

**Upper Green River Elk Herd Unit (E107)  
Brucellosis Management Action Plan  
April 2011**

**A. Introduction**

This update to the Upper Green River Elk Herd Unit (UGREH) Brucellosis Management Action Plan (BMAP) was prepared to evaluate brucellosis management recommendations developed and implemented during this plan's original development in 2007. Meetings among Wyoming Game and Fish Department (WGFD) personnel, interested livestock producers, federal land managers, and state and federal livestock health and regulatory officials were held to discuss progress on the plan's recommendations, review the various brucellosis management action options, and develop new brucellosis management recommendations based upon updated information. The WGFD has made much progress in the UGREH to better understand characteristics of elk to elk brucellosis transmission, refine elk parturition delineations, and to reduce the risk of both intra- and inter-specific brucellosis transmission. This update should be considered complementary to the original UGREH BMAP.

The UGREH is located on the northwest slope of the Wind River Mountain Range in northern Sublette County, Wyoming and includes elk from Hunt Areas (HA) 93, 95 and 96 (Fig. 1). The area is bound on the northwest by Hoback Rim, the north by Union Pass, the east by the Continental Divide, the southeast by Pine Creek and Fremont Lake, and the southwest by the Green River. Total area of the UGREH is approximately 828 square miles (mi<sup>2</sup>), of which 819 mi<sup>2</sup> are considered occupied elk habitat. Approximately 555 mi<sup>2</sup> is delineated as Spring/Summer/Fall range, 46 mi<sup>2</sup> as Crucial Winter Yearlong, and 218 mi<sup>2</sup> as Winter (Fig. 2). Three feedgrounds are located within the UGREH: Green River Lakes, Black Butte, and Soda Lake. The Green River Lakes feedground was established to minimize starvation losses, while the other two feedgrounds were developed primarily to reduce depredation to privately owned stored hay.

The U.S. Forest Service (USFS) manages the majority of lands within the occupied elk habitat in the UGREH, with 30.7% designated as Wilderness (Bridger Wilderness). Private lands comprise 20.5 % of the herd unit with most concentrated at lower elevations associated with riparian and floodplain habitat of the Green River, New Fork, and Willow Creek drainages.

