

**Big Piney Elk Herd Unit (E106)**  
**Brucellosis Management Action Plan Update**  
**Wyoming Game and Fish Department**  
**April 2011**

**A. Introduction and herd unit overview**

Per recommendations presented by the Wyoming Governor's Brucellosis Coordination Team (BCT), this update to the Big Piney elk herd unit (BPEHU) 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 substantial progress in the BPEHU 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 BPEHU BMAP (WGFD 2007).

The BPEHU is located on the east slope of the Wyoming Range in western Sublette and eastern Lincoln Counties, WY and includes elk Hunt Areas 92 and 94 (Fig. 1). The area is bound on the north by the Hoback Rim, on the northeast by Highway 189, on the east and southeast by the Green River, on the southwest by LaBarge Creek, and on the west by the hydrographic divide between the Green River and Grey's River drainages. The Bureau of Land Management (BLM) is responsible for management of 607 mi<sup>2</sup> (38%) of the surface area in this herd unit. The U. S. Forest Service (USFS) manages 380 mi<sup>2</sup> (24%) of the area. Private and state lands account for the remaining 587 mi<sup>2</sup> (38%) of the area along: North and South Horse Creek; North and South Cottonwood Creek; North, Middle, and South Piney Creek; and LaBarge Creek. Currently, four feeding sites and one staging area (hereafter termed "feedgrounds") are located within the BPEHU: Franz, Jewett, Bench Corral, Finnegan, and North Piney (staging area). All feedgrounds in this Herd Unit (excluding Bench Corral) are located along the border of BLM or private lands and USFS lands and were established "uphill" from livestock operations primarily to prevent damage to stored hay (and later, prevent commingling).

Total area of the BPEHU is approximately 1,574 square miles (mi<sup>2</sup>), of which 1,557 mi<sup>2</sup> (99%) have been delineated by the WGFD as occupied elk habitat. Approximately 1,300 mi<sup>2</sup> (83%) are delineated as Spring/Summer/Fall range, 124 mi<sup>2</sup> (8%) as Crucial Winter Yearlong range, 8 mi<sup>2</sup> (<1%) as Crucial Winter range, 71mi<sup>2</sup> (5%) as Winter range, and 55 mi<sup>2</sup> (3%) as Winter Yearlong range (Fig. 2).

