

## MESM GROUP PROJECT PROPOSAL 2023-2024

### Assessing the Impacts of Feedground Closure on Brucellosis Transmission Risk in Elk to Cattle in the Greater Yellowstone Ecosystem



*Photo credit: PERC*

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#### **Proposers:**

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## **OBJECTIVES**

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The primary goal of this project is to enhance conservation of elk and migration corridors on private lands in the Greater Yellowstone Ecosystem (GYE), which includes the Grand Tetons, by assessing how dismantling elk feedgrounds on public land will affect the risk of brucellosis spread among elk herds and transmission to cattle.

Specific objectives include:

- Estimate the effect of feedground closures on the risk of brucellosis transmission in elk herds within the GYE
- Determine potential changes in elk migration patterns due to the closure of public feedgrounds
- Investigate how altered migration patterns and brucellosis risk would impact stakeholders. The stakeholders and specific impacts we would be investigating are:
  - Financial impact assessment for ranchers in GYE
  - Ecological impact for conservationists
  - Cultural impact for associated tribes in the GYE

## **SIGNIFICANCE**

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The Greater Yellowstone Ecosystem's (GYE) iconic migratory elk herds rely on private ranchlands for winter-range habitat, but providing that habitat often comes along with significant costs for ranchers.<sup>1</sup> Ranchers in the GYE face unique risks associated with brucellosis, a bacterial disease that elk transmit to cattle that causes cows to abort their fetuses. In the United States, brucellosis is only found in the GYE. The disease creates financial challenges for ranchers, which in turn affects tolerance for wildlife and ranchers' ability to maintain the large, working landscapes that support habitat for elk and other species.<sup>1</sup> If brucellosis is transmitted to cattle, ranchers are required to quarantine or slaughter their herds, which results in major financial hardships. In recent years, brucellosis rates in elk have been increasing along with the disease's geographic extent.<sup>3</sup> To combat the negative interactions between elk and cattle in the GYE, elk feedgrounds were established in the early-20th century to divert elk away from cattle. While this did decrease the number of brucellosis cases in nearby cattle<sup>9</sup>, the disease has increased tremendously in elk populations within the feedgrounds due to the elk being in such close proximity to one another. This in turn increased brucellosis among both fed and unfed elk due to their co-mingling in the spring and summer seasons. While brucellosis cases in cattle have decreased, they have not totally disappeared due to the interaction between fed and unfed elk.<sup>3</sup>

By creating projected models and mapping based on migratory patterns, this project would assist landowners, wildlife officials, and conservation organizations that seek methods to mitigate brucellosis in GYE elk populations in the long term. Comprehensive mapping and modeling are extremely useful tools to predict migratory patterns, disease cases and spread, and biodiversity projections. There is currently no such tool to assess the risks associated with closure of elk feedgrounds in the GYE. The next step would be to project how closure of elk feedgrounds in the GYE would affect local stakeholders such as cattle ranchers, conservationists, and tribes. Closing feedgrounds could lead to financial impacts for cattle ranchers, such as having to quarantine/slaughter their cattle if the cattle get brucellosis, herd-wide vaccinations, or potentially losing some winter forage area. Specific management tools and recommendations can be addressed in a future project, such as the Elk Occupancy Agreement or Brucellosis Compensation Fund that PERC has initiated in Paradise Valley, Montana. This project will only investigate potential impacts, not solutions.

## **BACKGROUND**

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Brucellosis is a bacterial disease that causes reproductive issues in affected cattle, bison, and elk in the GYE. Brucellosis can also occur as a zoonotic infection in humans through the consumption of unpasteurized and raw

dairy products and meat of infected animals. The disease can cause infertility and induce abortions in elk and cattle, resulting in economic losses for cattle ranchers. While bison also carry brucellosis, there have been no documented cases where the disease was transferred to cattle from bison, largely due to federal and state efforts to keep these species separate.<sup>10</sup> Between 2002-2014, 21 livestock herds were infected with brucellosis from elk transmission.<sup>13</sup> From 1985-2015, Wyoming Game and Fish vaccinated 97% of feedground elk with a vaccine developed for cattle, but there was “no reduction in seroprevalence or abortion events.”<sup>12</sup> If a new vaccine were developed, over 50% of the female elk population would need to be vaccinated, which is only potentially feasible in elk feedgrounds.

