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Review of Wyoming's Brucellosis Management Plan

A Review to Assess the Specific Disease Management and Disease Mitigation Activities Currently in Place within Wyoming's Designated Surveillance Area

2017 Review of Wyoming's Brucellosis Management Program

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Dates of the Review: June 19-21, 2017

Locations Visited

- Wyoming Livestock Board Office, Cheyenne, Wyoming – Dr. Bob Meyer and Staff
- Wyoming Livestock Board Office, Riverton, Wyoming – Dr. Jim Logan, Dr. Thach Winslow, and Ms. April Peregoy
- Wyoming State Veterinary Laboratory, Laramie, Wyoming – Dr. Will Laegreid and Dr. Brant Schumaker
- Riverton Livestock Auction, Riverton, Wyoming – Dr. Jake Hall and Market Staff
- Torrington Livestock Markets, Torrington, Wyoming – Market Management

Executive Summary

The State of Wyoming and the Wyoming Livestock Board (WLSB) are doing a good job preventing brucellosis from leaving the Designated Surveillance Area (DSA) via cattle or owned bison, as evidenced by no affected herds being detected outside of the DSA. The WLSB implements a robust livestock surveillance program that includes testing eligible cattle leaving the DSA at change of ownership, intrastate and interstate movement, or slaughter (both in-State and out-of-State). The WLSB's strategy is to detect brucellosis through individual animal testing, not whole or fractional herd testing. While regular testing at the herd-level within the DSA would be more prudent, individual animal tests may be more economically feasible and acceptable to the ranching community. The WLSB works cooperatively with State wildlife partners to conduct wildlife surveillance and monitor changes in elk prevalence to remain apprised of risk within and beyond the DSA.

Recent detections of exposure to brucellosis in wild elk outside of the DSA in the Bighorn Mountains has increased the scrutiny of Wyoming's administration of their brucellosis program by outside stakeholders. The Wyoming Game and Fish Department (WGFD) identified 11 seropositive elk in the Bighorn Mountains since 2012 and through the 2016 hunting season. No culture-positive animals have been detected to date, but sampling is very limited. Detection of seropositive elk beyond the DSA begs the question as to whether Wyoming should expand its current DSA to include Big Horn County. Currently, WLSB manages Big Horn County, as well as neighboring Sheridan County as an "Area of Concern." This official declaration allows WLSB to fiscally support voluntary testing of animals within this area. Veterinary Services (VS) acknowledges that the estimated current risk of transmission from wild elk to livestock in Big Horn County is low and even lower in Sheridan County. However, elk surveillance is ongoing and is not sufficient to fully estimate the risk. As a result, VS finds it would be best to require testing at the change of ownership for animals leaving Big Horn County and maintain voluntary testing in Sheridan County. Meanwhile, surveillance in elk should be enhanced in the Bighorn Mountains to continue to inform risk assessments. If Wyoming recognizes an appreciable increase in elk seroprevalence or identifies a culture positive elk in this area, re-evaluating the DSA boundary will be necessary. VS intends to follow up on this issue next year and will review it annually as part of the memorandum of understanding (MOU) process.

Overall Strengths

- WLSB administers solid regulatory rules with a common sense approach to conduct both live-animal and slaughter surveillance on animals in or leaving the Wyoming DSA.
- WLSB cooperates closely with markets serving the DSA to conduct testing on all test-eligible animals, as well as voluntarily testing many animals leaving the Area of Concern.
- The Wyoming State Veterinary Laboratory (WSVL) provides a strong diagnostic system with rapid reporting.
- Recently affected herds have been detected early based on low intra-herd prevalence. As a result, the WLSB has been successful at early detection, to date.
- Wyoming has an effective and capable WGFD to vigorously manage elk winter feed grounds, conduct wildlife surveillance across the State, and implement risk mitigation activities.

