

**Afton Elk Herd Unit (E105)**  
**Brucellosis Management Action Plan Update**  
**Wyoming Game and Fish Department**  
**April 2011**

**A. Introduction and herd unit overview**

This update to the Afton elk herd unit (AEH) Brucellosis Management Action Plan (BMAP) was prepared to evaluate brucellosis management recommendations developed and implemented during this plan's original development in 2006. 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 AEH 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 AEH BMAP.

The AEH is comprised of the western slope of the Wyoming Range to Tri-basin Divide, the Salt River Range, and west to the Wyoming-Idaho state border including Star Valley (Figure 1). The Salt River and the Greys River are the major drainages in the herd unit, which is located entirely within Lincoln County and covers 968 mi<sup>2</sup>. The U.S. Forest Service (USFS) manages 79% of the surface area within the AEH. Private property, restricted primarily to Star Valley, makes up most of the remaining area (19%). The major uses of the USFS lands include domestic livestock grazing and year-round recreation. Grazing allotments are predominantly cattle along the riparian bottomlands and domestic sheep on the uplands.

Approximately 795 mi<sup>2</sup> (82%) of the AEH is considered occupied elk habitat (Figure 2). Of the total occupied elk habitat, approximately 662 mi<sup>2</sup> (83%) are designated as spring, summer, and fall range. There are 4.5 mi<sup>2</sup> (<1%) designated as crucial winter range, and 114 mi<sup>2</sup> (14%) are considered winter yearlong range. Around 278 mi<sup>2</sup> (35% of occupied elk habitat) in the AEH is considered parturition range.

The WGFD operates two feedgrounds within the AEH: Forest Park feedground is located in the upper Greys River in Hunt Area (HA) 90, and the Greys River feedground is located near Alpine in HA 88. The Greys River feedground serves to prevent damage, elk/cattle co-mingling, elk-vehicle collisions on nearby Highway 89, and winter starvation. Forest Park serves only to prevent starvation of elk in the upper Greys River.