# Big Piney (E106) Elk Herd Unit

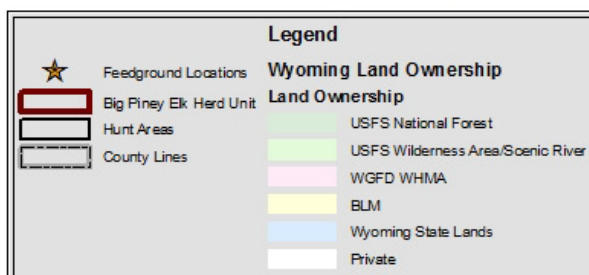
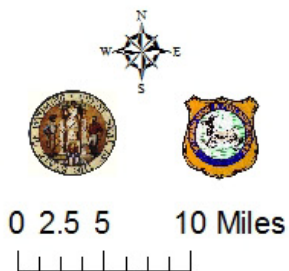
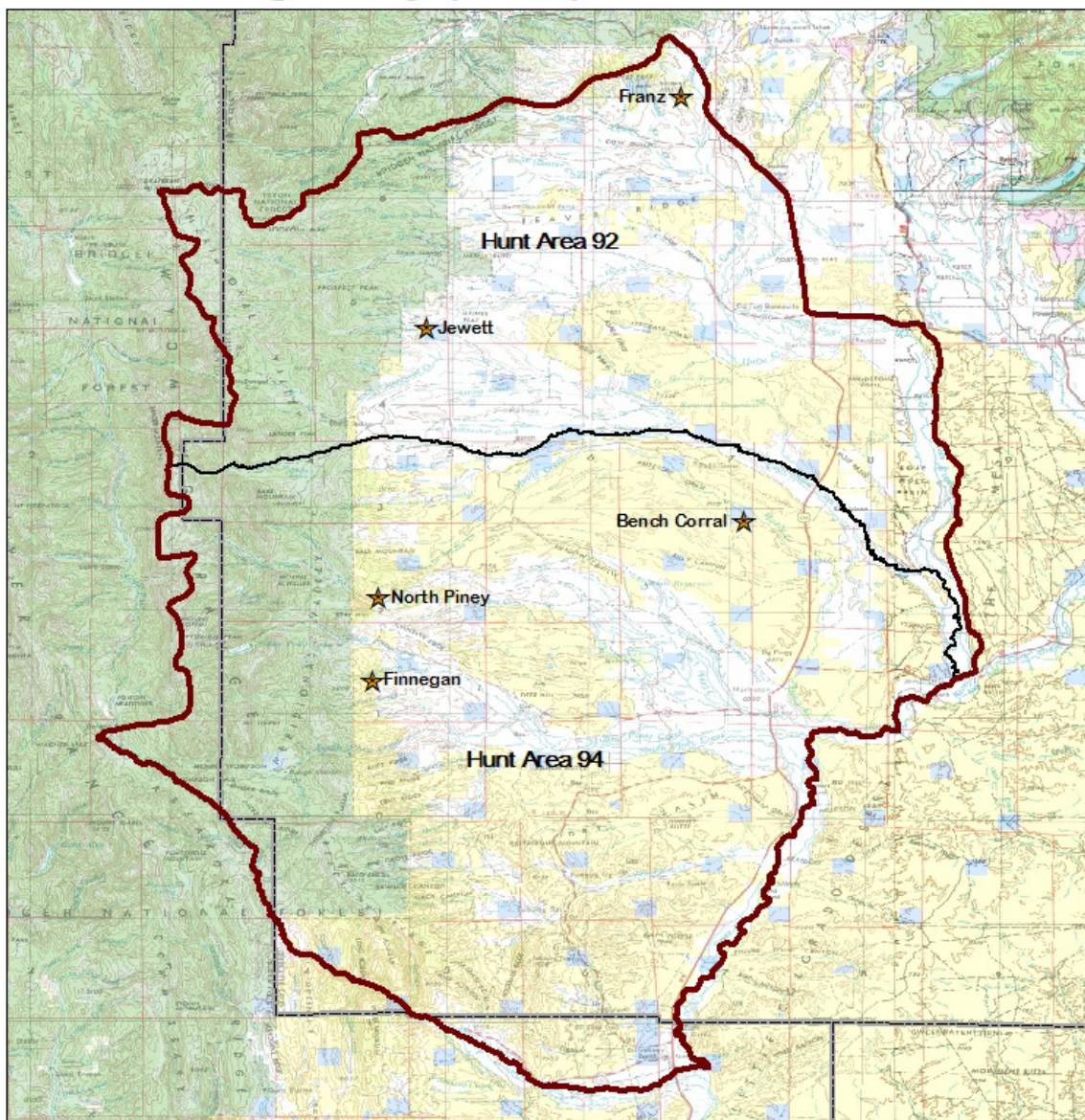


Figure 1. Herd Unit and Hunt Area boundaries for the BPEHU, Sublette and Lincoln Counties, WY. Includes state and federally owned lands and locations of feedgrounds.