Overall Weaknesses

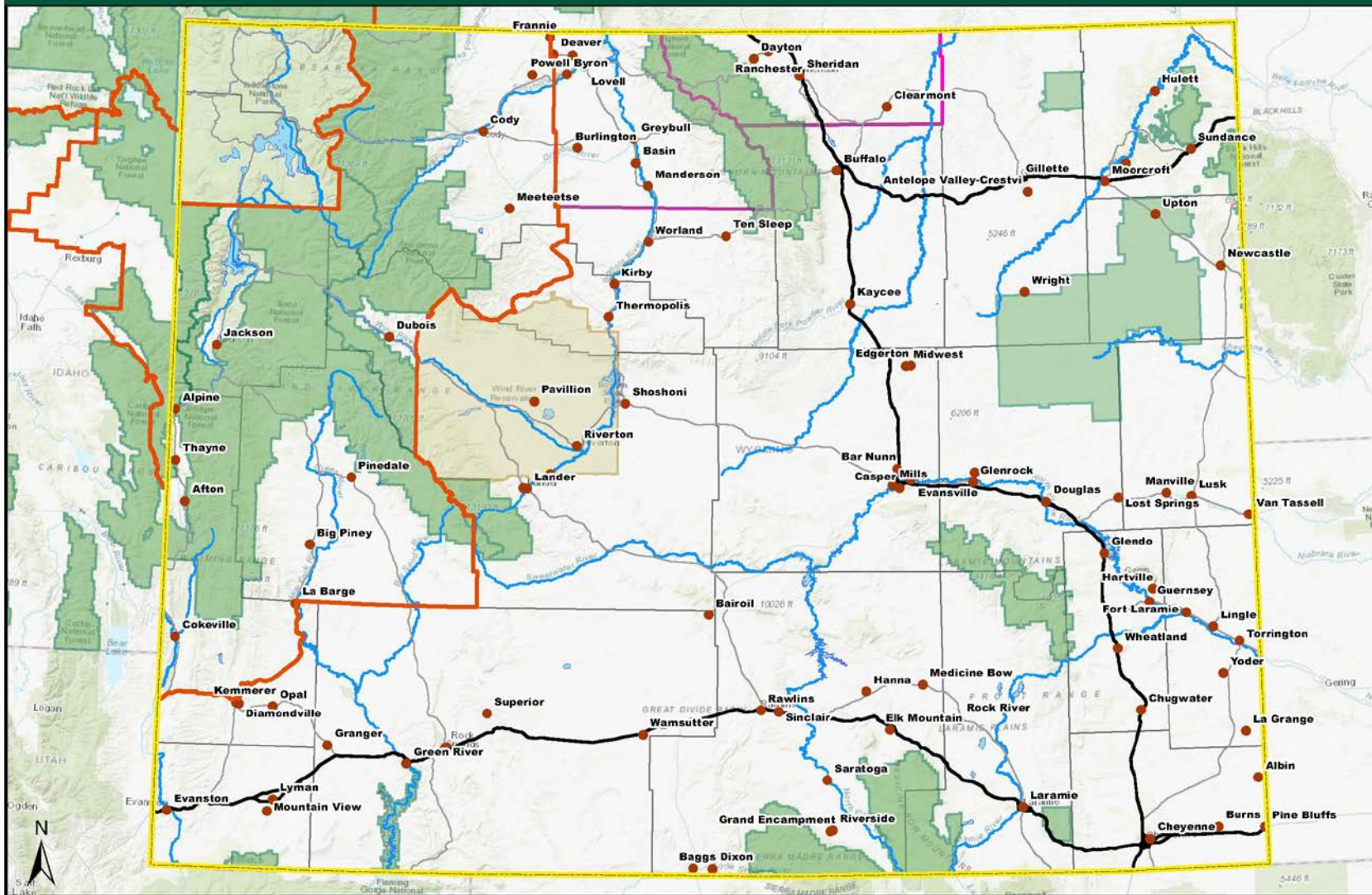
- Surveillance is based on an individual animal test approach vs. a herd-level test approach, which may allow some herds with risk to go undetected for a long period of time. Individual animal testing may be the most fiscally feasible surveillance, as well as the most cost-effective, for Wyoming at this time.
- Wyoming Chapter 2 establishes the geographic boundary of the DSA. However, there is no written rule or policy establishing specific criteria or threshold for re-evaluating the boundary. The establishment of the boundary is left solely to the WLSB based on input from the State veterinarian and other stakeholders.
- The WLSB reports the number of animals tested across the State monthly, but measurable metrics to monitor compliance and enforce the rules with respect to testing of animals when required do not currently exist.
- Herd plans are voluntary within the DSA, with less than 30 percent of eligible herds participating, potentially leaving some herds at risk with no defined management plan. The WLSB works to encourage participation and focuses on herds with known risks.
- There is a lack of adequate information to fully assess the current risk of brucellosis wildlife-livestock transmission in the Bighorn Mountains.

Key Recommendations

1. Develop written guidelines or policy based on specific criteria for defining the boundary of Wyoming's DSA. Base the area on:
 - a. Elk range/location, changes in observed elk seroprevalence or culture positive elk, elk-livestock interface, or other risk factors, and
 - b. Establish criteria that would trigger a change in the DSA based on these risk factors.
2. Develop a method to monitor, enforce, and report the testing of animals leaving the DSA to ensure compliance with rules and regulations, including the number tested on a herd-level basis. At a minimum, reporting should occur annually.
3. Establish a minimum annual target for the percentage of animals tested from each DSA herd (e.g., each DSA herd tests at least 15-20 percent of its eligible animals annually, including the tests that occur when test-eligible animals leave the herd). This target is based on expected cull and replacement rates within the herd.
4. Classify DSA-herds out into high-, medium-, or low-risk categories and document where risk occurs and which herds are on herd plans based on risk level. Continue to target high-risk herds for participation in formal herd plans, and include medium- and low-risk herds when possible. Define what constitutes high-, medium-, and low-risk to create these categories. Conduct risk assessments with individual herds, which will take additional time and resources.
5. Continue reimbursement for pre-movement testing for all test-eligible animals moving out of the DSA, as well as supporting the laboratory testing.
6. Work with WGFD to maintain or increase elk surveillance, especially in the Bighorn Mountains, to enact wildlife management strategies to decrease prevalence when necessary.

7. Consider testing eligible animals at the change of ownership in Big Horn County. Continue voluntary testing in Sheridan County. This will require increased funding to compensate for testing, conduct herd risk assessments, and continue education in these counties. VS will stay in regular communication with the WLSB and re-assess their approach for the Bighorn Mountains in one year.
8. Finalize the MOU between APHIS and WLSB before December 31, 2017, and review it annually.
9. Maintain funding for Wyoming's brucellosis management program. A decrease in funding may put any portion of the activities and effectiveness of the program at risk.