# Afton Elk Herd Unit (E105) Hunt Areas

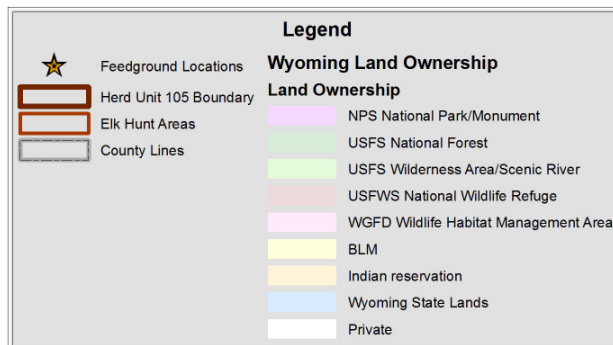
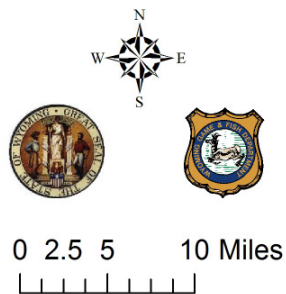
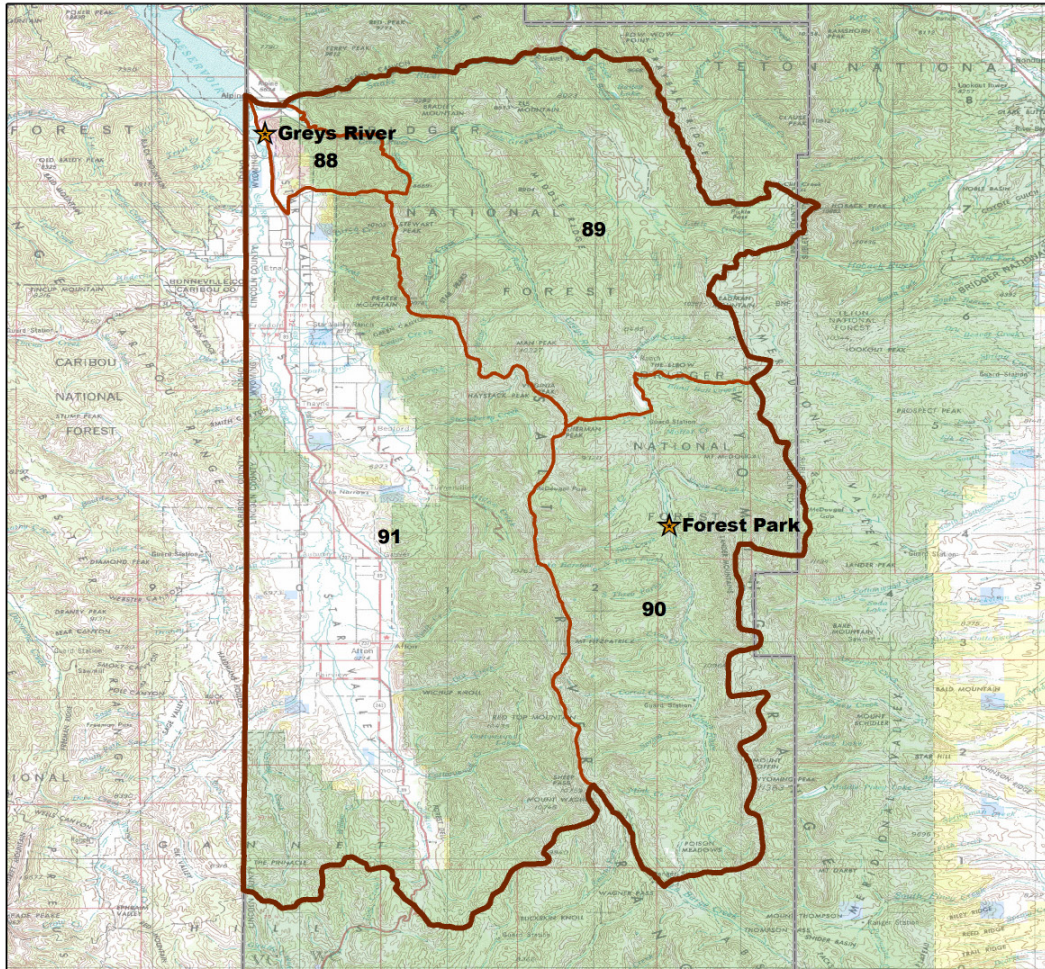


Figure 1. Land ownership, feedground locations, and Hunt Areas within the Afton EHU.