# Big Piney Elk Herd Unit Seasonal Ranges

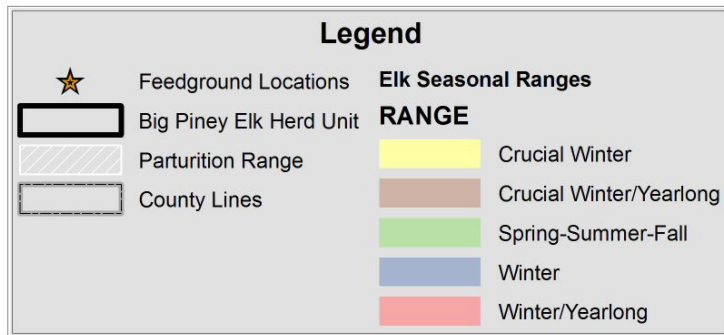
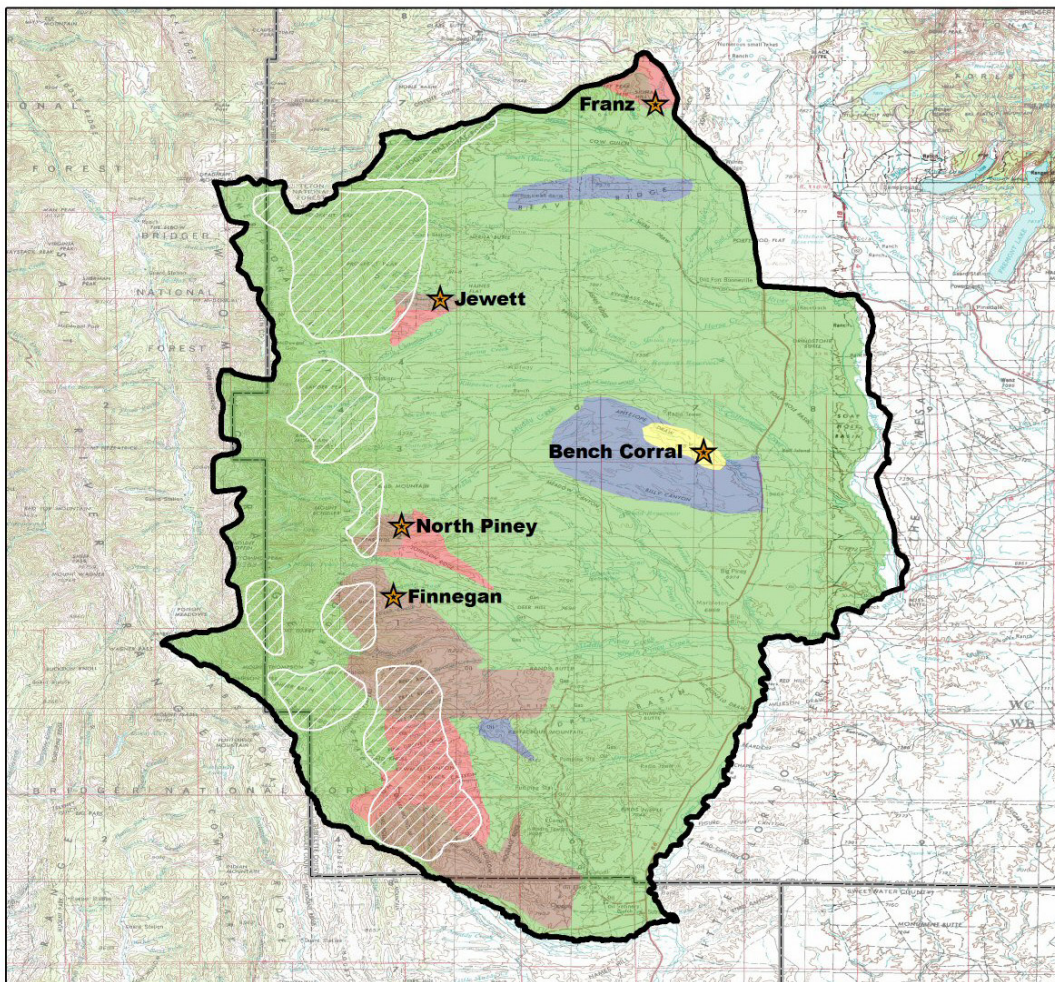


Figure 2. Areas delineated by WGFD as specific seasonal ranges of elk on the BPEHU, Sublette and Lincoln Counties, WY. Total area of the BPEHU is 1,574 mi<sup>2</sup>.