# Upper Green (E107) Elk Herd Unit

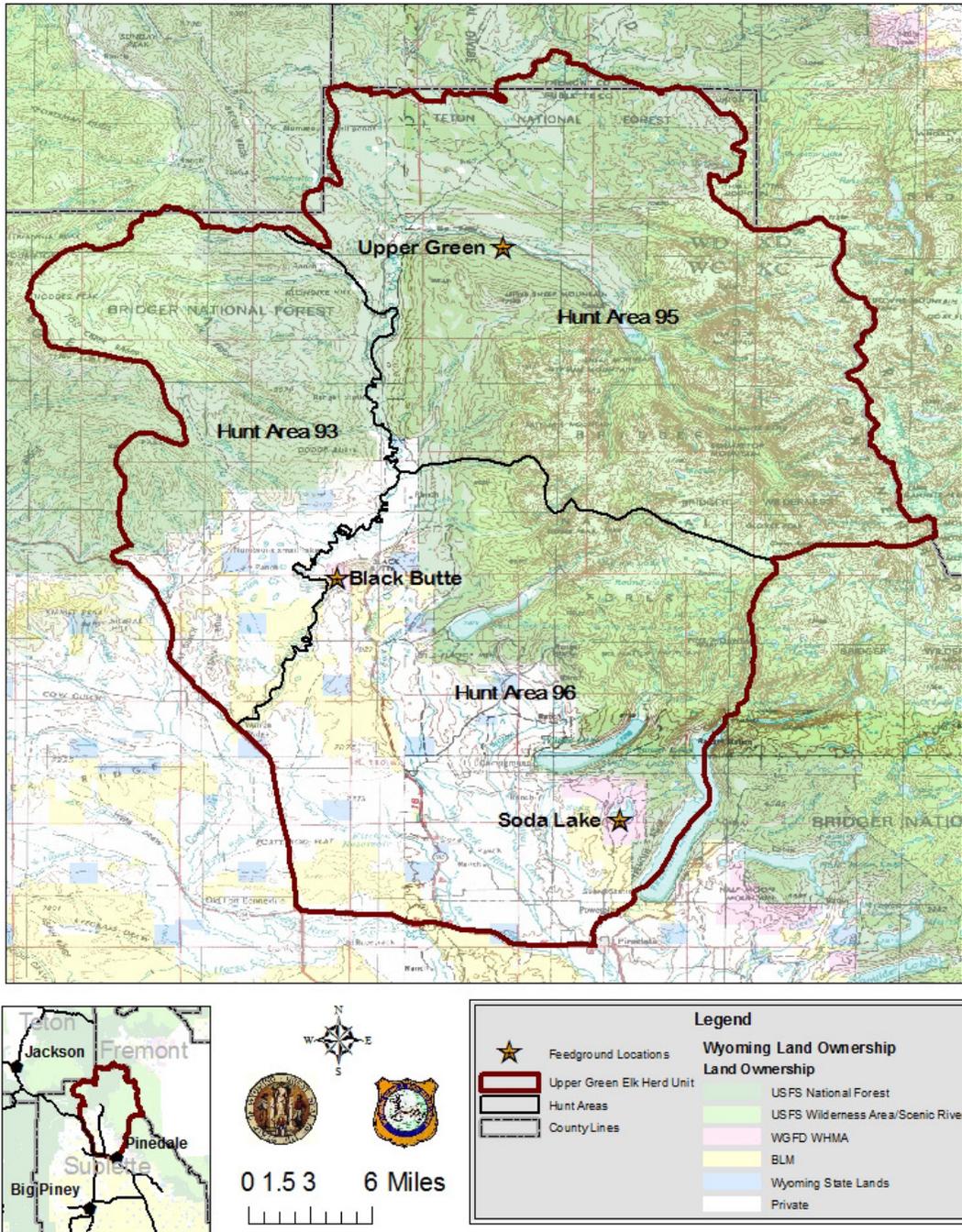


Fig. 1. Land ownership, feedground locations, and Hun Areas within the Upper Green River EHU.

# Upper Green Elk Herd Unit Seasonal Ranges

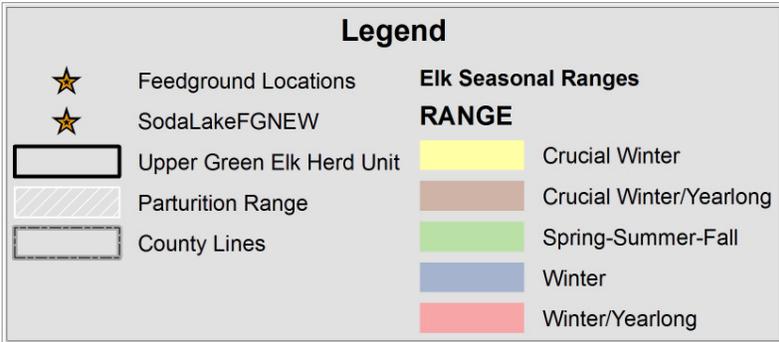
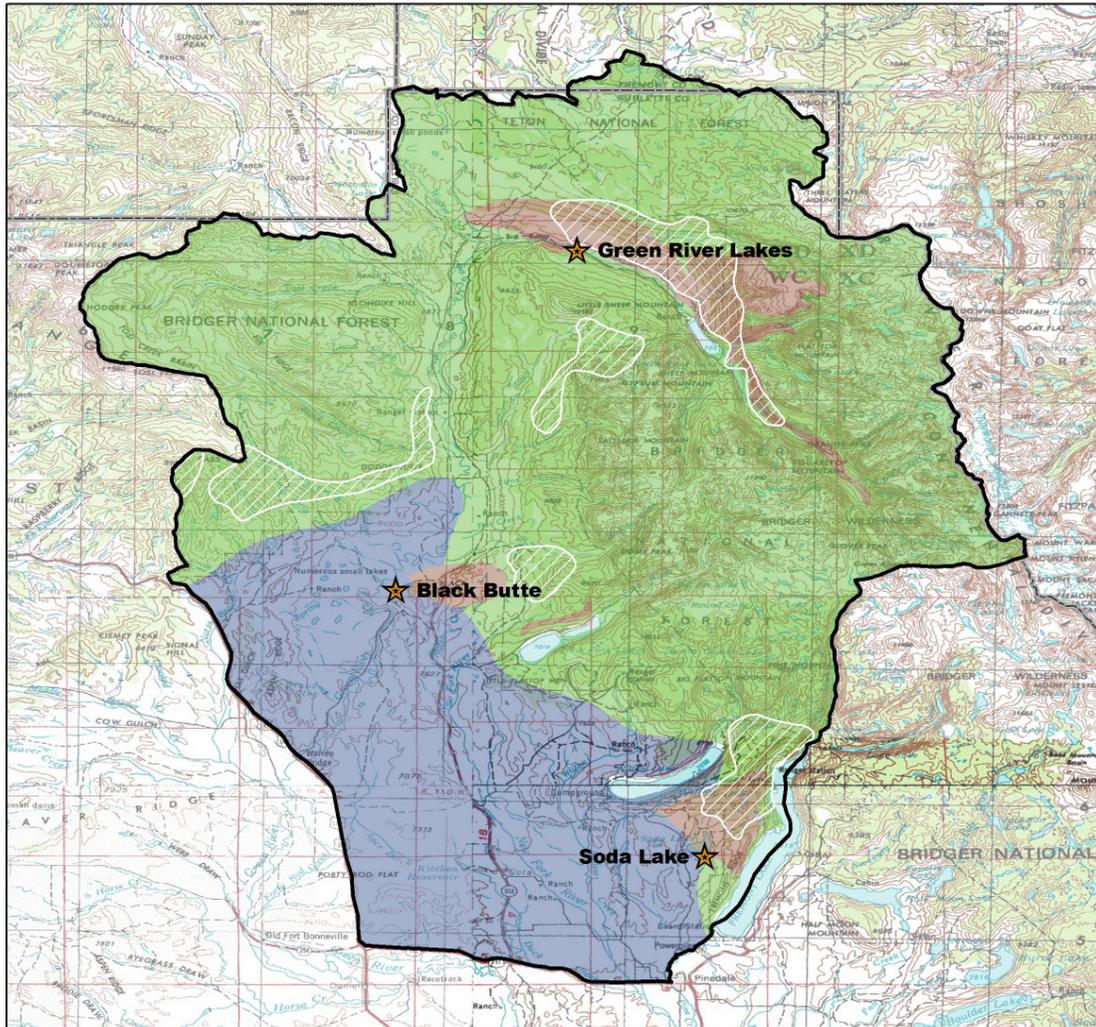


Fig. 2. Seasonal elk ranges, winter closures, and elk feedgrounds within the Upper Green River EHU.