## Afton Elk Herd Unit Seasonal Ranges

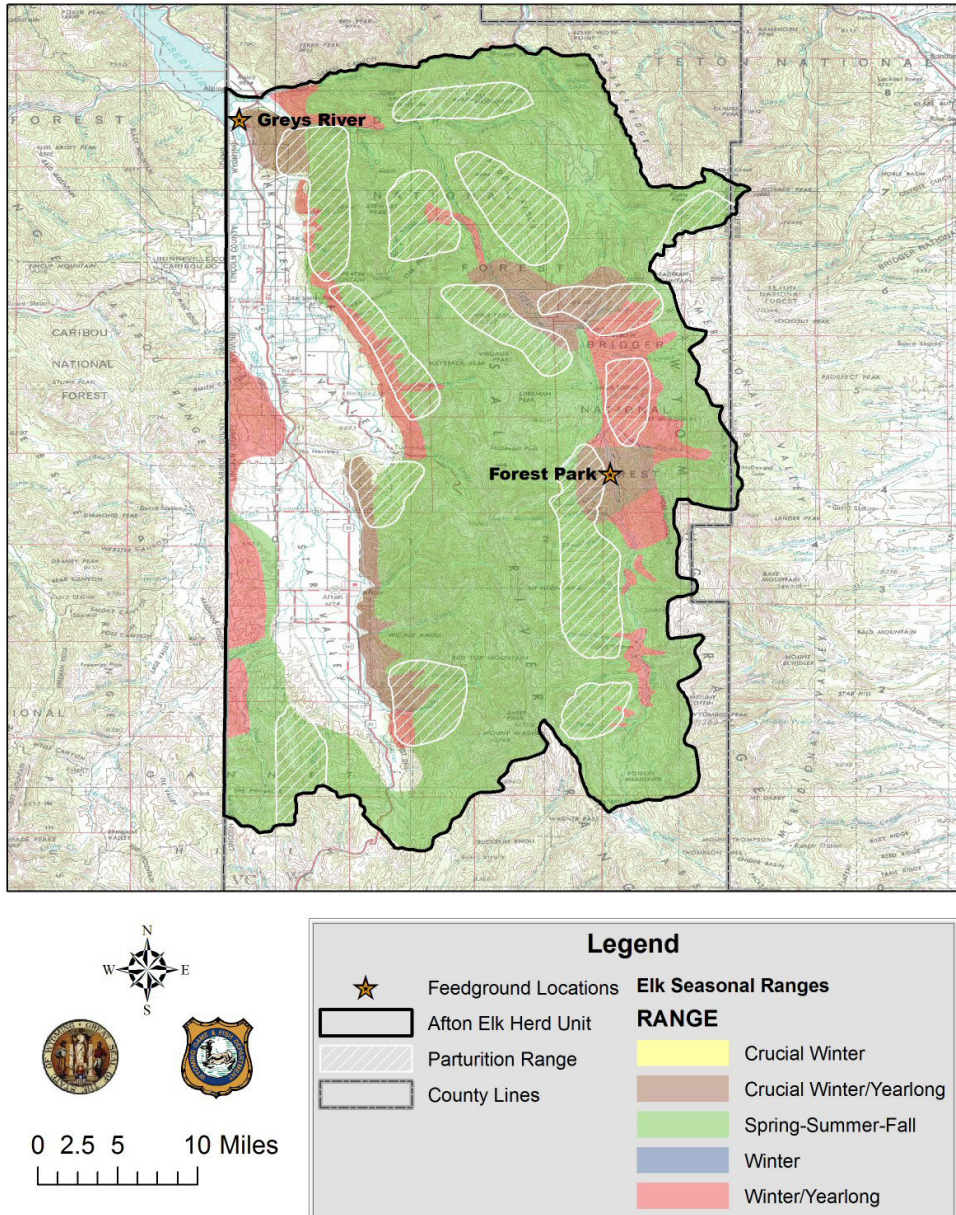


Figure 2. Seasonal elk ranges and elk feedgrounds within the Afton EHU.

## **B. Brucellosis Management Options**

Listed below are potential options for managing brucellosis on the three feedgrounds in the AEH. 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 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. 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 feedgrounds to lower elevation sites with increased geographic area for elk to disperse and increased distance from winter cattle operations.
2. Reduction/elimination of supplemental feeding.
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 operations by providing incentives to producers.
5. Elk-proof fencing of feedgrounds or 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 winter range through fee-title purchase, conservation easements, or other methods.
9. Continuation of *Brucella* strain 19 elk vaccination.

## **C. Discussion of Options**

### **1. Feedground Relocation**

Feedground relocation options are very limited in the AEH. All risks of co-mingling occur during the winter and spring months in Star Valley and thus do not involve the Forest Park feedground, which is isolated from livestock operations in Star Valley by the Salt River Range. Elk attending the Greys River feedground immigrate from all directions. Changing the location of the Greys River feedground would either move it away from established elk migration routes or put it in closer proximity to the cattle herds to the south in the Star Valley. Decision authority would lie with the WGFC. If more optimal locations for these feedgrounds existed, one should consider the following.

#### **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

2. Feedground Elimination

This option, given current conditions and herd objectives, is probably unfeasible for feedgrounds in the AEH. However, if current conditions and herd objectives change, through implementation of one or more of options 3, 4, 6, 7, and 8, this option might become more realistic. The WGFC has the authority to make this decision.

