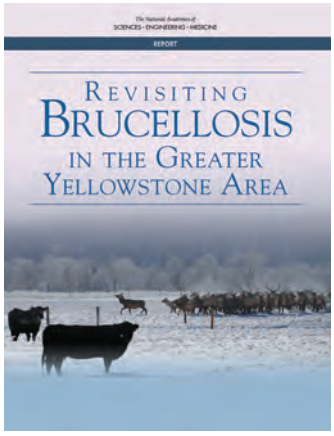
Report
HIGHLIGHTS

May 2017

Revisiting Brucellosis in the Greater Yellowstone Area



An increase in brucellosis cases in the Greater Yellowstone Area has alarmed cattle and domestic bison producers and spurred new scientific analyses of the factors involved. Recent evidence indicates that elk are the main transmitters of the disease, and, thus, control efforts should focus on limiting transmission from elk to livestock. This report lays out various options that could be applied to control the disease and prevent its spread.

Brucellosis is a regulated disease of livestock that has significant consequences for animal health, international trade, and potentially human health. Nearly a century of dedicated funding and resources from the U.S. Department of Agriculture, states, and livestock producers has eliminated brucellosis in most of the United States. States must maintain brucellosis class-free status, among other criteria, to sell live cattle.

The Greater Yellowstone Area (GYA), where brucellosis is endemic in bison and elk, is the last known U.S. reservoir of the disease. From 1998–2016, 22 cattle herds and 5 privately-owned bison herds were affected in Idaho, Montana, and Wyoming. Most cattle in the GYA are vaccinated with *B. abortus* strain RB51. Although this vaccine is effective in reducing the spontaneous abortions associated with the disease, it does not necessarily prevent infection.

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA–APHIS) commissioned this study to inform its brucellosis eradication strategy. That effort also involves other federal and state agencies that have authority across state, federal, private, and tribal lands in the GYA, as well as national parks, forests, and wildlife refuges.

A NEW FOCUS ON ELK

New evidence indicates that all recent cases of brucellosis in GYA cattle are traceable genetically and epidemiologically to transmission from elk, not bison. Data show that the prevalence of brucellosis in elk in some regions has been increasing, and data

What is Brucellosis? Brucellosis in the Greater Yellowstone Area (GYA) is a disease caused by the bacteria *Brucellosis abortus.* Brucellosis was first detected in Yellowstone National Park bison in 1917 and has been present ever since. Brucellosis can be transmitted from one species to another. The hallmark of the disease in cattle, bison, and elk is abortion or birth of nonviable calves.

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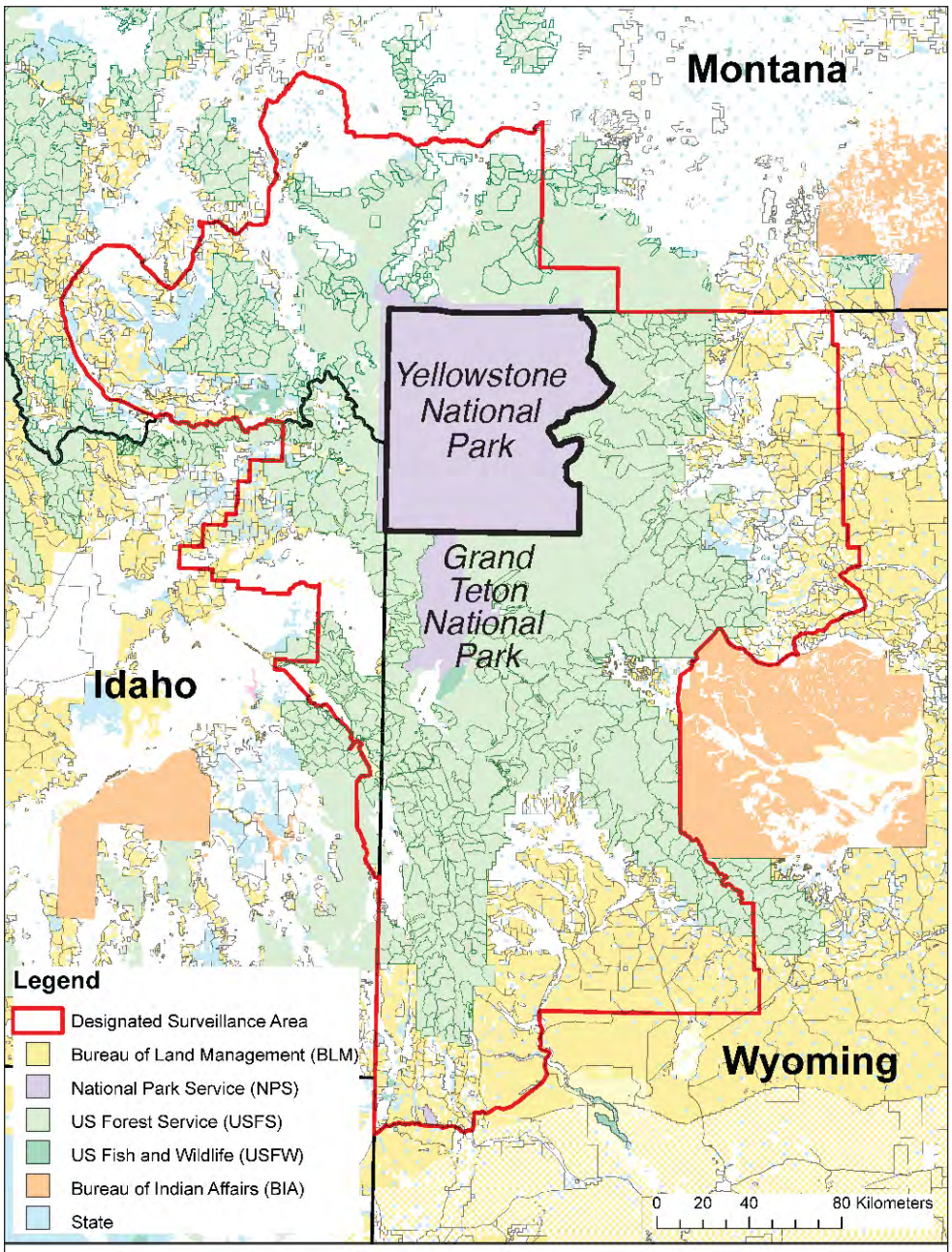
also strongly suggest that elk maintain brucellosis infection, even within populations that have limited to no direct contact with infected bison. In addition, direct contact of elk with cattle is more prevalent than contact of cattle with bison, which may be increasing the risk of transmission.