## **B. Brucellosis Management Options**

Listed below are potential options for managing brucellosis on the three feedgrounds in the UGREH. A discussion of each follows, respectively. Short-term objectives of these options are to reduce co-mingling of elk and cattle and the prevalence of brucellosis in elk. Long term objectives include eliminating the reservoir of brucellosis in wildlife in the Greater Yellowstone Area (GYA) if determined to be technically feasible, maintain livestock producer viability, reduce/eliminate dependence of elk on supplemental feed, maintain established elk herd unit objectives, improve range health, and maximize benefits to all wildlife. Implementation of several options together will likely be more effective than instituting any option alone. The Wyoming Game and Fish Commission (WGFC) will require support from various constituencies (agriculture, land management agencies, sportspersons, etc.) prior to pursuing these options, and several options will require decisions from entities other than the WGFC.

1. Re-locating the feedground to a lower elevation site with increased area for elk to disperse and increased distance from winter cattle operations
2. Elimination of the feedground
3. Reducing numbers of elk on the feedgrounds through increased harvest
4. Reducing numbers of susceptible cattle and stored crops in areas around feedgrounds during winter, or implementing changes in cattle operation by providing incentives to producers.
5. Elk-proof fencing of problem areas and private lands to prevent elk from drifting onto private land and reduce commingling.
6. Elimination of seropositive elk on feedgrounds through test and removal program
7. Extensive habitat enhancement projects in suitable winter range areas near feedgrounds where the potential of commingling with livestock is minimal
8. Acquisition of native or potential winter range through fee-title purchase, conservation easements, or other methods
9. Strain 19 elk vaccination

## **C. Discussion of Options**

### 1. Feedground Relocation

This option would initially require a suitable area lower in elevation, in a lower precipitation zone, either with no winter cattle operations in the vicinity or in conjunction with option 5 to prevent commingling. Current habitat conditions should be evaluated to determine production, health of vegetation, and approximate potential of the area. All lands within the BLM Pinedale District are leased for grazing, so it is likely one or more permittees would need to be involved in the selection of a particular area. If purchase of AUM's is a viable option for the permittee, this could reserve forage for elk and other wildlife. Additionally, implementation of option 8 may facilitate realization of this option. Decision authority would lie with the permittee, BLM, USFS, and the WGFC.

#### Pros:

- may contribute to lower brucellosis prevalence

- elk would have increased area to disperse
- feeders could feed in larger area and on clean snow
- elk numbers could be maintained at or near current levels
- may decrease damage and co-mingling situations
- reduced browsing on local native woody vegetation

Cons:

- brucellosis prevalence may persist
- requires funds for erection of new structures, fences, roads, etc.
- potential difficulty relocating and/or habituating elk to the new site
- may increase localized grazing of native herbaceous and woody vegetation
- may increase dietary competition of elk with other wildlife

Black Butte is the most apparent feedground in the UGREH where relocation could improve brucellosis management. Most elk/livestock conflict within the UGREH is associated with elk that leave this feedground during the supplemental feeding season. Moving the feedground to nearby BLM or USFS land is not a possibility at this time, and would probably not lower brucellosis transmission risks to cattle. Alternatively, elk from Black Butte feedground could be relocated to the existing Soda Lake feedground. In recent years, numbers of elk attending the Soda Lake feedground have been below objective. Consolidation of these two feedgrounds has occurred in the past due to elk leaving the Black Butte feedground; elk numbers on Soda Lake feedground were between 1,000 and 1,300 in those years. Consolidation could provide a greater opportunity for elk to free range, increased harvest opportunity, and a shorter feeding season, which may lower brucellosis prevalence in elk that originated from the Black Butte feedground. However, higher elk numbers at the Soda Lake feedground might act to increase elk concentrations and length of the feeding season, thus encouraging brucellosis transmission. Additionally, it may be difficult to keep elk spatially separated from cattle on their route from Black Butte to Soda Lake feedground. Further implementation of option 7 on the southerly exposure above Willow Ridge and other areas near the Soda Lake feedground may facilitate realization of this option. The WGFC has the authority to make this decision.

2. Reduction or Elimination of Supplemental Feeding

This option is intended to lower brucellosis transmission among elk by decreasing concentrations and is more likely to be successful if administered as a "phase-out." Risk of damage/commingling, especially in the initial years may prohibit implementation of this option. However, if current conditions and herd objectives change, through implementation of one or more of options 3, 4, 6, and 8, this option may become more practical. During winter 2009-10, elk were not fed at Soda Lake and Green River Lakes feedgrounds due to mild conditions

Pros:

- would reduce the risk of intraspecific transmission of brucellosis and other diseases
- would facilitate efforts to eliminate brucellosis in elk within the PEH
- would reduce feedground and vaccination expenses to the WGFD

Cons:

- would increase the risk of property damage and interspecific transmission of brucellosis to livestock if implemented abruptly with current numbers of elk and/or prior to elimination of brucellosis in elk
- would increase damage control costs for WGFD
- would increase elk winter mortality
- would lower the number of elk that could be maintained in the PEH
- would reduce income to the WGFD due to reduced license sales
- would reduce hunter opportunity
- may increase potential for vehicle-elk collisions on Highway 352

As a result of the 2006 BMAP, numerous research studies were developed to improve our limited understanding of brucellosis transmission among elk on feedgrounds. Based on results of those studies, the Target Feedground (TFG) Project was developed, which targets some feedgrounds for alternative management in effort to reduce elk-elk disease transmission. A major objective of the TFG project is the reduction of the supplemental feeding season by forcing elk on to native range 3-4 weeks earlier in late winter/early spring. The Soda Lake and Green River Lakes feedgrounds have been successfully targeted for that objective since 2008.