Pros:

- would reduce the risk of intraspecific transmission of brucellosis and other density-dependent diseases
- would facilitate efforts to eliminate brucellosis in elk in the AEH
- 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 with current numbers of elk and /or prior to elimination of brucellosis in elk
- increased risk of property damage would entail increased fiscal and personnel resources from WGFD
- would increase elk winter mortality
- would lower the number of elk that could be maintained in the AEH
- would reduce income to the WGFD due to reduced license sales
- would reduce hunter opportunity
- may increase potential for vehicle-elk collisions
- would eliminate the means for elk vaccination and test & removal program (offset by natural reduction in intraspecific brucellosis transmission)

3. Elk Reduction

Reducing elk numbers on the feedgrounds in the AEH through liberalized hunting seasons could allow more flexibility to pursue options 2 and 6, and could lead to more favorable conditions for options 7 and 8. The WGFC has the authority to make this decision for those elk in Wyoming during the hunting season.

Hunting seasons in recent years have been designed to increase elk numbers on the Greys River feedground as the number of elk attending this feedground has been below the Commission-established quota of 1000 since 1998. The quota for Forest Park feedground is 750 elk; the post-hunt population objective for the AEH is 2200 elk. Reducing the number of elk wintering off of feedgrounds, especially in HA 91, has been a goal of the WGFD for several years. Elk in this HA tend to contribute to co-mingling

and damage concerns more than elk wintering on the feedgrounds. In HA 91, hunting seasons have been designed to harvest the antlerless segment of the population by increasing the number of days of general-license any-elk hunting, and increasing the number of limited-quota licenses.

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)

4. Cattle Producer Change of Operation

This is an option that high-risk and other producers in the AEH could implement to minimize/eliminate brucellosis risks to their herd. Brucellosis transmission potential within cattle and testing requirements associated with cow/calf operations would be eliminated if all cattle operations were yearlings, spayed heifers, and/or steers. Conversion to yearlings would also eliminate the need of storing most hay crops and winter feeding, reducing winter elk conflicts. Operations that feed through the winter can take small measures to avoid attracting elk such as feeding in the morning and feeding every day to keep feeding areas clean of hay. The opportunity for disease transmission is also greatly reduced if cattle and elk do not co-mingle between February and 15 June. Implementing facets of this option would require changes by the producer and possibly a favorable decision by the USFS to alter grazing permits.

Evaluation and implementation of 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 Ranch Herd Plans for each livestock operation.

5. Fencing

Fencing of winter cattle feedlines could prevent elk from co-mingling with cattle. Elk-proof fencing around private stackyards can help in reducing an operation's attractiveness to elk. New fencing would require favorable decisions by the landowner.

Where fencing stackyards is considered beneficial, WGFD provides fencing materials to landowners.

Elk-proof fencing around elk feedgrounds can contain most elk within a given area. A drift fence already exists for several miles (11 to the south and ½ to the north) along the Star Valley front from east of Etna to the Greys River feedground. Co-mingling is not an issue with elk that attend the Forest Park feedground, thus fencing should not be necessary at that location. Fencing projects around the feedgrounds would require favorable decisions by the landowner (state and/or federal).

Pros:

- may reduce damage problems and complaints
- may reduce risk of elk-cattle brucellosis transmission
- may be successful in fencing off stored hay and small-scale issues
- reducing the attractiveness of particular operations to elk may lead to overall reductions in damage in the general area

Cons:

- costs may be prohibitive- for construction, maintenance and monitoring
- congregating all or most of the elk within the fence may be unfeasible
- long lengths of fencing could impede movements of other wildlife
- does not address seroprevalence of brucellosis in elk
- some producers may be unwilling to erect fences
- may require federal agency cooperation and potential National Environmental Policy Act (NEPA) compliance
- impedes Forest access
- takes away opportunities to view wildlife

6. Elk Test and Removal

This option has been shown to reduce brucellosis antibody prevalence among elk captured from feedgrounds (see WGFD Test and Slaughter pilot project report; <http://gf.state.wy.us/wildlife/Brucellosis/index.asp>). The number of aborted fetuses and associated fetal fluids contaminated with *Brucella* bacteria would likely be decreased among elk attending feedgrounds in the AEH if this option were implemented, likely reducing risk of both intra- and interspecific brucellosis transmission. The WGFC has the authority to make this decision.