In contrast, there have been no cases of transmission from GYA bison to cattle in the 27 herds infected with brucellosis since 1998, despite no change in the percentage of brucellosis infected bison individuals (seroprevalance). This is likely a result of bison management practices outlined in the Interagency Bison Management Plan (IBMP) combined with the fact there are fewer cattle operations in the GYA region where bison leave Yellowstone National Park.

With elk now viewed as the primary source for new cases of brucellosis in cattle and domestic bison, federal and state agencies should prioritize efforts on preventing brucellosis transmission by elk. Modeling should be used to characterize and quantify the risk of disease transmission and spread from and among elk.



The Greater Yellowstone Area consists of the Yellowstone and Grand Teton National Parks and the surrounding 6 national forests, 3 national wildlife refuges, state lands, Bureau of Land Management land parcels, and private and tribal lands. GYA oversight is provided by the National Park Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and the U.S. Department of Agriculture (USDA) Forest Service and several state agencies. The designated surveillance area (DSA, red border) is the area where brucellosis is monitored.

ADAPTIVE MANAGEMENT OPTIONS TO REDUCE RISK

No single management approach can independently result in reducing risk to a level that will prevent transmission of brucellosis among wildlife and livestock. An integrated approach is critical. In making timely and science-based decisions for reducing the risk of transmission from elk, federal and state agencies should use an *active* adaptive management approach that would include iterative hypothesis testing and mandated periodic scientific assessments. Management actions should include multiple, complementary strategies over a long period of time, with set goals to measure incremental progress toward reducing the risk of transmission from and among elk. Management options that can be applied include the following:

Population Reduction. Reducing the population size of elk, cattle, or bison are all likely to reduce the risk of brucellosis transmission to cattle by reducing the area of potential contact or the number of infected individuals

in those areas. Transmission among elk appears to be influenced by density. Potential management approaches for elk population reduction include hunting, contraception, and test and removal of infected animals. If further reducing the prevalence of brucellosis in bison is desirable, bison population control measures should include targeted removal of infected bison, quarantine and relocation, and contraception.

Intervention Options within Feedgrounds. Elk are fed in the winter at the National Elk Refuge and 22 supplemental winter feedgrounds in Wyoming for conservation and hunting purposes, and also for separating elk from cattle. However, it is widely accepted that feedgrounds promote transmission of brucellosis among elk and are likely responsible for elevated prevalence in those areas. Potential interventions in feedgrounds could include balancing the timing and use of the feedgrounds, feeding in checkerboard patterns, test and removal of infected animals, contraception, removal and cleanup of aborted fetuses, and incremental closure of feedgrounds. The report recommends that use of supplemental feedgrounds should be gradually reduced and the impacts of those reductions robustly analyzed and evaluated.

Spatial and Temporal Separation. Bison management to prevent brucellosis transmission has been successful in part due to spatial and temporal separation from cattle. Spatial and temporal separation also plays an important role in reducing transmission risk from elk. Separation of susceptible and infected animals during high-risk periods has been and should continue to be utilized as a risk reduction tool.