This option, given current conditions and herd objectives, is probably unfeasible for the Black Butte feedground, unless elk were relocated to an existing feedground where intra- and interspecific brucellosis transmission risks were currently lower (i.e., Soda Lake feedground). Green River Lakes has a high potential due to low damage/commingling risk. Soda Lake feedground also has a high potential because of the 25-mile elk fence and high quality and quantity of native forage surrounding the feedground. This option would probably require implementation of option 3. Options 4, 6, 7, and 8 would also facilitate successful implementation. The WGFC has the authority to make this decision.

3. Elk Reduction

Reducing elk numbers on feedgrounds in the UGREH through liberalized hunting seasons could allow more flexibility to pursue options 1, 2, and 6, and could facilitate conditions for options 7 and 8. The WGFC has the authority to make this decision.

Pros:

- might contribute to lower brucellosis prevalence
- would increase hunting opportunities in the short term
- would increase license revenues in the short term
- would decrease elk densities on feedgrounds
- potentially reduce conflicts on private lands
- would reduce costs of supplemental feeding and vaccination

Cons:

- the response of seroprevalence of brucellosis in elk when populations are reduced is unknown, yet it is unlikely to reduce incidence to an acceptable level assuming the remaining elk are still fed

- damage to private crops might still continue
- the general public may be unwilling to accept large reductions in elk numbers
- success might be limited to hunter efficiency
- would result in loss of some hunting opportunity in the long term
- will reduce license revenue in the long term (might be offset by reduced management costs)

Hunting seasons have been liberalized in HA 93 and 96. With the arrival of winter-like conditions prior to the end of hunting season in 2010 combined with increased hunter access, this cause elk to be more available to hunters, thereby increasing harvest, but also increasing workloads for WGFD personnel in hazing efforts as elk seek out refuges on private lands void of hunter access.

All feedgrounds within the UGREH would probably be affected positively from a disease transmission standpoint with fewer elk, as densities on feedlines would decrease. The Black Butte feedground may benefit most due to the limited hunting access and because elk numbers often exceed quotas established by the WGFC.

#### 4. Cattle Producer Change of Operation

This is an option that high-risk producers and others within the UGREH could implement to minimize/eliminate brucellosis risks to their herds. Changing cattle operations from cow/calf to yearling, spayed heifer, or steer would eliminate brucellosis transmission potential within cattle and testing requirements associated with cow/calf operations. Conversion to yearlings would also eliminate the need of storing most hay crops and winter-feeding, reducing winter elk conflicts. Smaller changes in operations, such as developing a water source enabling the producer to calve in a lower risk area, are other options that could be more appealing if incentives were provided. Implementing facets of this option would require a decision from the producer and possibly a favorable decision by the BLM or USFS to alter grazing permit(s).

Evaluation and implementation of the alternatives in this option are totally under the jurisdiction of individual livestock operators, Wyoming Livestock Board, State Veterinarian and APHIS. Discussion and recommendations pertaining to this option should be contained in Individual Herd Reports for each livestock operation.

#### 5. Fencing

Elk proof fencing of winter cattle feedlines or problem areas could prevent elk from co-mingling with cattle. This would require favorable decisions by the landowner. Additions of a wing to the existing 25-mile elk fence may improve ability to haze elk from private land during winter.

##### Pros:

- may reduce damage complaints
- may reduce risk of elk-cattle brucellosis transmission

##### Cons:

- costs
- congregating all or most of the elk within the fence may be unfeasible

- large areas of fencing could impede migrations of other wildlife
- does not address seroprevalence of brucellosis in elk
- some producers may be unwilling to erect fencing
- would require federal agency cooperation and potential NEPA evaluation for federal lands

Interspecific disease transmission risk in association with Black Butte feedground would decrease more than other feedgrounds in the UGREH with implementation of this option because damage/commingling risk connected with elk from this feedground is currently higher.

#### 6. Elk Test and Removal

This option could eliminate a percentage of the seropositive animals on a feedground (Scurlock et al. 2010). The number of aborted fetuses and associated fetal fluids contaminated with *B. abortus* may be decreased. The WGFC has the authority to make this decision.