Brucellosis management is particularly challenging in Wyoming, where elk are fed during winter months on feedgrounds established in the early 20th century on public lands outside of Yellowstone and Grand Teton National Parks. These feedgrounds are controversial today, with many groups now calling to end elk feeding in the state. Feeding concentrates elk populations during critical disease-transmission periods and can lead to higher overall disease rates among elk. The feedgrounds persist today, in part because they keep elk off of private lands, where they mingle with cattle and increase elk-to-cattle brucellosis transmission risks. Ending elk feeding would disperse elk across the landscape, likely leading to increased interactions with cattle and higher rates of brucellosis transmission to livestock, at least in the short run.

Mounting political pressure from neighboring states and a recent lawsuit that forced the closure of one feedground operation indicate that a broader shift in feedground policy may be on the horizon. Moreover, growing concerns about another disease—chronic wasting disease (CWD), which is incurable and deadly to elk—may force the issue, especially if CWD gets into feedground-fed elk populations. Since 2020, CWD has been found in two feedground-supported elk herds, marking the first time the disease has been found in the region.<sup>4</sup>

## **EQUITY**

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The GYE is closely bordered by Tribal reservation lands such as the Wind River Indian Reservation and Crow Reservation, which are home to ~35,000 residents. In addition, there are 27 federally recognized tribes that have historical connections to the GYE.<sup>11</sup> Native Americans have a deep connection to hunting and subsistence of the land, and elk hunting is one way that tribes are able to stay culturally connected to the land. The support of conservation of elk populations and migratory patterns allows for Native Americans to stay connected to their culture and heritage. The Wind River Tribe previously worked with other organizations to conduct a deer and elk migration study in 2020. The tribe recently presented some information on brucellosis testing on their reservation and how they monitor for it.<sup>14</sup> It would be beneficial to this project to reach out to this tribe as well as other local tribes to gain their perspectives and experience in brucellosis management.

## **AVAILABLE DATA**

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There are numerous sources of data available for this project, including:

- PERC has built an internal dataset of brucellosis cases from academic and news sources.
- Wyoming Fish and Game have non-feedground brucellosis reports developed from blood work collected by local elk hunters and sent to Fish and Game
- Brucellosis cost estimates can be found in Wilson (2011)<sup>7</sup>
- Risk modeling efforts that might be useful can be found in [Rayl et al. \(2018\)](#)<sup>8</sup> and [Boroff et al. \(2016\)](#)<sup>9</sup> (we have full access to these studies through a Dropbox shared by PERC)
- Elk migratory maps through the Greater Yellowstone Area from both PERC and National Geographic

- [USGS](#) migration routes of the Jackson elk herd

## **POSSIBLE APPROACHES**

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- Model the potential altered migratory route of the Jackson elk herd after closure of feedgrounds
  - Adapt methods from Jones et al., 2014
    - resource selection functions using telemetry data from elk to predict risk of transmission
    - integrate predictions on spatiotemporal data on livestock distribution to estimate the risk of transmission from elk to livestock
  - Use GIS to create map and model
- Investigate the effects of brucellosis in elk and on ranchers if feedgrounds remain open
  - Assuming there is little to no change in elk migration patterns, model the disease risk incidence of brucellosis and CWD in transmission to cattle ranchers
- Determine distribution of brucellosis transmission risk after feedground closures and identify spatiotemporal overlap with cattle
  - Adapt methods from Merkle et al., 2017 and Rayl et al., 2019
  - Focus on elk abortions (primary transmission route of brucellosis) during transmission risk period (spans > 4 months), a timespan in which GYE elk migrate tens to hundreds of km
  - Create a disease case and potential spread map of brucellosis on either the one elk herd or the disease in one feedground
- Determine how local tribes like the Wind River Tribe manage elk and brucellosis spillover on their reservations
  - Investigate how tribes envision their involvement in GYE and elk conservation

## **DELIVERABLES**

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Deliverables for the project include:

1. **Report** detailing estimated impact of continuing feedground operations versus feedground closure on brucellosis transmission risk from elk to cattle
2. **Maps** depicting both continued feedground operation and potential feedground closures and the respective projected elk migration with ranchers' winter ranges
3. **Summary** of how the closure of the feedground could impact local stakeholders, such as cattle ranchers, conservationists, and tribes

## **INTERNSHIPS**

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PERC is committed to funding at least 1 paid summer internship. They welcome additional students to partake in the internship during the summer, but will likely only be able to provide funding for one paid internship.