Testing, Surveillance, and Designated Surveillance Area (DSA). Regionalization is now a well-accepted approach to allow subnational disease containment without jeopardizing the disease status of an entire nation. The DSA zoning concept is a valuable approach toward brucellosis control in the GYA, but its effective use is dependent on responsible and timely adjustments of DSA boundaries based on adequate surveillance, particularly in elk. Currently, there is no federal guidance for conducting wildlife surveillance and no uniformity in rules and standards. If DSA boundaries are not expanded in a timely manner in response to finding wildlife with brucellosis, there is an increased risk for the spread of brucellosis in cattle and domestic bison outside the DSA boundaries and beyond the GYA.

Managing Brucellosis with Designated Surveillance Areas (DSAs)

The costs of managing brucellosis can be reduced by confining surveillance of wildlife and testing of cattle to the smallest geographic area possible. In 2010 in response to an interim rule, the states of Idaho, Montana, and Wyoming established designated surveillance areas (DSAs) where brucellosis-infected animals are known or suspected to exist, based on past surveillance in wildlife and recent livestock cases. The states already have expanded their DSA boundaries at least once as brucellosis infected elk have expanded beyond DSA boundaries. Failure to expand DSA boundaries in a timely manner in the future will increase the probability that exposed or infected livestock may not be detected in time to prevent the further spread of infection as they are marketed and moved across the country.

In response to this increased risk, USDA–APHIS should take the following measures:

- Work with appropriate wildlife agencies to establish an elk wildlife surveillance program that uses a modeling framework to optimize sampling effort and incorporates multiple sources of uncertainty in observation and biological processes.
- Establish uniform standards for expanding the DSA boundaries in response to finding brucellosis infected wildlife.
- Revise the national brucellosis surveillance plan to include and focus on slaughter and market surveillance streams for cattle in and around the GYA.

Vaccination. Brucellosis vaccination has been an important part of the program to eradicate brucellosis from domestic cattle, and it is effective when used in conjunction with other disease management approaches such as quarantine, herd management to reduce intra-herd transmission, and test and removal. An improved vaccine for each of the three species (elk, bison, and cattle) would help suppress and eventually eliminate brucellosis in the GYA. For free-ranging bison and elk, appropriate and cost-effective vaccine delivery systems would be critical. However, until the issue of infected elk transmitting brucellosis to cattle is fully addressed, there will still be a perception of risk by other states that would likely drive continued testing of cattle leaving the DSAs even if cattle are vaccinated with a highly effective vaccine.

BIOECONOMICS: A FRAMEWORK FOR MAKING DECISIONS

Economic resources for managing disease risks in the GYA are scarce. Any management strategies that impose costs on agencies and other stakeholders while producing few benefits will not be adopted. Costs are not limited to direct monetary costs of undertaking

management actions, and benefits are not limited to reduced economic risks to cattle producers. The costs and benefits also include the positive and negative impacts to the ecological processes of the region that are directly or indirectly valued by stakeholder groups, tourism, and others.

A coupled systems/bioeconomic framework would be valuable for evaluating the socio-economic costs and benefits of reducing brucellosis in the GYA and to weigh the potential costs and benefits of particular management actions within an adaptive management setting. A bioeconomic framework is also needed to identify appropriate management actions to target spatial-temporal risks, including risks beyond the GYA.

A CALL TO STRATEGIC ACTION

Given the increasing incidence of brucellosis in GYA cattle and domestic bison herds over the past few decades, significant resources are needed to address this expanding problem. Without the necessary changes and investments, brucellosis may spread beyond the GYA, resulting in serious economic and public health consequences for the United States. Although eradication of brucellosis from the GYA remains a distant goal due to scientific, social, political, and economic reasons, significant progress toward reducing or eliminating brucellosis transmission from wildlife to domestic species is possible.

Managing an ecosystem as complex as the Greater Yellowstone Ecosystem will require coordination and cooperation across federal, state, and tribal jurisdictions. Participation of leadership at the highest federal (Secretary) and state (Governor) levels for initiating and coordinating actions and in sharing information is critical. In addition, a forum to coordinate scientific approaches to brucellosis control would be a valuable mechanism to ensure that science informs policy. A strategic plan is needed to coordinate future efforts, fill in critical knowledge and information gaps, and determine the most appropriate management actions under a decision-making framework that is flexible and accounts for risks and costs.

COMMITTEE ON REVISITING BRUCELLOSIS IN THE GREATER YELLOWSTONE AREA

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For More Information . . . This Report Highlights was prepared by the Board on Agriculture and Natural Resources based on the report *Revisiting Brucellosis in the Greater Yellowstone Area.* The study was sponsored by the U.S. Department of Agriculture Animal and Plant Health Inspection Service. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authoring committee and do not necessarily reflect those of the sponsor. Copies of the report are available from the National Academies Press, (800) 624-6242; **http://www.nap.edu**.

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