Pros:

- would reduce brucellosis antibody prevalence in elk
- may 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

## 7. Habitat Enhancement

Habitat enhancement projects may reduce the time elk spend on feedgrounds. If habitat improvements are completed near feedgrounds or between summer range and feedgrounds, the enhanced forage produced will decrease the dependence of elk on artificial feed, snow conditions permitting. Reduced feeding durations and lower elk concentrations on feedgrounds, especially during the high transmission risk period, may decrease the probability of intraspecific brucellosis transmission events. Habitat enhancement projects also create vegetative diversity, enhance aspen communities, and improve range conditions for other species.

Forest Park feedground is located on and surrounded by USFS land, and the Greys River feedground is bordered by primarily USFS land. Thus, decision authority is with the USFS for most areas. Consultation and cooperation with the affected grazing permittee would also be necessary. USFS personnel have indicated there may be opportunities for aspen/sagebrush treatments throughout the AEH. Habitat enhancement options may continue to arise, and the WGFD will continue to work closely with the USFS to pursue habitat enhancement options. The WGFD could also explore options to increase palatability of forage on the Greys River feedground, which is on land owned by WGFC. Increased forage quality in the fall may entice elk onto the feedgrounds and away from damage situations, without an earlier initiation of feeding. Habitat enhancements might be best used in conjunction with options 2,3, and 8 to achieve maximum success.

### 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



## 8. Acquisition/Conservation Easements

Disease transmission risk on feedgrounds in the AEH might be decreased by managing lands adjacent to, or connected with, areas used by wintering elk. With adequate intact, healthy, and accessible elk winter habitat available, elk feeding may be reduced. This option also secures habitat for other wildlife species. The buying or long-term leasing of land to be managed commensurate with wildlife benefits 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

## 9. Continuation of Strain 19 Elk Vaccination Program

The WGFD initiated this program in 1985 on Greys River feedground 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).