## **B. Brucellosis Management Options**

Listed below are nine potential options for managing brucellosis on the five feedgrounds in the BPEHU. Short-term objectives of these options are to reduce prevalence of brucellosis in elk and prevent co-mingling of elk and cattle. 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. Relocating feedgrounds to lower elevation sites to maximize both geographic area for elk to disperse and 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**

This option would initially require a suitable area lower in elevation, in a lower precipitation zone, with no winter cattle operations in the vicinity. Current habitat conditions should be evaluated to determine production, health of vegetation, and approximate potential of the area. All lands within the BLM Pinedale Field Office are leased for grazing, so it is likely one or more permittees will need to be involved in the selection of a particular area. If purchase of AUMs is acceptable to a permittee, this could reserve forage for elk and other wildlife. Incorporation of options 3-8 may make this option more viable, however decision authority would lie with the permittee, BLM, and 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

Prior to feeding elk at the current 5 feedground sites, WGFD fed on at least two other sites, Reardon Canyon (1950-1958) and Deer Hills (1952-1958, Fig. 3, WGFD 1989). The Reardon Canyon site is located approximately two miles outside the southeast edge of the BPEHU in the Pinedale Elk Herd Unit (E108). It was commissioned to entice elk to move from the BPEHU along an historic migration route onto historic winter range of the Little Colorado Desert, thereby preventing damage to stored hay along the Green River, but was decommissioned as elk became increasingly difficult to move across the river. The Deer Hills site is located approximately eight miles east of the current Finnegan location and was decommissioned in 1959 as elk continued to cause damage to stored hay on Mickelson's "Guthrie" place. Subsequently, establishing feedgrounds further up-slope was chosen as the solution, and Finnegan and North Piney feedgrounds were commissioned in 1960. Locations of Franz (1952-current) and Jewett (1956-current) have likely shifted up-slope over the years, but records are anecdotal. Elk from North Piney were baited (relocated) to Bench Corral (1975-current) during winter 1995-96. Since that time, and despite WGFD efforts to hold elk at North Piney, elk have continued to "migrate" from North Piney to Bench Corral (Fig. 4, WGFD 2009) around late January causing few commingling events, minimal damage to adjacent hay production operations, and no damage to range conditions or reduction of AUMs on BLM lands adjacent to Bench Corral (WGFD 2007).

Figure 3. Locations of current and historic (decommissioned) feedgrounds on the BPEHU.

