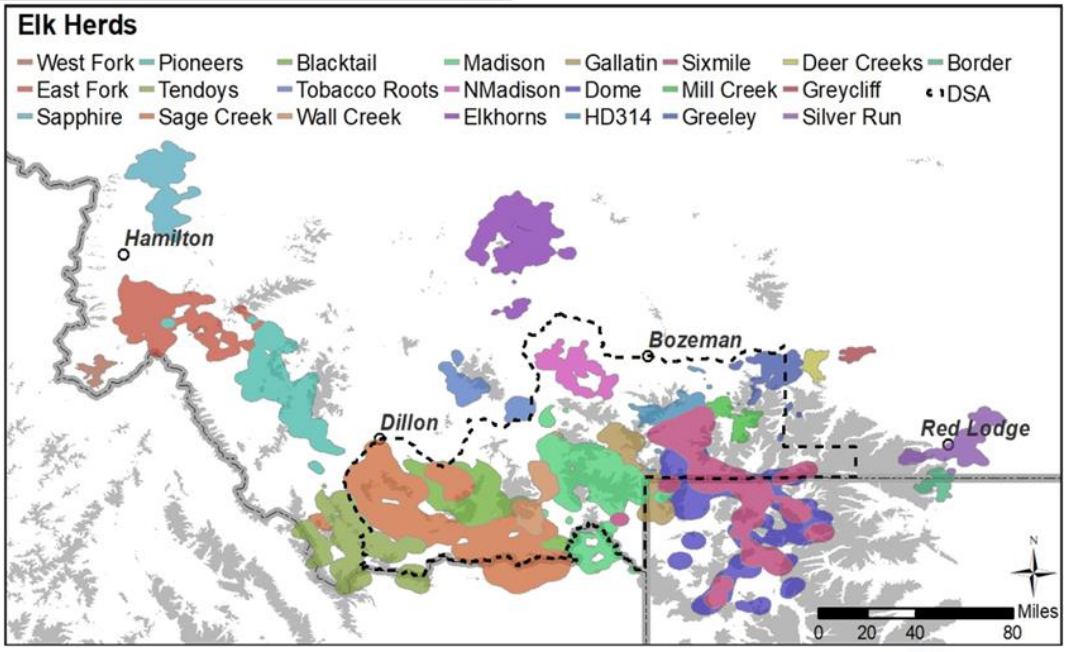



**Figure 3** (Bottom Right) Annual kernel density distributions of ALL elk herds in SW Montana with GPS collar data showing the potential overlap and interchange between herds. Gray polygons represent mountain ranges.

## 6. What is the history of our efforts?

- Hunter harvest surveillance was conducted from 1981-2010 and targeted elk brucellosis surveillance is ongoing since 2011.
- FWP and the Fish and Wildlife Commission initiated the Elk Management Guidelines in Areas with Brucellosis Working Group in the fall of 2011. The group provided guidance for the first Elk Management in Areas with Brucellosis Work Plan (adopted by the Commission annually).
- Since 2012, 25 elk have been removed using the Brucellosis Annual Work Plan lethal removal options.
- No elk were removed in brucellosis hunts in 2018 or 2019, and one was removed in 2020.
- Hazing efforts in 2020 totaled 340 hours.
- Some stackyard fencing.
- Brucellosis has been used as a justification for shoulder seasons in certain districts; these seasons allow hunting until February 15th.

## 7. What is the goal of brucellosis management in wildlife?

Goals of the Work Plan are to reduce the risk of elk-livestock brucellosis transmission, ensure management tools and actions are acceptable to the diversity of viewpoints and stakeholders, and minimize operational costs.

## 8. Are our management efforts working?

- There have been new infected domestic herds since implementation of our management efforts, but all new livestock detections have been within the Designated Surveillance Area (DSA) and Montana has not exported brucellosis-infected livestock out of state. This demonstrates that the collaborative surveillance and management efforts of DOL and FWP are working to protect Montana from the negative impacts of brucellosis.
- The Annual Work Plan is a risk mitigation plan, not a disease eradication plan. The focus is on managing elk distribution to reduce transmission risk.
- Recent evaluation of management to redistribute elk suggests: 1) hunting is more effective than hazing in redistributing elk away from conflict zones [places with livestock where elk pose risk], 2) hazing redistributes animals if applied frequently, 3) elk responses to hunting and hazing were ephemeral, and 4) elk use of conflict zones increased at night in spite of hunting or hazing.

- Data from elk collars have improved our understanding of elk movement and potential routes for the spatial spread of brucellosis.
- Data from targeted surveillance have detected the disease in new elk populations and directly informed the DSA boundary and associated testing and risk management efforts for livestock by DOL.