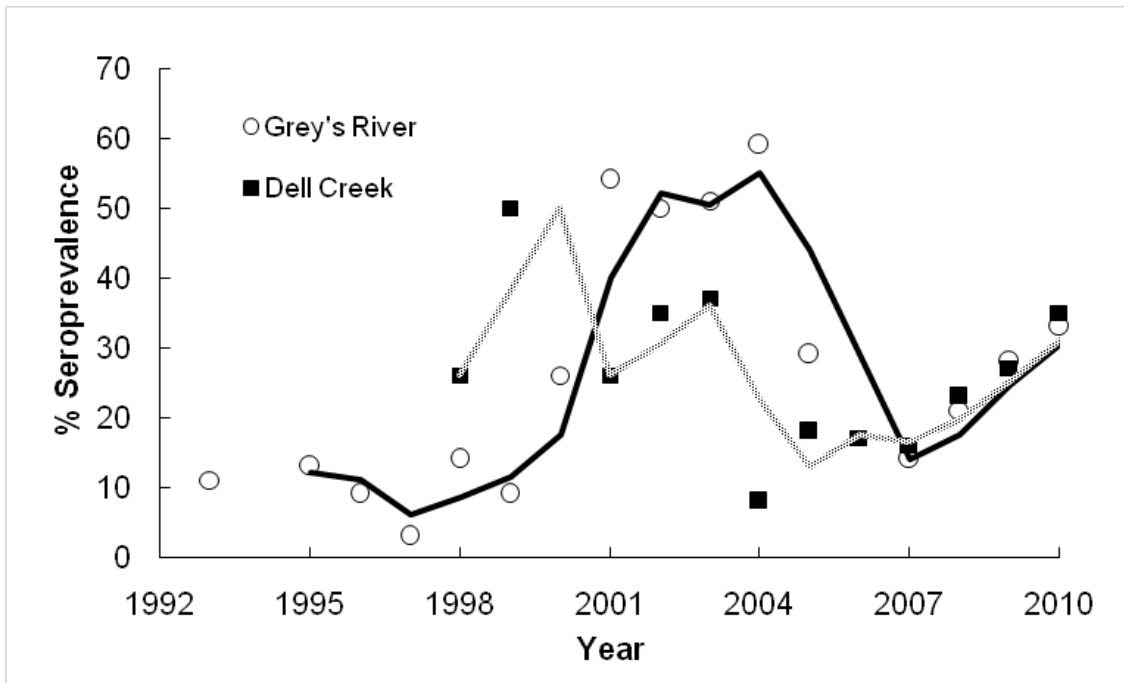


Figure 3. Seroprevalence levels in elk from Grey's River and Dell Creek feedgrounds, 1993-2010. Trendlines depict moving averages within individual feedground.

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 four feedgrounds in the FCEH. 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.

Pros:

- may be reducing total number of *Brucella* induced and infected elk fetuses aborted on feedgrounds
- perceived by many as an effective disease management tool

Cons:

- cost and logistics
- not shown to reduce seroprevalence in elk on feedgrounds
- elk must be concentrated on feedgrounds to ensure delivery is feasible

## **D. Coordination Meetings**

### **1. Producer Meeting**

A meeting was held 14 December 2010 in Thayne to discuss the nine options among livestock producers and associated land and resource management agencies within the AEH. A presentation was given by WGFD that summarized brucellosis management and research strategies and their relation to the nine options. Fourteen producers, seven WGFD personnel, and one representative from the USFS attended the meeting. Several questions and comments were proposed by attending producers regarding why increased brucellosis trends were being observed in NW Wyoming in the absence of feedgrounds, how much interchange occurs among feedgrounds and other elk herds, the potential to haze elk during parturition to separate them from cattle, and inquiries into the persistence of the *Brucella* bacteria in the environment. There was a comment of support from producers for the continued operation of feedgrounds for a variety of reason, and one producer noted that changes in cattle operations, particularly switching to a yearling operation, present many challenges and would likely not be profitable for the producer. No substantial changes or actions were made to the BMAP or management of the AEH feedgrounds following this meeting.

### **2. Interagency Meetings**

A meeting was held 18 January 2011 between WGFD and USFS personnel to discuss the nine options. As with the producer meeting, WGFD began with a presentation covering brucellosis management strategies and research projects. Several questions arose regarding the future of Test & Slaughter, efficacy of strain 19 vaccination and associated costs, and findings from ongoing brucellosis/feedground research projects. USFS gave their general support for WGFD in research endeavors, habitat enhancement projects, and elk management strategies.

### **3. Public Meeting**

A meeting was held 23 March 2011 between WGFD and concerned members of the public to discuss the nine options as they pertained to the Jackson, Fall Creek, and Afton Elk Herd Units. Seven public individuals, and four WGFD personnel attended the presentation which summarized WGFD brucellosis management and research strategies and their relation to the nine options. Several topics were discussed following the presentation including *B. abortus* in wolves, environmental persistence of *B. abortus*, impacts of wolves on feedground elk populations and management, strain 19 vaccination efficacy, and financial impacts of brucellosis. No major changes were proposed at that time for any Herd Unit, and members of the public found the presentation informative and useful.

Additional written comments were accepted from the public through 12 April 2011. Comments were received from one member of the public, and from representatives of the Greater Yellowstone Coalition (GYC) and Jackson Hole Conservation Alliance (JHCA). Principal comments pertinent to the AEH are collated below:

- Encouraged the WGFD to pursue erection of elk-proof fencing around winter livestock feeding areas in order to maintain separation between elk and livestock.

- Stressed the importance of diseases other than brucellosis in feedground management (e.g., CWD).
- Questioned effectiveness of *Brucella* strain 19 vaccination for reducing seroprevalence of elk.
- Commended the WGFD for brucellosis research being conducted, and for the Target Feedground Project.

## **E. Proposed Management Actions**

### **1. Feedground Relocation**

The current sites of the Grey's River and Forest Park feedgrounds are located optimally for current management and the WGFD has no plans to relocate these feedgrounds in the foreseeable future.