#### Pros:

- would reduce brucellosis prevalence in elk
- could reduce elk numbers to more efficiently pursue options 1,2,6,7, and 8.
- may increase tolerance of elk on private lands if brucellosis prevalence is decreased
- may increase other State's acceptance of cattle from within the GYA

#### Cons:

- very expensive and requires substantial fiscal and personnel resources
- requires large traps on feedgrounds capable of working many animals with large holding pens
- must be implemented for several years to have appreciably decrease in brucellosis antibody prevalence
- general public may not support such an operation due to decreased elk numbers/hunting opportunity
- does not address other potential diseases on feedgrounds
- Data suggest only 54% of antibody-positive elk are actually infected
- *Brucella* antibody prevalence will likely rebound post implementation
- would require federal agency cooperation and potential NEPA evaluation for federal lands

The rates of both intra- and interspecific brucellosis transmission may decrease on all feedgrounds within the UGREH given implementation of this option. The WGFC has the authority to make this decision.

#### 7. Habitat Enhancement

These projects have been utilized in areas adjacent to feedgrounds with some success in reducing feeding duration. Decision authority is with the BLM and USFS for most areas. Affected permittee consultation and cooperation is also necessary.

Pros:

- could reduce feeding duration and brucellosis prevalence
- would benefit many species of wildlife and, in some instances, cattle
- funding is available through government and non-government agencies

Cons:

- may have limited effectiveness in reducing dependency on supplemental feed in years of average or greater snow accumulations that make forage unavailable
- elk may not be tolerated on treatment areas when in close proximity to livestock
- requires changes in post-treatment wildlife and livestock management within the treatment area to ensure treatment effectiveness
- may increase likelihood of invasive species establishment

This option may be best used in conjunction with options 1, 2, 3, and 8 to achieve maximum success. The risk of intra- and interspecific disease transmission may decrease on the Green River Lakes and Soda Lake feedgrounds. There is a low potential for a brucellosis management outcome with implementation of this option near the Black Butte feedground.

8. Acquisition/Conservation Easements

This option secures habitat for myriad wildlife species. With adequate intact, healthy, and accessible elk winter habitat available, the need for some feedgrounds could be eliminated, although current elk numbers may not be maintained. The buying or long-term leasing of land to be managed and maintained solely for wildlife is an option that can be used to maintain stability and health of all wildlife populations. Decision authority is with the private landowner.

Pros:

- secures habitat for all wildlife
- long-term solution
- helps secure future revenues for the WGFD
- may facilitate options 2 and 7
- could reduce brucellosis prevalence in elk
- agreeable among landowners and agencies

Cons:

- expensive
- limited availability of lands with high potential for wintering elk or connecting to existing or potential elk winter ranges
- requires landowner willingness

Disease transmission risk on all feedgrounds within the UGREH may decrease by managing lands adjacent to, or connected with, native elk winter ranges. This option could be combined with option 1, 2, 3, 5, or 7.

### 9. Continuation of Strain 19 Elk Vaccination Program

The WGFD initiated this program in 1985 on Greys River feedground in the Afton Herd Unit and has vaccinated about 80,000 elk to date on 21 state operated feedgrounds and the National Elk Refuge. Elk cows and calves were vaccinated the first two years on each feedground, then calves only thereafter assuming adequate coverage is maintained. Dell Creek feedground within the Hoback EHU serves as a control population (i.e., no vaccination) to assess effectiveness of the vaccination program in reducing brucellosis seroprevalence in elk. Brucellosis seroprevalence data from Dell Creek and Greys River feedground elk indicate no significant difference, no downward trend, and that seroprevalence may fluctuate cyclically over time throughout both populations (WGFD 2010b, Figure 3).

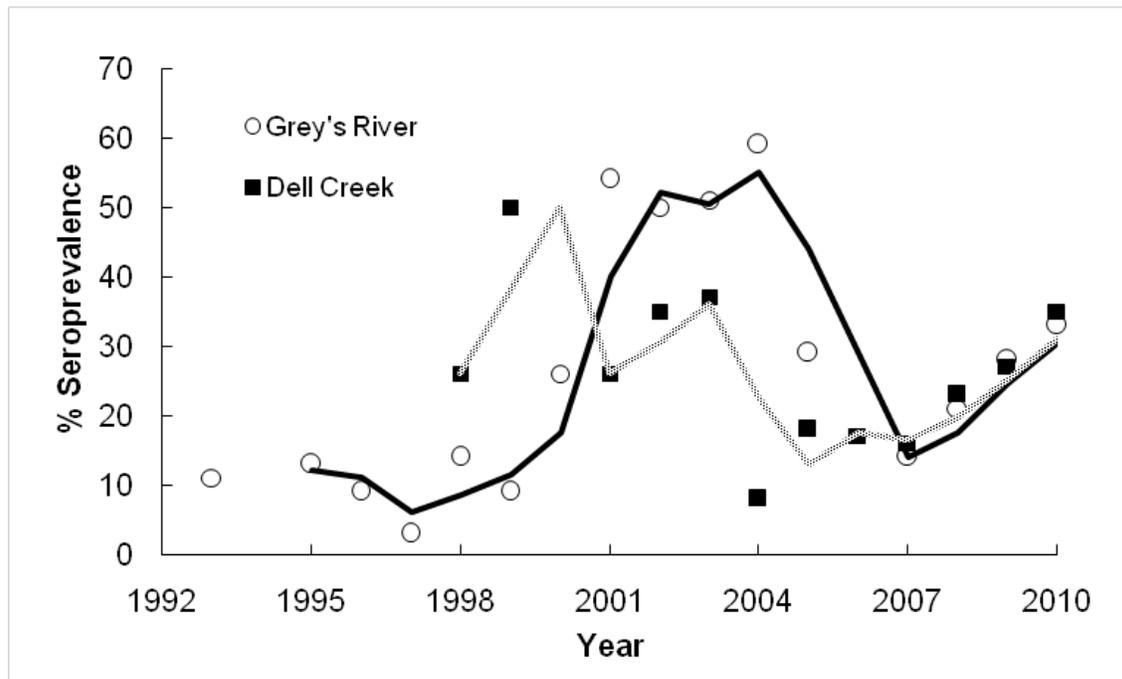


Figure 3. Seroprevalence levels in elk from Grey's River and Dell Creek feedgrounds, 1993-2010. Trend lines depict moving averages within individual feedground.