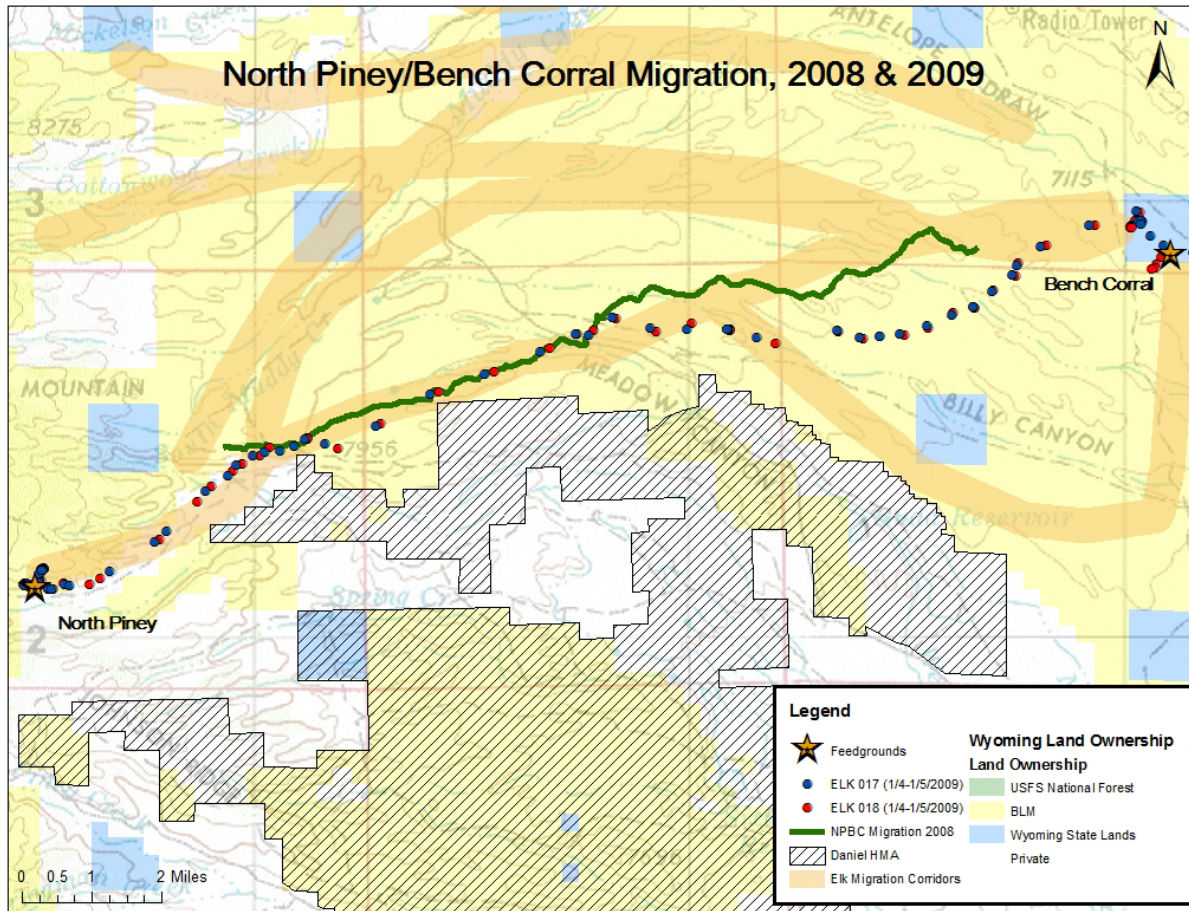


Figure 4. Elk “migration” route from North Piney to Bench Corral feedground, 2008 (green line), mapped by handheld GPS. GPS collars deployed winter 2008 on two (2) Bench Corral Elk (blue and red circles) show overlap with 2008 route. Routes taken in 2008 and 2009 show avoidance of private lands, including those enrolled in the Daniel/Big Piney Hunter Management Area. Elk typically leave North Piney just prior to or following a large winter storm, and attempts to map (with snowmobile and GPS) 2009 and 2010 migrations have occurred but failed due to heavy snowfall and high winds (drifting) obscuring the trail.

## 2. Reduction or Elimination of Supplemental Feeding

As part of WGFD’s Target Feedground Project (WGFD 2008), a significant reduction of the feeding season (particularly end date) has been occurring since 2008 at the Bench Corral feedground and North Piney staging area. Minor reductions to length of feeding season (early end date) have been occurring at remaining feedgrounds since 2009. Given the current “migration” to Bench Corral, elimination of supplemental feeding (feedground decommissioning) is most feasible for the North Piney staging area. However, if current conditions and herd objectives change, through implementation of one or more of Options 3 – 8, this Option may become more realistic for additional feedgrounds. The WGFC has the authority to make this decision.

### Pros:

- reduced risk of intraspecific transmission of brucellosis and other diseases
- facilitate efforts to eliminate brucellosis in elk

- reduced feedground and vaccination expenses incurred by WGFD

Cons:

- increased 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
- possibly increased elk winter mortality
- possibly lowered number of elk that could be maintained in the BPEHU
- possibly reduced income to the WGFD due to reduced license sales
- potentially reduced hunter opportunity
- increased potential for vehicle-elk collisions on Highway 189

### 3. Elk Population Reduction

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

Pros:

- would decrease elk densities on feedgrounds
- may contribute to lower brucellosis prevalence
- could increase hunting opportunities in the short term
- could increase license revenues in the short term
- potentially reduce some 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
- the general public may be unwilling to accept large reductions in elk numbers
- will cause a loss of elk hunting opportunity in the long term
- may reduce license revenue in the long term (may be offset by reduced management costs)

The 2008 post-hunt population of elk on the BPEHU was counted at 3,370 elk (WGFD 2010a). This count has risen steadily since at least 2000 (2,509 elk), but has been relatively stable since 2005 (3,108 elk). Hunting seasons in recent years have been designed to reduce elk numbers throughout the BPEHU to the WGFC quota of 2,400 elk. Attempts to increase harvest of adult females in both HA 92 and HA 94 has occurred via an early (1 Oct – 14 Oct) and late (1 Nov – 15 Nov, implemented 2010) cow/calf season (General license applies). In 2008, 500 limited quota Type 6 (cow/calf) licenses were available and split (250/250) between HA 92 and HA94. In 2010, 400 and 450 Type 6 licenses were available for HA 92 and HA 94, respectively. These Type 6 licenses are valid 1 Oct – 30 Nov and during the special late season (1 Dec – 31 Jan) hunt on the Daniel/Big Piney Hunter Management Area. These management strategies are intended to bring the elk population closer to overall feedground and EHU objectives.