Wyoming Brucellosis DSA



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- State Boundary
- DSA
- Forest Boundaries
- Wind River Reservation
- County Boundaries
- Area of Concern
- Interstate
- USWY Highways
- Lakes
- Rivers
- Cities / Townships

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Background Information

Dr. Sara Ahola, Dr. Mark Camacho, and Ms. Sue Wageman conducted an in-person APHIS review of Wyoming's Brucellosis program on June 19-21, 2017. The intent of the review was to revisit the Wyoming's management of brucellosis within its boundaries. WLSB administers brucellosis oversight, specifically Dr. Jim Logan, the State Veterinarian, and his staff, which are collectively referred to as the WLSB throughout this review.

Given Wyoming's wildlife reservoir of brucellosis in elk and bison, the State is required to manage brucellosis in cattle and owned bison through an agreed upon MOU between APHIS and the State. This MOU should contain a Brucellosis Management Plan (BMP) and be revisited annually for mutual agreement. While APHIS and Wyoming have not formally agreed upon an MOU, the BMP has undergone an annual review via approval of Wyoming's umbrella cooperative agreement and brucellosis activities occurring under that agreement. This review served to evaluate brucellosis mitigation activities in the State more thoroughly and to identify areas of strength and areas needing improvement. APHIS also notes that in the State's fiscal year (FY) 2018, the Wyoming's legislature approved a forty percent budget cut to brucellosis appropriations. The WLSB's brucellosis appropriations have been cut for three years in a row, and over \$120,000 in the last year.

2012 Review

APHIS conducted its last in-depth review of Wyoming's brucellosis management program in 2012 and determined these key summarized recommendations:

- Increase the number of herds within the DSA with approved herd plans;
- Develop formal templates for a brucellosis-affected herd plan and an unaffected DSA herd plan detailing the proactive risk mitigation actions in place;
- Increase surveillance on slaughter cattle coming out of the DSA, especially when going direct to slaughter;
- Continue wildlife surveillance activities and studies to expand the knowledge base about brucellosis in elk; and
- Continue producer education and outreach.

The WLSB enacted changes in their program since the 2012 review and followed the recommendations by making a rule change to require testing on all cattle going to both in-State and out-of-State slaughter, creating formal at-risk and affected herd plan templates, continuing efforts to better understand the role of elk in brucellosis transmission in Wyoming, and continuing to educate their producers. The WLSB also continues their effort to include all herds at risk in the voluntary herd plan program, but has not increased the number of herds participating in that program since the 2012 review, mainly due to producer reluctance.

Brief overview of the cattle and owned bison industry in Wyoming

The Wyoming cattle and owned bison industry is primarily based on cow-calf operations, with approximately 704,000 beef cows and 183,000 replacement heifers produced by 4,365 farms and ranches. Approximately 90,000 head of cattle in 570 herds live within the DSA. Domestic/owned bison numbers are estimated to be approximately 10,000 head owned by 66 producers, 14 of which are within the DSA, with an unknown total number of bison. There are few dairies in

Wyoming with approximately 6,000 head of milk cows in the State on 36 dairy operations. Wyoming has feedlot capacity to finish 100,000 to 120,000 head of cattle per year, depending upon placements, and has approximately 70 farm and background feed yards supplying the stocker, feeder, and slaughter channels on an intermittent basis. Wyoming is a net export State, with most cattle and bison leaving herds for feeding, slaughter, and breeding out-of-State. Wyoming producers spent years developing quality genetics in their herds and many replacement animals were sold both in-State and out-of-State. (Adapted from WLSB 2017)

Recent Brucellosis Infections in Wyoming

Currently, there are no brucellosis-affected herds identified in Wyoming. Three affected herds have been detected within the boundaries of Wyoming since 2012, but were released from quarantine. All three were located within the DSA and the *Brucella abortus* (*B. abortus*) isolates from these herds were closely related to isolates previously identified in elk, as determined by whole genome sequencing (WGS) conducted by APHIS. These livestock herds had low intra-herd prevalence, indicating the disease had not been present long and did not have much time to transmit from animal-to-animal within the herd. This is a tribute to the effectiveness of the WLSB's brucellosis program. These herds were managed by a test-and-remove strategy, per an affected herd plan. The WLSB oversaw the herd plans and cooperated with local and national APHIS staff to ensure proper adherence to the Brucellosis Uniform Methods and Rules (UM&R).

Review Objectives

1. Review the adequacy of Wyoming's brucellosis rules to prevent the spread of brucellosis beyond the DSA.
2. Assess the enforcement of those rules.
3. Assess the diagnostics, risk mitigations, and education in place to support the program.
4. Assess wildlife surveillance and risk mitigation activities.
5. Evaluate if the DSA boundary is appropriate.

Objective One: Review the adequacy of Wyoming's brucellosis rules to prevent the spread of brucellosis beyond the DSA

Findings and Observations

Overall Adequacy of Regulations

- WLSB administers their brucellosis management program through three State rules:
 - Chapter 2 (vaccination, testing, identification);
 - Chapter 6 (reimbursements); and
 - Chapter 8 (importation).
- Table 1 on page 8 summarizes Chapter 2 regulations.
- The language used in Chapter 2 to define the creation of a DSA is too vague. Currently the language reads, "The DSA can be modified by Board order if exposure risks beyond described boundaries arise."
- In addition to State rules, title 9, *Code of Federal Regulations* (9 CFR), part 78 requires that APHIS and Wyoming sign an MOU for the management of brucellosis. A working

draft was previously agreed upon between the two parties; however, the MOU has not been finalized and cooperative activities have been ongoing. APHIS will continue working with Wyoming to ensure that the MOU is completed.