In captive studies, Strain 19 prevents abortion in 29% (Roffe et al. 2004) to 62% (Herriges Jr. et al. 1989) of elk challenged with *Brucella* strain 2308. Protection from *B. abortus* induced abortions afforded by strain 19 vaccination may not be sufficient to effectively reduce seroprevalence in elk on feedgrounds. This may be due to the potential for numerous elk to come into contact with a single infected fetus aborted on a feedground (Maichak et al. 2009), and the potential that the infectious dose may overwhelm antibody protection (Cook 1999). The decision authority lies with the WGFC.

This option is currently employed on each of the three feedgrounds in the UGREH. Disease transmission risk will likely not decrease significantly if this option is continued, based on previous controlled studies and the program's evaluation to date between Grey's River and Dell Creek feedgrounds.

## **D. Coordination Meetings**

### 1. Producer Meeting

A meeting was held 29 December 2010 in Pinedale to discuss the nine options among livestock producers and associated land and resource management agencies within the Upper Green River, Big Piney, and Hoback elk herd units. A presentation was given by WGFD that summarized brucellosis management and research strategies and their relation to the nine options. Four producers and seven WGFD personnel were present. Representatives from the WLSB, BLM, USFS, NRCS, and WY land board were invited, but did not attend.

There was a producer comment about feedgrounds in general, noting that if elk weren't fed they would seek food elsewhere, such as haystacks or cattle feedlines. Though, numerous smaller feedgrounds might be advantageous. One commenter noted a conversion of cow calf to yearling operation is not feasible for many producers. A question arose as to whether a combination of Test and Removal and vaccination work to eradicate brucellosis in elk. The major problem is that the *Brucella* strain 19 vaccine is only 25-60% efficacious in elk, but there is ongoing working to develop new vaccines. Producers would like to see better a vaccine for both cattle and elk; though wolves are confounding management efforts. Producers would generally support the practice of boosting cattle with RB51 every year. One question arose on how much habitat treatments cost in comparison with test and slaughter and how they compare in effectiveness to brucellosis reduction. How effectiveness is measured (i.e, long-term vs. shortterm) would likely play a large role in evaluating brucellosis reduction strategies.

### 2. Public Meeting

A meeting was held 24 March 2011 between WGFD and concerned members of the public to discuss the nine options as they pertained to the Pinedale, Upper Green River, Big Piney, and Hoback Elk Herd Units. Three individuals and five WGFD personnel attended the presentation which summarized WGFD brucellosis management and research strategies and their relation to the nine options. A couple topics were discussed following the presentation including strain 19 vaccination efficacy in elk and cattle, and VIT research. No major changes were proposed at that time for any herd unit, and members of the public found the presentation informative and useful.

## **E. Proposed Management Actions**

### 1. Feedground Relocation

During winter 2010-2011, 600+ elk that would have normally wintered at Black Butte feedground were moved to Soda Lake feedground through the combined effects of early onset of significant snow accumulation, a later hunting season (cow season through November 30), and elk hazing efforts. Intra and inter-specific disease transmission is greater at the Black Butte feedground due to several reasons: 1) there is little to no adjacent native winter range, thus elk dependence on supplemental feed is much greater at Black Butte than at Soda Lake; 2) Black Butte is located in closer proximity to wintering cattle, and does not have the protective benefits of an elk fence that lines the perimeter of the Soda Lake feedground and surrounding winter ranges; 3) the size of the

feedground at Black Butte is smaller than at Soda Lake, increasing elk densities while on feedlines; and 4) private property surrounds the Black Butte feedground, creating a situation where desired elk harvest is very difficult to attain, leading to higher elk numbers.

The consolidation of elk feedgrounds has been successful before. Hay was trailed from the North Piney feedground to Bench Corral feedground during winter 1995-1996 in an attempt to move elk from a site with a very long feeding season and little adjacent winter range to a lower elevation site more conducive to winter free-ranging activities. North Piney feedground today is operated as a 'staging area', gathering elk above private lands prior to elk making the move on their own volition to Bench Corral. Continuing this movement of elk from Black Butte to Soda Lake would be beneficial for disease management concerns. However, there are management concerns with successfully moving elk without causing damage and commingling concerns, or 'teaching' elk where private land refuges or other problem areas exist.

## 2. Feedground Elimination

The potential for elimination or phase out of any of these feedgrounds, is however, low. No detailed discussion of the option was held.

## 3. Elk Reduction

The WGFD will continue to manage for current WGFC-established elk herd unit population objectives. Reductions beyond the current population objective would require a public input process to discuss the issue and determine the level of support. Authority over this option ultimately lies with the WGFC. The WGFD will continue to design and implement harvest strategies that manage the population at objective, with desirable distribution of elk between Soda Lake and Muddy Creek feedgrounds.