#### 4. Cattle Producer Change of Operation

This is an option high-risk and other producers within the BPEHU could implement to minimize/eliminate brucellosis risks to their herds. Changing cattle operation 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

This Option could be facilitated by Options 1 and 3, and may facilitate Options 6, 7, and 9 in the BPEHU. Elk-proof fencing around private stackyards in the BPEHU reduces “attractiveness” of stored hay and likelihood for damage by elk (WGFD 2007). When fencing stackyards is considered beneficial at reducing damage, WGFD provides fencing materials to landowners. Fencing of winter cattle or elk feedlines could prevent elk from comingling with cattle. New fencing would require favorable decisions by the landowner (private, state, or federal).

##### Pros:

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

##### Cons:

- cost and maintenance
- 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/maintain fencing
- could require cooperation and potential NEPA evaluation for federal lands

Large-scale, elk-proof fencing around feedgrounds can contain most elk within a given area, as evidenced by fences in Jackson Hole (surrounding National Elk Refuge), Star Valley (surrounding Grey’s River feedground), and Pinedale (border of USFS land from New Fork Canyon to Fremont Ridge). Smaller-scale fences (e.g., adjacent west of Muddy Creek feedground) may prevent elk from drifting onto localized areas, but likely do not contain most elk in the Herd Unit. Following a brucellosis outbreak in 2008, temporary electric fence has been implemented annually (post-feeding) just south of Franz feedground and has prevented cattle from drifting onto the feedground and comingling with resident elk. Currently, no permanent elk-proof fences exist in the BPEHU for any purpose other than fencing of stackyards. Wide-scale fencing across a large geographic range in any part of the BPEHU is likely not possible because of 1) conflicts with seasonal migration routes of other wildlife species

(e.g., deer, moose, antelope) and 2) cost. Fencing (complete enclosure) of elk feedgrounds would likely reduce risk of interspecific disease transmission but likely increase risk of intraspecific disease transmission. Fencing of cattle winter feeding pastures on private lands could eliminate most elk-cattle disease transmission risk, but would need cooperation from willing landowners, would be costly, would restrict movement of other wildlife species, and could considerably complicate cattle management.

#### 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 BPEHU given implementation of this option.

#### 7. Habitat Enhancement

Habitat projects have been utilized in areas adjacent to feedgrounds with some success in reducing feeding duration. The 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

##### Cons:

- may have limited effectiveness at reducing dependency on supplemental feed by the availability of forage in locations or years of high snow accumulation

- 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
- would require approval of federal agencies for federal land, private landowners for deeded land, and the State Land Board for state land projects
- may increase likelihood of invasive specie(s) establishment
- cost, coordination, and logistics of implementation

This Option may be best used in conjunction with options 1, 2, 3, and 8 to achieve maximum success. Opportunities for habitat enhancement aimed at reducing elk dependency on feedgrounds in the BPEHU are located primarily around Bench Corral feedground. Other areas on the BPEHU exist (e.g, aspen ecotones), but may have less of an effect at reducing length of feeding season because of variable snow conditions. Since 1990, about 8,200 acres of sagebrush and aspen have been treated with various methods (fire, mechanical, Spike herbicide) within the BPEHU (WGFD 2007, 2010c IN REVIEW). Increased forage quantity/quality in autumn may entice elk onto the feedgrounds and away from damage situations, without an earlier initiation of feeding. Increased forage quantity/quality in spring may entice elk off of feedgrounds, reducing risk of intraspecific brucellosis transmission.

#### 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. The decision authority is with the private landowner and the WGFC.

#### Pros:

- secures habitat for all wildlife
- long term solution
- could maintain some elk populations
- may facilitate options 1,2, and 7
- could reduce brucellosis prevalence in elk

#### Cons:

- cost and logistics
- limited availability of lands with high potential for wintering elk or connecting to existing or potential elk winter range.
- requires landowner willingness

Disease transmission risk on all feedgrounds within the BPEHU may decrease by managing lands adjacent to, or connected with, native elk winter ranges.