- The review team looked at the testing regimens for quarantine release from the most recent case herds with WLSB staff. After review, it appeared that the WLSB is properly following the UM&R when possible and consulting with USDA before attempting any alternative testing regimens that might work best in a particular situation. The WLSB had well-documented summaries of all regulatory activities on their most recent affected herds for the review team to inspect.

Vaccination Requirements

- Vaccination is required for all sexually intact females within the DSA, except nursing female calves still at their dam’s side.
- Outside of the DSA, vaccination is required prior to the change of ownership. Adult vaccination (AV) and booster vaccination occurs as needed and as approved by WLSB.
- Brucellosis vaccination is part of Wyoming’s cattle culture and occurs regularly. According to WLSB records, in 2016 over 183,000 (27,300 in the DSA) cattle/bison were vaccinated.

Table 1. Summary of WLSB Chapter 2 Brucellosis Regulations

<u>Vaccination</u>	
State-wide	Required prior to change of ownership for any intact female over 12 months. Adult vaccination and booster is allowed with prior approval.
DSA	All weaned, intact females in DSA, including those imported, grazed, and kept within the boundaries.
Exemptions	Direct to slaughter or approved feedlot; to a State that accepts non-vaccinates.
<u>Live Animal Testing</u>	
Test Eligible	Sexually intact females 12 months or older.
DSA	Before change of ownership, movement out of the DSA, or interstate movement.
Timeframe	Within 30 days before or one time from August 1-January 31 if moving during this time period.
Exemptions	Moving to an approved livestock market for test. Out-of-State origin commuter herds leaving Wyoming: 20 percent of herd tested (open, late-bred, culls). If approved herd plan waives testing due to low-risk movement, e.g. routine herd movement with no change of ownership.
<u>Slaughter Testing</u>	
State-wide	All animals tested, 12 months of age and over, at in-State slaughter facilities.
DSA	Must be tested before leaving the State, either on-farm or at market, as a live animal before moving to slaughter, (i.e. no slaughter exemption for test).
<u>Identification</u>	
State-wide	All sexually intact animals 12 months or older at change of ownership.

DSA	All sexually intact females, regardless of age, when leaving the DSA.
Exemptions	Non-vaccinated females temporarily leaving DSA for contiguous, seasonal grazing, and returning with no change of ownership. Moving to a designated feedlot for identification.

Testing Requirements and Implementation

- WLSB’s surveillance strategy is targeting individual animal testing, rather than herd-level testing, to detect movement of seropositive animals outside of the DSA. This method of disease detection is determined after much discussion between the WLSB, the State veterinarian, Wyoming’s cattle industry, WGFD, and their Greater Yellowstone Area (GYA) State neighbors. Limits in workforce, appropriations, and industry support prevent the WLSB from conducting more herd-level tests.
- WLSB defines the high-risk period of exposure to brucellosis within the DSA as February 1-June 30, based on observed elk abortion data. Testing must occur in 30 days or less prior to movement or change of ownership, unless the animal is moving between August 1 and January 31, in which a one-time test is required.
- WLSB’s pre-movement testing protocol may be entirely appropriate for Wyoming’s level of brucellosis infection and producer cooperation, but as mentioned previously, this approach has a few notable weaknesses when compared to regular area herd-level testing, such as:
 - Potential for some herds to go undetected for a long period of time if an appreciable number are not tested;
 - Lack of exposure status in test negative individual animals allowed to move out of the DSA without a herd-level test;
 - Dependence on a robust regulatory infrastructure that can capture all pre-movement situations and provide the appropriate testing and authorization at the speed of commerce; and
 - Difficulty in documenting to outside regulatory agencies whether all test eligible animals are actually tested prior to movement.
- While regular mandatory herd-level testing for all herds residing within the DSA may be more prudent, it would likely require significantly more monetary outlays for reimbursement and laboratory expenses. Given the WLSB’s current budget and low prevalence in livestock, an individual animal testing approach may be the most cost-effective surveillance and is deemed adequate to mitigate the risk of exporting brucellosis beyond the DSA.
- Recent herd detections imply WLSB is finding herds early with low intra-herd prevalence and before much intra-herd spread.
- WLSB changed their rules since the last review to remove slaughter exemptions for animals leaving the DSA and requires a test on DSA test-eligible animals before leaving the State.
 - WLSB has agreements with in-State markets (Riverton, Torrington, Buffalo, and Worland), as well as five out-of-State markets that receive DSA cattle to conduct testing:
 - two in Billings, MT;
 - one in Idaho Falls, ID; and

- two in South Dakota, located in Belle Fourche and St. Onge.
 - Market veterinarians are paid for testing conducted on Wyoming cattle, so there is an incentive to conduct and report the testing, which occurs regularly.
- WLSB adequately reports testing on a monthly-basis in cooperation with APHIS, breaking out tests by DSA and non-DSA animals, market or on-farm testing, and wildlife.
- In-State slaughter establishments test all animals over 12 months coming through regardless of sex and whether they originate from the DSA or not. As a result, surveillance is enhanced through a sample of lower-risk animals located beyond the DSA.
- Reimbursement occurs for all testing required by Chapter 2 and cattle/bison producers realize no out-of-pocket expense, but do recognize indirect costs for brucellosis testing, such as those related to processing cattle. Testing occurs primarily on-farm or at livestock markets.
 - Veterinarians testing on-farm are reimbursed \$5.00 per head tested. If testing at a livestock market, the veterinarian is paid \$5.50 per head, with an additional \$2.00 per head added to cover labor costs to either the market owners or market veterinarian, depending on who supplies the labor.
 - Custom slaughter plants are reimbursed \$3.50 per head sampled.
 - An additional \$0.25 per head is reimbursed for those using APHIS' Mobile Information Management (MIM) system to create and transmit electronic test records.
- Out-of-State commuter herds are required to test a minimum of 20 percent of their herd when leaving the DSA and returning home, with an emphasis for the 20 percent on open or late bred cows. The 20 percent test rate for commuter herds was established based on expected culls and open rates. It is acknowledged that commuter animals are generally grazing during low-risk time periods and movement between States is approved by both State animal health officials.
- Commuter herd testing generally occurs when the animals return home, due to availability of testing facilities. Payment is provided by the State of Idaho and State of Utah to the testing veterinarian in the herd's home State. Compliance is monitored by the herd's home State. Issuance of a Wyoming grazing permit for the following year is contingent upon proof of test.