## 9. Is brucellosis likely to spread to elk in other areas of Montana?

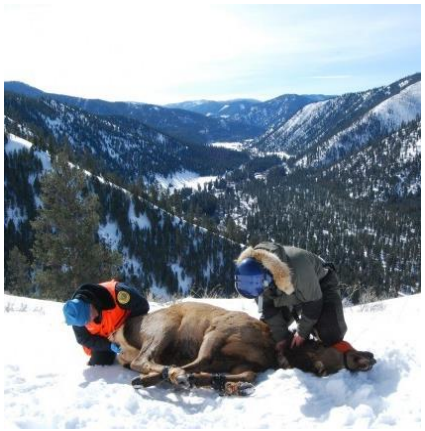
- Interchange between unexposed elk and exposed elk would represent a potential transmission route for brucellosis to expand from the GYA. Our collaring efforts confirm the interchange of elk between exposed and presumably unexposed herds.
- While there is connectivity, if, when, or how quickly brucellosis might spread across Montana will depend on a combination of factors, including the rates at which infected and uninfected elk herds mix, long-distance dispersal rates, and prevalence of brucellosis within the DSA.

## 10. What can we do to prevent spread into other parts of the state?

- Brucellosis prevalence has been correlated with both elk density and elk aggregations during the transmission risk period.
- Large reductions in elk density are required to see a noticeable effect on seroprevalence and this magnitude of reduction is unlikely to be compatible with other elk management and conservation goals.
- Managing elk aggregations and distribution during the risk period is the focus of the FWP program, but it is logistically challenging in many landscapes.
- Efforts to prevent dispersal and interchange among wild elk herds to prevent spread to other areas are unrealistic.
- Other popular ideas to prevent spread by reducing prevalence or transmission in elk include test and slaughter or vaccination programs, however both were attempted on Wyoming feed grounds with little to no efficacy. Implementation in wild, free-ranging elk would be logistically questionable.
- There is a prohibition on translocation of cervids to prevent the human-assisted spread of the disease.

## 11. What is FWP spending on brucellosis surveillance and management? What are the sources of funding?

- FWP has spent an average of $320,000/year on brucellosis surveillance and monitoring over the past three fiscal years.
- Most of this funding (~70%) is from USDA APHIS, passed through DOL for the Targeted Elk Brucellosis Surveillance project, which is giving us a detailed understanding of brucellosis prevalence in elk around the GYA.
- The focus of this funding is to test a statistically significant number of elk in different hunting districts on the periphery of the DSA. This involves aerial capture of >100 elk each year for testing and collaring.
- FWP expends license and Pittman-Robertson (PR) funds for brucellosis risk management, which consists primarily of providing hazers to keep elk separated from livestock during the high-risk period.



- FWP also spends considerable staff time implementing the IBMP, which is directed at keeping bison in the vicinity of YNP and separated from livestock.
- These figures do not reflect significant time and expenditures that FWP staff contributed to brucellosis management and response including our wildlife veterinarian, disease ecologist, biologists, and communications and education and enforcement staff.

## 12. What is the path forward?

- No clear mechanism to eliminate brucellosis in wildlife populations currently exists.
- Encourage removal of *B. abortus* from the federal (CDC/USDA) select agent list so more effective vaccines for livestock can be researched, which could eliminate transmission risk.
- Continue minimizing elk-livestock transmission risk using multiple methods focused on preventing comingling.
- Manage elk aggregations using lethal and non-lethal methods.
- Continue collaborating with DOL on targeted surveillance.
- Continue research to evaluate effects of management to adaptively improve efforts to reduce transmission risk.

## 13. What do we understand and what questions do we still have?

- *What we understand:*
    - We have learned much about the distribution and prevalence of brucellosis in elk in Montana.
    - We have completed extensive social science research about stakeholder views regarding different management options.
    - Much has been learned regarding brucellosis epidemiology in elk, including bacterial shedding risk of seropositive elk and the relationship between seropositive tests and active infections.
    - We have evaluated the effects of current management tools on elk distribution and elk-livestock transmission risk.
    - Interchange between elk populations is being monitored with GPS radio collars; we are still learning where interchange between elk populations does and does not occur.
    - We have developed spatial models to predict where transmission risk between elk and livestock is higher, which may allow for more targeted risk mitigation efforts.

- *Questions that remain:*
    - The efficacy of our management efforts needs to be evaluated so we can improve them. We are currently analyzing the effects of hazing and hunting on elk distribution and elk-livestock transmission risk as part of the multi-year targeted elk brucellosis surveillance project. As new management tools are implemented, similar evaluations will need to occur so that management strategies can be optimized.