## 4. Cattle Producer Change of Operation

The WGFD will encourage cattle producers to implement any changes to their operations that decrease the risk of interspecific disease transmission. WGFD will work with other agencies and cattle producers and to identify and secure compensation or incentives to producers for management changes.

## 5. Fencing

There are no current plans to construct fencing for brucellosis management in the UGREH. An addition of a wing to the existing elk fence has been identified on private land that may improve ability to haze elk from commingling situations to Soda Lake feedground. The extension of the existing elk fence north of New Fork lake along the USFS boundary toward the Upper Green could facilitate movement of elk from Black Butte to Soda Lake. However, this would undoubtedly impact movements of other species.

## 6. Elk Test and Removal

The WGFD implemented the pilot Test & Removal project in the Pinedale EHU from 2006 through 2010. The WGFD does not plan to implement this option in the UGREH in the foreseeable future.

## 7. Habitat Enhancement

Approximately 5,000 acres of habitat near the Soda Lake feedground has been enhanced since 1989. The WGFD will continue to coordinate with private landowners, federal land managers and livestock permittees to develop and implement habitat improvements that may reduce elk dependency on supplemental feed.

Several areas have been identified in the UGREH unit near feedgrounds. Pinyon Ridge, north and east the current Green River Lakes feedground, includes several large south-facing slopes currently and historically used by wintering elk. These 21,000 acres are part of the 32,000-acre Moose-Gypsum Creek project proposed by the USFS that could begin as early as 2011 and be implemented over the next 10 years. Near the Soda Lake feedground, habitat treatments on the large southerly exposure on the ridge north of Willow Lake may be beneficial to managing brucellosis. WGFD personnel have worked closely in development of these projects and will continue to work cooperatively to obtain funding for implementation of the treatments. The agencies will also work to obtain funding for development of forage reserves to provide alternate pasture for willing producers whose current allotment(s) are being rested for habitat treatments.

## 8. Acquisition/Conservation Easements

The WGFD will attempt to identify and pursue opportunities to implement this option. As projects are identified, proposals will be drafted and submitted, either through the Department's process of obtaining less than fee-title lands, or to various funding agencies to facilitate implementation of this option.

## 9. Vaccination of Elk Calves

The WGFD will continue the ballistic strain 19 elk vaccination program until adequate data are collected to determine efficacy of the program in reducing brucellosis seroprevalence in elk on feedgrounds.

## **F. Best Management Practices**

In addition to the above options and commensurate with their short and long term goals, the following best management practices should be considered for elk feedgrounds. Some may be currently employed, and should be maintained. Others may or may not be viable options for individual feedgrounds and livestock producers.

### Feedground Management

1. Feed on clean snow whenever possible
2. Report abortions to WGFD
3. Minimize feeding season to the extent possible
4. Low Density feeding methods
5. No harassment/harvest of scavengers on feedgrounds

## **G. Additional Actions**

### **Brucellosis Surveillance**

WGFD currently captures (trap or dart) and tests elk for exposure to brucellosis on 7 to 15 feedgrounds annually. This practice should continue on as many feedgrounds as possible annually to assess efficacy of the Strain 19 vaccination program and monitor prevalence of the disease. To assess efficacy of Target Feedground Project activities such as Low Density feeding and early end date (WGFD 2008), sufficient number of elk should be captured and tested for brucellosis prior to or during inception of those activities for comparison to elk tested eight to 10 years (Cross et al. 2007) following inception of those activities. Additionally, hunter-harvested elk brucellosis surveillance will occur annually in an effort to survey the entire state over a 4-year period.

### **Information and Education**

BFH and other WGFD personnel regularly inform and educate various public factions about wildlife diseases, including brucellosis. Educational outreach has included group presentations, news releases, interpretive signs at feedgrounds and crucial winter ranges, and various brochures and publications. The importance of quality wildlife habitat and substantial role that disturbance (e.g., fire) plays in natural ecosystems are also stressed during public forums. BFH and other WGFD field staff make numerous private landowner contacts regarding habitat improvement projects, wildlife-friendly management techniques, or ways to prevent commingling of elk and livestock. Additional efforts are focused on area school groups and events such as the WGFD's annual Hunting and Fishing EXPO to inform children and their parents on brucellosis. These efforts should be continued to inform the public of the WGFD's role in brucellosis research and management and relay consequences of the disease to the State's economy. Additionally, should any of the aforementioned Options be officially adopted, I&E efforts should focus on why the Option(s) was (were) pursued and what benefits may be realized. The public should be made aware of any proactive management embarked upon by the WGFD, and their interests in the actions should be heard.

### **Research**

Sound management of brucellosis in elk on feedgrounds and the risk of transmission from elk to cattle necessitate accurate and reliable data to facilitate decisions. Most research concerning brucellosis, feedground elk, and feedground management has focused on elk vaccination and its impacts to seroprevalence of the disease at the population level. More recently, the Brucellosis-Feedground-Habitat (BFH) Program of WGFD in cooperation with Iowa State University, Montana State University, and the University of Wyoming has conducted and published several epidemiological studies regarding transmission at the elk-to-fetus level on and off feedgrounds. Summaries of unique research projects and their findings are listed below.