### **2. Feedground Elimination**

The WGFD will not pursue this option in the near future in the AEH given existing elk brucellosis seroprevalence, and the utility of elk feedgrounds in both manipulating winter distributions of elk and maintaining the current elk population objectives.

### **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 Grey's River and Forest Park feedgrounds.

### **4. Cattle Producer Change of Operation**

The WGFD will work with cattle producers and other agencies (e.g., NRCS, Teton Conservation District, USFS, WLSB) in the AEH to implement any changes to their operations that decrease the risk of interspecific disease transmission.

### **5. Fencing**

The WGFD encourages cattle producers in the AEH to fence areas where hay is stored (stackyards) for winter-feeding operations and will continue to deliver fencing materials for stackyard construction where appropriate. As opportunities arise for additional fencing projects (e.g., winter cattle feeding enclosures), WGFD will assess those situations on a case-by-case basis.

### **6. Elk Test and Removal**

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

### 7. Habitat Enhancement

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 in the AEH (WGFD 2010b). These projects will focus on areas designated as winter and transitional ranges, while working within the constraints of sensitive-species management and funding.

### 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 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

## **H. Literature Cited**

- Barbknecht, AE, WS Fairbanks, JD Rogerson, EJ Maichak, and LL Meadows. 2009. Effectiveness of vaginal-implant transmitters for locating elk parturition sites. *Journal of Wildlife Management* 73:144-148.
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, BM Scurlock, and LL Meadows. 2011. Elk (*Cervus elaphus nelson*) parturition site selection at local and landscape scales in western Wyoming. *Journal of Wildlife Management* IN PRESS.
- Cook, WE. 1999. Brucellosis in elk: studies of epizootiology and control. Ph.D. Dissertation, University of Wyoming, Laramie, Wyoming, 183pp.
- Creech, TG, PC Cross, BM Scurlock, EJ Maichak, JD Rogerson, J Henningsen, and S Creel. Low-density feeding reduces elk contact rates and brucellosis transmission on feedgrounds. *Journal of Wildlife Management* IN REVIEW.
- Cross, PC, WH Edwards, BM Scurlock, EJ Maichak, and JD Rogerson. 2007. Effects of management and climate on elk brucellosis in the Greater Yellowstone Ecosystem. *Ecological Applications* 17:957-964.
- Herriges, JD Jr, ET Thorne, SL Anderson, and HA Dawson. 1989. Vaccination of elk in Wyoming with reduced dose strain 19 *Brucella*: Controlled studies and ballistic implant field trials. *Proceedings of the U. S. Animal Health Association* 93:640-655.
- Maichak, EJ, BM Scurlock, JD Rogerson, LL Meadows, AE Barbknecht, WH Edwards, and PC Cross. 2009. Effects of management, behavior, and scavenging on risk of brucellosis transmission in elk of western Wyoming. *Journal of Wildlife Diseases* 45:398-410.
- Roffe, TJ, LC Jones, K Coffin, ML Drew, SJ Sweeny, SD Hagius, PH Elzer, and D Davis. 2004. Efficacy of single calfhooed vaccination of elk with *Brucella abortus* strain 19. *Journal of Wildlife Management* 68:830-836.
- Scurlock, BM, WH Edwards, T Cornish, and LL Meadows. 2010. Using test and slaughter to reduce prevalence of brucellosis in elk attending feedgrounds in the Pinedale Herd Unit of Wyoming: results of a 5 year pilot project. WGFD, Cheyenne, Wyoming.
- WGFD. 2008. Target Feedground Project. WGFD, Cheyenne, Wyoming.
- \_\_\_\_\_. 2010a. Annual Big Game Herd Unit Job Completion Report (2009) for the Afton Elk Herd Unit (E104), Jackson Region. WGFD, Cheyenne, Wyoming.
- \_\_\_\_\_. 2010b. IN REVIEW. Annual Terrestrial Habitat Report. WGFD, Cheyenne, Wyoming.