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

The WGFD initiated this program in 1985 on Grey's River feedground and has vaccinated around 80,000 elk to date on 22 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 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 Grey's River feedground elk indicate no significant difference, no downward trend, and that seroprevalence may fluctuate cyclically over time throughout both populations (WGFD 2010b, Fig. 5).

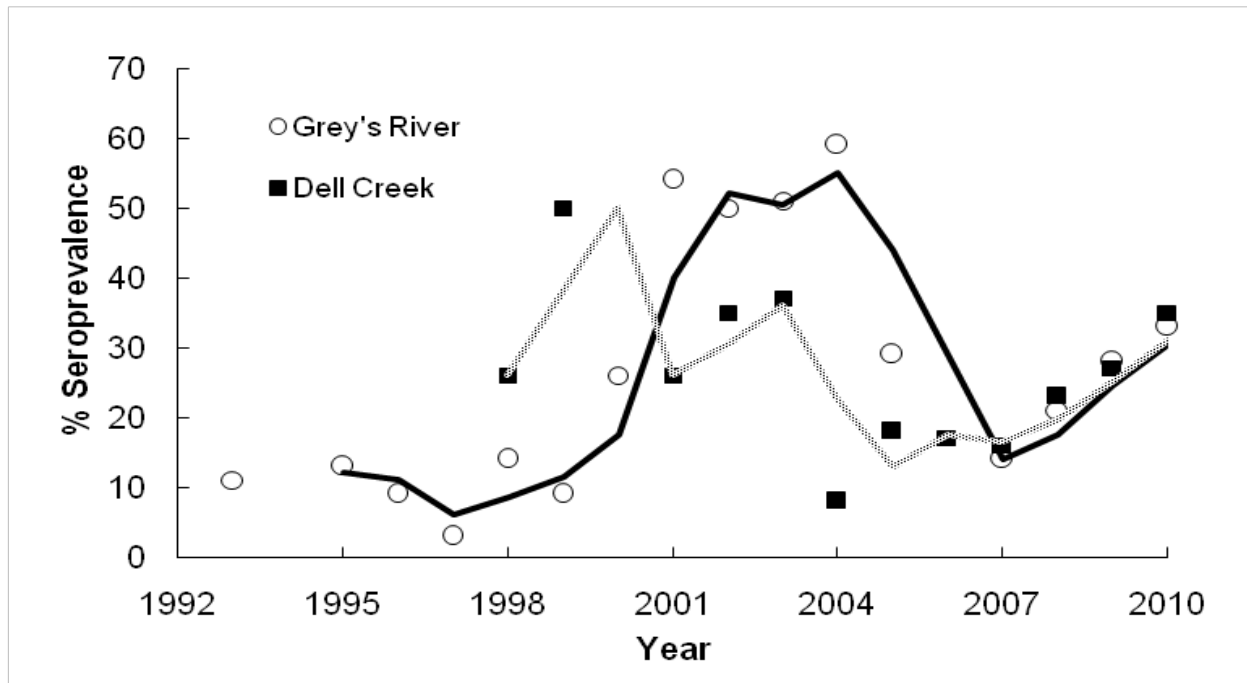


Figure 5. Seroprevalence levels in elk from Grey's River and Dell Creek feedgrounds, 1993-2010. Trendlines depict moving averages within individual feedground.

In captive studies, Strain 19 prevents abortion in 29% (Roffe et al. 2004) to 62% (Herriges Jr et al. 1989) of elk challenged with *B abortus* strain 2308. Protection from *Brucella* 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.

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

This Option is currently employed on all feedgrounds in the BPEHU. 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. Intra-Agency Meeting

Several informal conversations were held among Pinedale Region WGFD personnel from late summer through early winter 2010 regarding BMAP Options and their implementation. Most discussion pertained to the status and operation of North Piney Staging Area. It was determined at this time to allow elk to continue to “stage” at North Piney prior to their annual “migration” to Bench Corral, but that feeding would end actively either on 1 Jan or once the feeder could not drive a truck or car into North Piney. It was agreed that decommissioning of North Piney could be feasible in the future, but the current operational strategy (active end date/impassible road) will be monitored and documented for three to five years to assess if elk attending North Piney are having substantial impacts to adjacent landowner fences.