- Due to continuing changes in elk populations and distribution, there are several areas where elk brucellosis status is uncertain, requiring continued monitoring. Similarly, the connectivity among elk populations in the region is still uncertain in many areas.
- Predictions for how quickly and where might *B. abortus* spread geographically on the landscape could help us optimize our surveillance program (this work is currently underway by U.S. Geological Survey).
- The paucity of available information regarding where and when livestock are spread across the landscape affects our ability to develop spatial maps of elk-livestock transmission risk.

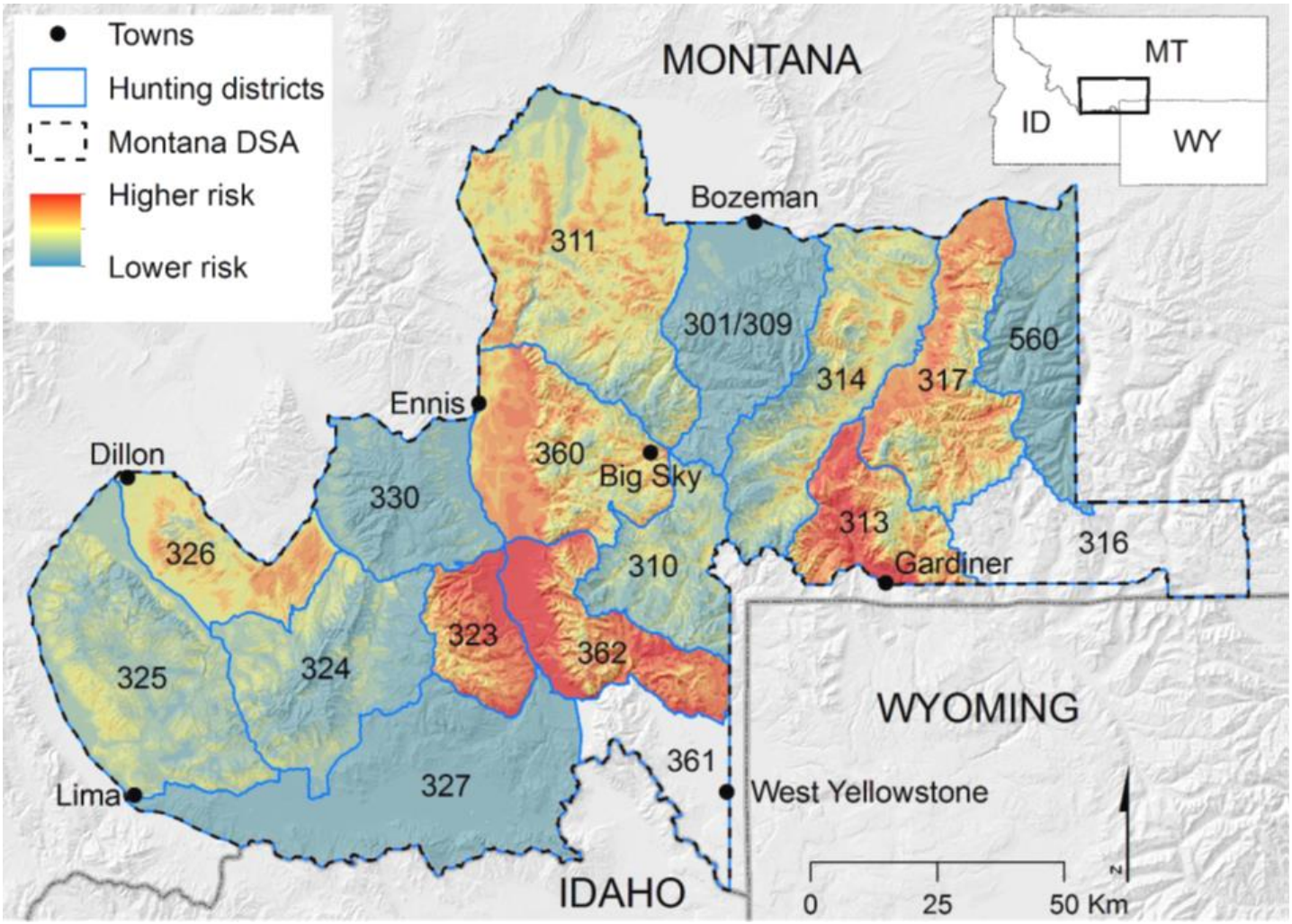



**Figure 4.** Predicted risk of brucellosis transmission by adult female elk within the Montana DSA during the month of March (in the middle of the brucellosis transmission risk period, 15 February-30 June). From: Rayl, N.D., Proffitt, K.M., Almberg, E.S., Jones, J.D., Merkle, J.A., Gude, J.A. and Cross, P.C., 2019. Modeling elk-to-livestock transmission risk to predict hotspots of brucellosis spillover. *The Journal of Wildlife Management*, *83*(4), pp.817-829.