## REFERENCES

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<https://doi.org/10.1371/journal.pone.0178780>
- 14 University of Wyoming. (2020). *Wyoleg.gov*. Retrieved January 24, 2023, from <https://wyoleg.gov/InterimCommittee/2020/STR-2020091405-01TribalRelationsPresentation2020.pdf>



January 26, 2023

Group Project Committee  
Bren School of Environmental Science & Management  
University of California, Santa Barbara

**RE: Group Project Proposal: Assessing the Impacts of Feedground Closure on Brucellosis Transmission Risk in Elk to Cattle in the Greater Yellowstone Ecosystem**

Dear Group Project Committee,

I am writing to express PERC's support for the group project proposal *Assessing the Impacts of Feedground Closure on Brucellosis Transmission Risk in Elk to Cattle in the Greater Yellowstone Ecosystem*. PERC is a nonprofit conservation research institute based in Bozeman, Montana, devoted to advancing market-based solutions to environmental problems. PERC's approach to conservation is to advance solutions that rely on voluntary exchange and result in positive environmental outcomes for both private and public resources.

This project aims to advance our ongoing work to enhance migration corridors for elk, deer, pronghorn, and other ungulate species in the Greater Yellowstone Ecosystem, with an emphasis on working with private landowners who provide key habitat. These species rely on private landowners for the vast majority of their winter habitat. To conserve Yellowstone's migratory pathways, we are committed to finding ways to make wildlife more of a benefit, and less of a cost, for the landowners and other stakeholders who provide critical habitat.

In particular, this project will address the wildlife disease transmission risks associated with elk feedground closures in Wyoming. This issue has garnered significant interest in recent years, and there are mounting pressures to close elk feedgrounds in the region. PERC commits to support this project through mentoring, funding at least one summer internship, providing data, and contributing additional resources if necessary. We also commit to helping to develop a project workplan, hosting students at our PERC office in Bozeman as needed, providing regular support and communication, and helping connect students with stakeholders in the region based on our existing key relationships.

**Internships and Funding:** PERC has a strong track record of hosting students, scholars, conservation practitioners, and environmental entrepreneurs at our offices through our [various summer fellowship programs](#). These programs bring together diverse groups of scholarly researchers and practitioners each summer, working on a variety of different projects, to foster rigorous exploration of environmental problems and devise creative solutions. In addition, we regularly manage and mentor interns and research assistants throughout the year who work on projects ranging from academic research to policy analysis.

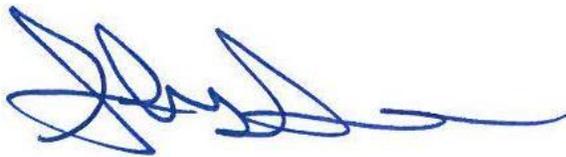
We commit to fund at least one summer internship for the Bren School graduate student project team but would also welcome any number of students to spend time with us in Bozeman during the summer, as needed (though we would likely only be able to financially support one paid internship). We have ample space and resources for students to work from our offices, as necessary, along with the other graduate students and fellows that will be visiting during the summer as well. This will provide an intellectually stimulating environment for the students to advance the project, receive feedback and mentorship from other researchers and scholars, and engage with other stakeholders in the region (e.g., conservation organizations, landowner groups, policymakers). Our ability to host students in our office, surrounded by a vibrant community of other researchers and scholars who can also provide input and guidance, will significantly enhance the group project experience and provide opportunities to develop professional skills.

**Funding:** We do not anticipate a need for significant additional funding beyond the costs of PERC's staff time to engage and mentor students, which we will contribute as in-kind funding. If additional costs arise, such as travel expenses or specific software requirements, we are prepared to commit at least \$3,000 in additional unrestricted funding to support this project.

**Data:** We expect that the data needed for this project is already publicly available from academic sources, as described in the project proposal, or will come from a dataset of brucellosis cases that has already been compiled over the past two years by PERC. We do not anticipate any restrictions on the use of such data.

We are excited to work with Bren School students on this project, which will advance important research to enhance migration corridors and resolve a pressing environmental issue. Thank you for the opportunity to submit this proposal. Please reach out to me ([shawn@perc.org](mailto:shawn@perc.org)) if you have any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Shawn Regan', with a long horizontal flourish extending to the right.

Shawn Regan  
PERC