Animal Identification Requirements

- WLSB rules exceed 9 CFR 86 (animal disease traceability) requirements, in that they require official identification (ID) be in place for all sexually intact cattle and bison 12 months and older at change of ownership, even if the animal is staying in-State. This applies to the entire State, not just the DSA.
- Many of these animals are identified by their official calfhood vaccinate (OCV) tag. If requested, WLSB provides orange OCV radiofrequency identification (RFID) tags at no charge to the producer. This program is increasing in popularity and WLSB continues to educate owners of the benefit of RFIDs, as well as supply RFID readers to veterinarians when possible. Given that sexually intact females within the DSA are required to be vaccinated, APHIS has observed excellent participation in official ID.
- All sexually intact female cattle leaving the DSA, regardless of age, must be officially identified.

- If not already identified, official ID is placed and recorded on official test charts when leaving the DSA, much of which occurs at livestock markets.
- ID requirements are exempt for non-vaccinated female calves at their mother's side if leaving to a contiguous grazing area and returning to the DSA with no change of ownership, for a feeder heifer shipped to a designated feedlot and identified upon arrival, or if there is a specific exemption in the herd plan to be identified at a pre-approved location outside the DSA (i.e. home ranch).
- Much of the animal movement within the State is recorded via brand inspections, which rely on documenting the presence/absence of a permanent, individual brand(s). However, no individual animal ID is recorded on brand papers.
- Animals may arrive at the market with previous test records that were conducted on-farm; however, no confirmation of that identification is made at the market. In other words, animals presented for sale are not run through the chute to confirm that they are in fact the animals on the current test-chart. This is simply a matter of business continuity and trust between the seller, the State Veterinarian, and the market veterinarian.

Recommendations

1. Define and explain the basis for the geographic area in which a disease risk exists from *B. abortus* and to which the BMP activities apply.
2. Define the criteria by which the boundary of the DSA should be evaluated for either expansion or contraction.
3. APHIS and the WLSB should finalize and sign an MOU to include a BMP as soon as reasonably possible, preferably by December 31, 2017, to come under full compliance with 9 CFR 78. APHIS and WLSB will revisit this MOU annually.
4. Continue reimbursement for testing to veterinarians and labs to maintain no out-of-pocket expense to producers. This portion of the program is essential to compliance.
5. Continue supporting the use of RFID or other electronic OCV tags and increase use through measurables (# of tags/year). Target herds within DSA that retain breeding heifers to work towards an all-electronic herd.
6. Work towards the use of electronic capture of data at livestock markets, such as creation of test charts, complete capture of all IDs (consider ultra-high frequency), etc. Until then, regularly audit test records and animal movements through livestock market.
7. If intra-herd prevalence increases in affected herds detected or in the DSA as a whole, then it would be prudent to switch strategies to area whole or fractional (e.g., 20 percent) herd tests.
8. Wyoming has enjoyed relatively few herds that have been affected by brucellosis in the last few years, but the WLSB should not become complacent, as the risk of brucellosis is steadily increasing via expanding elk populations and range.

Objective Two: Assess the enforcement of the rules

Findings and Observations

- Adherence to Chapter 2 relies heavily on WLSB’s Brand rules, which requires a brand inspection recorded on brand papers to cross county lines and/or at the change of ownership. Brand inspectors require proof of test prior to issuance of brand papers. If the animals are moving directly to a livestock market, owners have two options for brand inspection:
 - Receive the brand inspection at the farm. If the animals do not have a current test the brand inspector will stamp “DSA – Brucellosis Test Required” on the brand papers. This would ensure testing upon arrival at the market.
 - The owner acquires a Brand’s issued “G-form”, which allows an owner to haul directly to an in-State livestock market. After arrival, a brand inspection will be issued and testing either confirmed or conducted.
 - All brand papers are inspected at the livestock market upon arrival and animals that need to be tested are sorted off.
- Wyoming has a robust Brand Inspection division within the WLSB. There are 10-12 brand inspectors and two supervisors that serve the DSA. Brand inspectors are aware of DSA geographical boundaries and approved livestock markets and receive a monthly updated list of herds with active herd plans. With 95 brand inspectors and six supervisors State-wide, Wyoming seems to have the resources to accomplish this regulatory task.
- Producers with an approved WLSB Herd Plan are issued herd plan “wallet cards” that outlines their testing plan and any test exceptions. Brand inspectors are also provided a current list of herds with approved herd plans on a monthly basis.
- The WLSB did not have the ability to readily show the review team that all eligible animals coming out of the DSA were receiving the appropriate test.
- Three counties (Fremont, Lincoln, and Hot Springs) are partially contained within the DSA. Therefore, it is possible that movement could occur out of the DSA, but within one of these three individual counties, without a test due to the lack of brand inspection requirement. WLSB encourages herd plans for herds where this may occur, but does not require them. As a result, testing may not be enforced.
- In State FY 2016, the WLSB employs four Enforcement and Compliance Officers. These officers cover all purviews of the WLSB, not just animal health rules. With a forty percent budget cut imposed for FY 2018 on the WLSB, that staff will be reduced to one. This significantly decreases WLSB’s ability to conduct investigations into inappropriate or illegal actions.
- Proof of herd testing is required prior to re-authorization of the commuter permit for the following year. However, no verification of individual animal testing per the animal’s risk status within the herd (open, late bred, or cull) occurs.
- Riverton Livestock Auction markets the most DSA-origin animals, and WLSB relies heavily on the market veterinarian to conduct testing at the change of ownership, including those animals destined to slaughter. This process includes brand inspectors reviewing herd origin (DSA vs. non-DSA), market employees sorting animals that need testing, and the market veterinarian inspecting animals and conducting testing. Given the