##### 2. Producer Meeting

A meeting was held 27 December 2010 to discuss the nine options among livestock producers and associated land and resource management agencies (i.e., BLM, USFS, NRCS, WY Livestock Board, State Lands Board) within the Big Piney, Hoback, and Upper Green Elk Herd Units. Four producers and several WGFD personnel attended the presentation, yet personnel from other organizations were not present. Several questions and comments were proposed by attending producers regarding Strain 19 vaccination, Test & Removal, as well as the Target Feedground Project and other research findings (e.g., early end-date, Low-Density Feeding, VIT and GPS collar data). The concept of a “multi-feeding area” feedground was proposed and explained (particularly with respect to Bench Corral feedground), but no substantial changes or actions were made to the Big Piney BMAP or management of the Big Piney EHU feedgrounds following this meeting.

##### 3. 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 Big Piney, Hoback, Upper Green, and Pinedale Elk Herd Units. Three public individuals, one local media personnel, 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 informally throughout the presentation including brucellosis in horses, environmental persistence of *Brucella abortus*, impacts of wolves on feedground elk populations and management, and strain 19 vaccination efficacy. No major changes were proposed for any Herd Unit, and members of the public found the presentation informative and useful.

## **E. Proposed Management Actions**

### **1. Feedground Relocation**

The WGFD will not relocate any feedgrounds within the BPEHU at this time. However, North Piney will continue to function as a “staging area”, and these elk will be allowed to “migrate” to Bench Corral following an active end date of 1 January or once the feeder cannot drive a truck or car into North Piney.

### **2. Feeding Reduction/Elimination**

The WGFD will not eliminate any feedgrounds in the BPEHU at this time. However, WGFD will work with producers and land management agencies to determine opportunities to eliminate the North Piney Staging Area and pursue this option throughout the BPEHU as opportunities are identified. Furthermore, as part of the Target Feedground Project, all feedgrounds within the BPEHU are candidates for early end-date of feeding. WGFD will coordinate with feeders annually to select appropriate termination dates of feeding to minimize brucellosis transmission events on feedgrounds and the subsequent risk of intra- and interspecific transmission.

### **3. Elk Population Reduction**

The WGFD manages for the current, Commission established, elk herd unit population objective of 2,400 elk in the BPEHU. Efforts will continue to reduce current elk population numbers in the BPEHU (3,010 elk) and bring these closer to objective. The early (1 Oct-14 Oct) and late (1 Nov-15 Nov) “general antlerless” seasons, issuing of 900 Type 6 (i.e., cow/calf) tags, and additional late season (1 Dec - 31 Jan) hunting opportunities on the Big Piney Hunter Management Area will facilitate increased harvest.

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

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

### **5. Fencing**

The WGFD will encourage cattle producers in the BPEHU to fence areas where hay is stored (stackyards) for winter feeding operations and continue delivery of materials for stackyard construction. WGFD will not pursue large-scale fencing of any lands on the BPEHU at this time.

### **6. Elk Test & Removal**

The WGFD implemented the pilot Test & Removal project in the Pinedale Elk Herd Unit from 2006 through 2010. The WGFD does not plan to implement this Option in the HEHU in the foreseeable future.

### **7. Habitat Enhancement**

WGFD will continue to coordinate with private landowners, federal land managers, livestock permittees, and NGO’s (e.g., RMEF) to develop and implement habitat improvements that may reduce elk dependency on supplemental feed in the BPEHU.

## 8. Acquisition/Conservation Easements

The WGFD will continue to identify and pursue all opportunities to implement this Option. Project proposals will be drafted and submitted to various funding agencies to facilitate implementation of this Option.

## 9. Strain 19 Vaccination

The WGFD will continue the ballistic Strain 19 elk vaccination program until adequate data are collected to determine efficacy (or lack thereof) of the program at reducing brucellosis seroprevalence in elk attending 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 in the BPEHU. 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  $\geq 2$ 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 are listed below:

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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