#### **1. Effects of management and climate on brucellosis seroprevalence of feedground elk**

Cross et al (2007) compiled 16 years of seroprevalence data from feedground elk and 54 years of feeding and climate data from feedgrounds and local weather stations

throughout the Greater Yellowstone Ecosystem. They found that brucellosis seroprevalence was positively correlated to length of feeding season and end date of feeding, with feeding seasons lasting longer during years of increased snow. However, host (feedground) population size or density (animals per unit area of feedground) had little to no influence on seroprevalence. Therefore, they suggested management strategies to reduce length of feeding season (e.g., early end date) to reduce potential elk-to-fetus contacts (transmission events), and ultimately, seroprevalence of the disease on feedgrounds.

## **2. Effects of management, behavior, and scavenging on risk of brucellosis transmission**

Maichak et al (2009) collected 48 culture-negative fetuses, fluids, and placentas (fetal units) from elk associated with the Test & Removal project and placed these on and adjacent to feedlines, as well as off feedgrounds and on native winter range (NWR) locations from 2005 through 2007. They found that elk density and elk-to-fetal unit contacts declined dramatically off feedlines (no contacts off feedgrounds), females were slightly predisposed to fetal unit investigations (greater time of investigation than males and juveniles), and that most elk did not investigate fetal units when  $\geq 2\text{m}$  from their line of travel, particularly off feedlines. Additionally, they found that scavengers remove fetal units faster from feedground than NWR locations and reduce numbers of elk contacting fetal units. Therefore, they suggested that reduction of elk densities on feedgrounds, time spent on feedlines (e.g., altered feeding patterns), and protection of scavengers on and adjacent to feedgrounds could reduce intraspecific transmission of brucellosis.

## **3. Target Feedground Project and effects of low-density feeding**

Based on the findings from the projects mentioned above, WGFD developed and implemented management actions pertaining to the Target Feedground Project (TFP) in 2008 (WGFD 2008). The two (2) primary objectives of the TFP are to increase dispersion of hay throughout the feedground (termed Low-Density feeding) and actively end feeding three (3) weeks prior to the current 10-year average. Creech et al. (In Review) compared Low-Density (LD) to traditional feedlines at the Soda Lake feedground via data-logging radio collars and digital video cameras and found that LD feeding reduces elk-to-fetus contacts by 66%-75% and, based on an appropriate SIR disease model, may substantially reduce seroprevalence in elk if implemented over a decade or more. Active early termination of feeding is possible on some feedgrounds in light snow years, but the impacts of LD feeding and early termination of feeding on actual seroprevalence at the population level will require implementation of eight to 10 years (Cross et al. 2007).

## **4. Parturition/abortion ecology of feedground elk**

From 2006 through 2010, the BFH program of WGFD in conjunction with Iowa St, University, University of WY, Montana St University, and USGS deployed and recovered 301 vaginal implant transmitters (VITs) in 19 feedground and 3 NWR elk populations as part of a multi-faceted project to identify and characterize elk parturition (269/301) and abortion (17/301) sites, potential overlap with current elk parturition

ranges, and potential overlap with public grazing allotments. Barbknecht et al. (2009) found that VITs were an effective tool for locating elk parturition sites. Furthermore, Barbknecht et al. (In Press) found that most elk tend to select parturition sites with substantial horizontal and overhead cover, often on gentle southern aspects in aspen or aspen/conifer stands, but that parturition sites range from low elevation willow/riparian to high-elevation alpine habitats. To date about 90% of parturition sites have occurred out of currently delineated parturition ranges, and several parturition events have occurred on active grazing allotments. WGFD in conjunction with USGS is currently compiling and drafting various GIS models based on VITs to help refine elk parturition ranges. Of the abortions, 20% (13/65) were from seropositive females, 2% (4/227) were from seronegative females, and these occurred from 17 Feb to 6 July. About half of the abortions occurred on feedgrounds. Based on current funding, the BFH program will continue to deploy VITs through 2014 to further refine parturition ranges of specific feedground populations and increase sample size of abortions.

Furthermore, many aspects of feedground elk ecology, brucellosis transmission and pathology, and feedground management have not been investigated. Potential research topics that could assist in management decisions include:

1. Influence of Target Feedground Project actions (active early end feeding date, Low- Density feeding, lower palatability feed) on seroprevalence in elk.
2. Relationship of seropositive vs. culture positive, and strain of *Brucella*, in feedground elk.
3. Feedground elk parturition habitat site characteristics and proximity to cattle.
4. Effects of habitat improvement projects near feedgrounds on minimizing feedground dependence of elk (i.e. distribution, dispersal, length of feeding season, brucellosis seroprevalence).
5. Disease presence (other than brucellosis) and parasite loads in elk on feedgrounds.
6. Relationship of local scavenger densities vs. scavenging rates on feedgrounds.
7. Abortion and viable birth rates, and temporal and spatial distribution of abortions and births, in seropositive feedground elk.
8. Influence of snow-water equivalent (SWE) and habitat enhancement on elk use and distribution.
9. Genetic comparison of seropositive elk that do or do not abort.
10. Potential aerosol transmission of brucellosis and impacts to sero- and culture prevalence in elk and livestock.
11. Potential for salt/mineral licks as sites of inter- and intraspecific brucellosis transmission

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