economic incentive to test (\$7.50/head), the market veterinarian actively participates in surveillance and if any animal is believed to be eligible, it is tested.

- Additionally, the Riverton market veterinarian is testing all animals originating from the Bighorn Mountains-area, above State regulations. This satisfies import test requirements for the neighboring States of Montana, North Dakota, and South Dakota. The \$7.50/head incentive is also crucial to this testing.
- WLSB relies heavily on its staff to conduct brucellosis management activities. VS currently provides a secondary support role. Given Wyoming's ranching and political culture, it is understandable that VS is not a primary contact for many ranchers. However, VS is underutilized in Wyoming and could provide more support for education, outreach, herd risk assessment, plan design, and enforcement, if needed.

Recommendations

1. Create a system that reconciles the brand inspection data with animal testing data to easily demonstrate that proper surveillance is being conducted. Incorporate electronic brands when implemented. This will increase information for the WLSB to monitor and enforce testing, as well as provide credible information for outside trading partners.
Important components to consider:
 - a. Report the number of test eligible animals leaving the DSA via brand records versus the number of animals tested on a regular basis, at minimum annually.
 - b. Include the number of herds tested and the number of animals tested within each herd.
 - c. Measure how often each individual herd within the DSA gets an individual animal test and what percentage of the herd is tested on an annual basis.
 - d. Measure how long individual herds within the DSA go without having a single movement test.
2. In the interim, while developing the above report, conduct an audit of 5-10 ranches in the DSA to evaluate current compliance.
3. Consider adding sexually intact males into test-eligible, as they may be sentinels of herd-infection.
4. Develop a method to better enforce testing of individual animals at risk due to grazing within the DSA. Beyond verifying that an individual herd that grazed within the DSA was tested at 20 percent, verify that it was the higher-risk animals (opens, culls, late bred) that are required to be tested.
5. Reconcile all animals presented at the market with previous test records as the animals presented for sale. Use electronic means when possible, to facilitate rapid collection of animal information to facilitate commerce.
6. Allow VS to participate more in day-to-day brucellosis management activities. The current personnel are permanent Wyoming residents and have the skills to support Wyoming's brucellosis efforts. APHIS recognizes the unique ranching culture in Wyoming and the need to carefully establish relationships between the Federal government and private producers.

Objective 3: Assess Diagnostics, Risk Mitigations, and Education

- Determine if mitigations are in place that reduces exposure to infected sources and the risk of infection if exposure occurs.

Findings and Observations

- The main focus of WLSB's risk mitigation is the spatial-temporal separation of cattle from wild elk and/or wild bison during the high-risk period.
- WLSB works with producers within the DSA to develop herd plans and assess risk through an individualized herd risk assessment conducted by a WLSB staff veterinarian with the herd manager. This assessment considers factors such as the year-round location of the herd, herd pregnancy rates, live calf rates, number of abortions/late-calvers/weak calves, the percentage of OCV animals, and potential exposure to elk and/or bison.
- Herd plans are voluntary within the DSA and across the State; however, WLSB works to ensure the majority of "high-risk" herds are on a herd plan, which are renewed annually. APHIS notes that no specific criteria was given to the review team as to what constitutes a "high-risk" herd.
- At a minimum, a herd is subject to Wyoming State rules and regulations, regardless of location. These rules and regulations act as a safety net if a high-risk herd is not identified or volunteers to be on a herd plan.
- The number of active herds with herd plans fluctuates from year-to-year, but averages around 150 active plans at any given time.
- Economic incentives, beyond reimbursement for tests conducted, do not exist to conduct herd-level tests or to enact a herd plan.
- Specific mitigations may include fencing off haystacks, additional testing or vaccination plans above State requirements, hazing wildlife away from cattle operations, and changes to seasonal grazing locations.
- The review team met with Dr. Will Laegreid and Dr. Brant Schumaker at the WSVL in Laramie, Wyoming. We discussed the lab workload and capacity for bovine brucellosis testing. The WSVL appears to be well-managed and is a valuable resource for the Wyoming brucellosis eradication program.
- The WSVL meets the established national brucellosis standard operating procedures, which include the national testing protocol. Their personnel participate successfully in annual proficiency testing provided by the National Veterinary Services Laboratory (NVSL) to conduct brucellosis tests. They have quick turnaround times for test results for reporting back to the submitter but noted that NVSL often does not provide a quick turnaround for confirmation testing. WSVL stated that waiting for NVSL confirmation can delay business continuity when a load of animals is held at a market.
- The response rate of approximately 16 BAPA positives per 10,000 samples tested fell into the expected range. By comparison, approximately five BAPA responders per 10,000 samples were found at the Kentucky National Brucellosis Surveillance lab in 2016, which covers large areas of the United States with no known brucellosis infection.
- APHIS noted that WSVL is in possession of elk serology and culture data that was collected cooperatively among the three GYA States and APHIS. Attempts at analyzing that data have not been successful, due to a lack of sharing of that data by WSVL. APHIS has attempted multiple conversations with WSVL to make that data available for

analysis with no success, which is preventing progress in assessing best testing protocols in elk.

Education

- WLSB staff veterinarians attend regular meetings within the State to meet with producers and educate them on State rules and brucellosis epidemiology.
- WLSB indicated that producers and veterinarians within the DSA understand brucellosis well because they frequently deal with the regulations. However, many producers and veterinarians outside the DSA have little detailed knowledge of brucellosis as they do not regularly deal with the disease.
- Educating the public about the human health concern of brucellosis is important. The information must reach the non-agriculture public, hunters, and agriculture communities, because everyone is affected in some way by brucellosis.
- The WLSB provides handouts/brochures and electronic materials to producers for further education.
- Ongoing education is needed, including funding to send staff out into the State on a regular basis.
- WLSB may develop some type of brucellosis education module (similar to APHIS' National Veterinary Accreditation Program training) to educate producers and veterinarians not regularly dealing with the disease.

Recommendations

1. The WLSB should have a goal of 100 percent of defined high-risk herds within the DSA to have an active herd plan with the WLSB. Consider incentives to encourage participation or make herd plans mandatory under State rules given specified criteria (e.g., known high-risk interactions with elk).
2. The WLSB should have a goal of 100 percent of herds with elk contact inside the Bighorn Mountains during peak period (seasonal grazing or resident herds) to have an active herd plan with WLSB. Consider incentives to encourage participation.
3. WSVL should engage with GYA partners to share currently available elk serology and culture data to provide more information regarding elk brucellosis assays.
4. Continue regular meetings and education within the DSA and expand resources beyond DSA, especially in Big Horn County.
5. Communication and outreach should be kept in front of the general public due to public health concerns and the potential impact on Wyoming should brucellosis prevalence increase in livestock. Therefore, it is important to fund ongoing education through in-person meetings and travel. APHIS cooperative agreements serve a key role for this recommendation.

Objective Four: Evaluate wildlife surveillance and risk mitigation activities

Findings and Observations

- WGFD works to monitor elk seroprevalence both in the feed grounds and around the State. They have a competent staff and laboratory to support field work to understand elk ecology and brucellosis in elk better.
- There are two categories of elk surveillance:
 - Feed ground elk testing.
 - WGFD performs feed ground elk surveillance on 22 State feed grounds and the National Elk Refuge feed ground, where approximately 25,000 elk are fed annually.
 - In 2016, WGFD tested 325 elk 18 feed grounds, applied 87 global positioning system (GPS) collars, and placed 39 vaginal implant transmitters (VITs) to monitor reproductive events. The average seroprevalence across the feed grounds was 26 percent.
 - The high observed seroprevalence in feed ground elk is a major concern for ongoing spillover events into livestock. The 2017 National Academy of Sciences review recommended phasing out feed grounds over time.
 - Non-feed ground elk testing.
 - Non-feed ground surveillance is based primarily on hunter-submitted samples, but also includes samples that are collected during trapping events.
 - Current surveillance is based in the Bighorn Mountains and in herds surrounding the DSA that do not use feed grounds. Additionally, nearly one quarter of the brucellosis non-endemic area is surveyed each year on a rotating basis to provide State-wide information every four to five years.
 - In 2016, a high seroprevalence of 32 percent was noted in the Gooseberry Herd Unit within the DSA; however, it was noted that sample size was small and results may not be significant. In 2016, in the Bighorn Mountains in the Area of Concern, 2133 samples were tested with one serologic positive resulting in an estimated seroprevalence of 0.05 percent.
 - Non-feed ground elk are also included in research efforts utilizing GPS collars that track the movement of 150 animals over three years.
- WGFD provides, through cooperative agreement with APHIS, fencing to livestock producers for decreased elk damage and comingling. WGFD also conducts routine hazing to move elk away from conflict areas. Habitat enhancement, improved lower-density feedline initiatives also work to decrease the risk of elk-to-elk transmission and elk-to-livestock transmission.
- Ongoing research across WGFD to better understand the elk population, movement and distribution, reproductive events, etc., is an integral component to successful brucellosis management.
- WGFD is doing a good job conducting surveillance, research, and risk-mitigation activities to decrease the risk of spillover and better understand elk's role in disease transmission.
- WGFD works with neighboring States to stay apprised of elk surveillance and research activities; however, no high-level coordination occurs to manage surveillance and/or research across the three Greater Yellowstone States.
- APHIS cooperative agreement monies are integral to the ongoing implementation of research and mitigation activities, especially in light of the 40 percent budget cut for FY 2018.

- Admittedly, WGFD’s objective is not to stop the spread of brucellosis within the elk population, but to assist in mitigating the risk of spillover into livestock.

Recommendations

1. Maintain or increase elk surveillance, acknowledging that hunter samples are key to increasing the sample size and representativeness of the population over time. Consider offering incentives to increase hunter samples, such as added numbers to the hunt lottery or reduced tag fees for the following year if a successful sample is submitted.
2. Aggressively target the Bighorn Mountains to improve confidence in the apparent seroprevalence in elk. Include practices to improve tissue sampling, such as continued personnel on site during the hunt season to facilitate sample collection.
3. Implement adaptive management strategies to prevent increases in seroprevalence across the State, with an increased emphasis in the Bighorn Mountains. Surveillance data should be used to inform these management actions.
4. Continue working with Montana and Idaho to stay apprised of activities related to research. Work to coordinate more activities or sampling strategies to offer a more unified set of data and information to better characterize the risk of elk transmission and effective mitigation activities.
5. Continue cooperative investing in research related to understanding the risks of elk-to-livestock transmission.

Objective Five: Evaluate if the DSA boundary is appropriate

Findings and Observations

- Eleven seropositive elk were detected from 2,382 samples in the Bighorn Mountains from 2012-2016. Estimated seroprevalence of elk in that area is currently 0.4 percent across all hunt units. For hunt units within the Bighorn Mountains, the 95 percent confidence intervals range from a 0.0 percent lower bound to an 11.2 percent upper bound.
- To date, seropositive elk have been found only in Big Horn County, on the western slope of the Bighorn Mountains. No seropositive elk have been found in Sheridan County, on the eastern slope of the Bighorn Mountains.
- WLSB manages Big Horn and Sheridan Counties as an “Area of Concern” which allows the State to reimburse for voluntary testing. WLSB is also encouraging herd owners to complete herd plans to mitigate risks and currently has 21 producers on herd plans, 19 in Big Horn County and 2 in Sheridan.
- The Area of Concern contains approximately 65,000 head of cattle and an unknown number of bison. According to the National Agricultural Statistics Service in 2015, they divided by the two counties as follows:

	Cattle Producers	Number of Beef Cows	Bison Producers	Number of Bison
Big Horn County	174	25,000	1	unknown
Sheridan County	266	39,600	9	unknown

- From 2015 through June 1, 2017, close to 5,900 animals have been tested from Big Horn County and 3,200 from Sheridan County. It was not reported whether these were all unique animals or if some animals were repeatedly tested from year-to-year.
- While estimated elk prevalence in the Bighorn Mountains is low and risk of spillover is assumed to be low, it is possible that the WLSB is underestimating the risk of spillover based solely on this data. If instead the real prevalence is much higher, the risk of spillover may be much greater, and the consequence of such a spillover would be costly.
- Estimated seroprevalences are calculated by hunt-unit across the State and utilized by WLSB to develop an appropriate DSA boundary in partnership with WGFD and stakeholder input.
- WGFD recognizes that elk population is increasing and that, in general, the range of elk locations is expanding.
- WLSB is considering reducing the DSA boundary in Lincoln County, moving it north to the U.S. Forest Service boundary. Input during the review from WGFD was that feed ground elk had been observed within that southern boundary; therefore, it may not be prudent to reduce the Lincoln County DSA boundary line.
- WLSB uses “buffer” areas for its DSA, areas where it is estimated that elk seroprevalence is low and less likely for transmission to occur. However, the review team observed that some of the hunt units along the DSA boundary have high prevalences. For example, hunt units within the Gooseberry management area had an observed prevalence of 32.1 percent in 2016 – notably this prevalence is based on a very small sample size. These hunt units are along the DSA boundary, potentially offering no “buffer” where seroprevalence is low.
- Further assessment and modeling of potential elk-livestock interactions may be useful in assessing overall risk. Information such as comparisons of elk locations throughout the year, hunt unit seroprevalences, livestock locations (including seasonal grazing herds), weather impacts, and more at a State- and local-level may be useful to integrate all available data.
- A simple comparison of elk “herds” with observed seroprevalence compared to livestock locations throughout the year does not exist.

Recommendations

1. Reassess the DSA boundary based on current seroprevalence in hunt units along the boundary along with other risk factors, such as wildlife and livestock herd location throughout the year. Change the boundary based on scientific and documented criteria with relation to risk of wildlife-livestock transmission and in accordance with the criteria to be developed under Objective One.

2. Evaluate including the Big Horn County in the DSA and, under the rules of Chapters 2 and 6, to conduct first-point testing at the change of ownership, movement out of the area, and interstate movement.
3. Work with WGFD to mitigate the risks of elk-to-elk transmission within the Bighorn Mountains.

Conclusion

APHIS appreciates the hard work the WLSB conducts to manage brucellosis activities in the State. It is apparent through the recent changes made to Chapter 2 rules and the Board Order to manage Big Horn and Sheridan counties as an Area of Concern that the WLSB wants to reasonably and appropriately manage brucellosis within the State. The WLSB has a good working relationship with its livestock markets, producers, veterinarians, APHIS, WGFD, and the WSVL. Drs. Logan, Meyer, and Winslow are well-respected in their State and collectively have numerous years of experience in brucellosis and disease management in general. Wyoming is fortunate to have their practical approach and knowledge base.

While the number of affected herds has been low during recent years, it is clear that the risk of wildlife-to-livestock spillover is not decreasing and, if anything, it may be increasing. It is imperative that WLSB, WGFD, and the private citizens of Wyoming remain vigilant in their activities and pursuit of brucellosis eradication in Wyoming livestock.

APHIS will continue to work with Wyoming annually by providing cooperative agreement funds when available, reviewing BMPs, and supporting activities directly in the State with personnel and other resources, as needed. Additionally, another comprehensive in-person review is planned for 2020 as a follow-up to this review. APHIS hopes that Wyoming will review and enact these recommendations to continue to improve its brucellosis program.