Jackson Elk Herd Unit (E102)
Brucellosis Management Action Plan

Wyoming Game & Fish Department
7 June 2007

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A. Introduction

1. BMAP Goal & Objectives

In February 2004, Wyoming lost its brucellosis class-free status when 31 reactor cattle were detected in a Sublette county herd (Wyoming Brucellosis Coordination Team [BCT] 2005). Infection of these cattle likely originated from elk on the nearby Muddy Creek feedground. Following this loss of class-free status, increased surveillance of Wyoming cattle revealed a series of herds with the disease in the Greater Yellowstone Ecosystem (GYE, Wyoming BCT 2005).

To develop management strategies regarding brucellosis in the GYE of western Wyoming and regain brucellosis class-free status, the Governor's BCT identified the Brucellosis Management Action Plan (BMAP) process as their highest priority recommendation for reducing brucellosis transmission from elk to elk and from elk to cattle (Wyoming BCT 2005). Because of increased surveillance, research and BMAP development efforts, and lack of infection in cattle herds since 2005, Wyoming regained its brucellosis class-free status September 2006.

The objectives of this BMAP are to 1) document and analyze all available quantitative and qualitative data regarding brucellosis, 2) use available data to develop management actions to reduce risk of brucellosis transmission among wildlife and from elk to cattle, and 3) select appropriate management actions for implementation in the Jackson Elk Herd Unit (EHU). This plan, combined with its Appendices (1-4), include data and information relevant to understanding, formulating, and implementing management actions. This document will receive annual re-evaluation to incorporate new brucellosis and feedground research results, feedground management protocols, and agency (state, federal, private) recommendations.

2. Jackson Elk Herd Unit Overview

The Jackson EHU is located in the upper Snake River drainage and includes all drainages of the Snake River downstream to and including the Gros Ventre River drainage and Flat Creek north of the town of Jackson. The Jackson EHU includes elk Hunt Areas (HA) 70-72 and 74-83 (Figure 1). Total area of the Jackson EHU is approximately 2,350 mi^2 (~1.5 million acres) of which 2,299 mi^2 (98%) have been delineated by the Wyoming Game and Fish Department (WGFD) as occupied elk habitat. Approximately 2,054 mi^2 (89%) are delineated as Spring/Summer/Fall range, 2 mi^2 (0.1%) as Crucial Winter Yearlong range, 152 mi^2 (6.6%) as Crucial Winter range, 52 mi^2 (2.3%) as Winter range, and 39 mi^2 (1.7%) as Winter Yearlong range (Figure 2). There are 151 mi^2 designated as parturition range (*see* Appendix 3, Figure 32).

The U. S. Forest Service (USFS) manages 1,454 mi^2 (61.8%) of the area. The National Park Service (NPS) manages 683 mi^2 (29.0%) of land within the area, comprised of Grand Teton National Park (GTNP), Rockefeller Memorial Parkway, and Yellowstone National Park (YNP). GTNP and the National Elk Refuge (NER; 38.7 mi^2; 1.6%) comprise most of the valley floor north of the town of Jackson. Private lands account for 114 mi^2 (4.8%) of the area. State lands make up the remaining 5 mi^2 (0.2%). There are three state-operated elk feedgrounds within the Jackson EHU: Alkali, Patrol Cabin, and Fish Creek; each of these are located in the Gros Ventre River drainage east of GTNP. Elk also receive supplemental winter feed on the NER, operated by the U.S. Fish and Wildlife Service (USFWS).

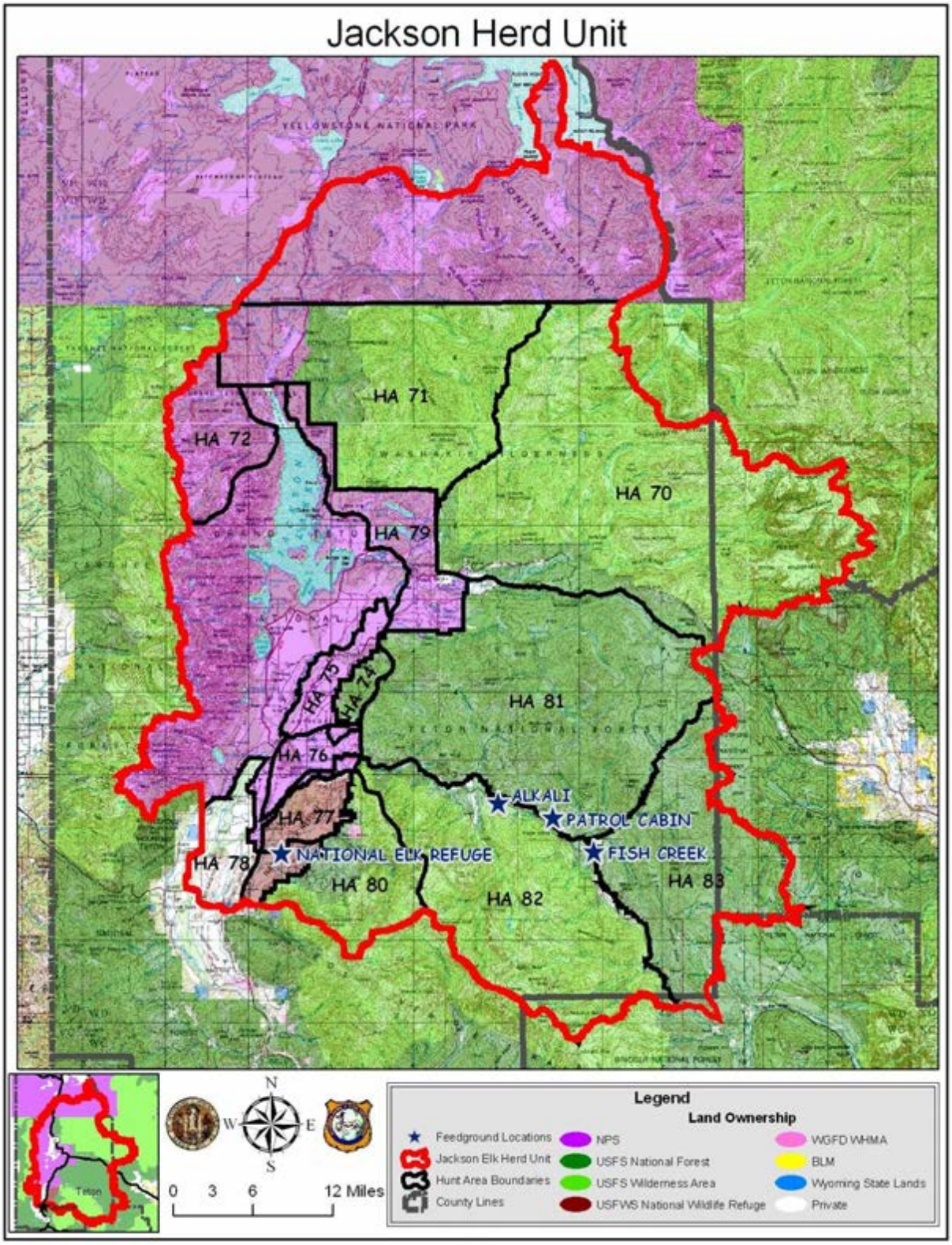

Figure 1. Herd Unit and Hunt Area boundaries for the Jackson EHU, Teton County, WY. Includes state- and federal-owned lands and locations of elk feedgrounds.

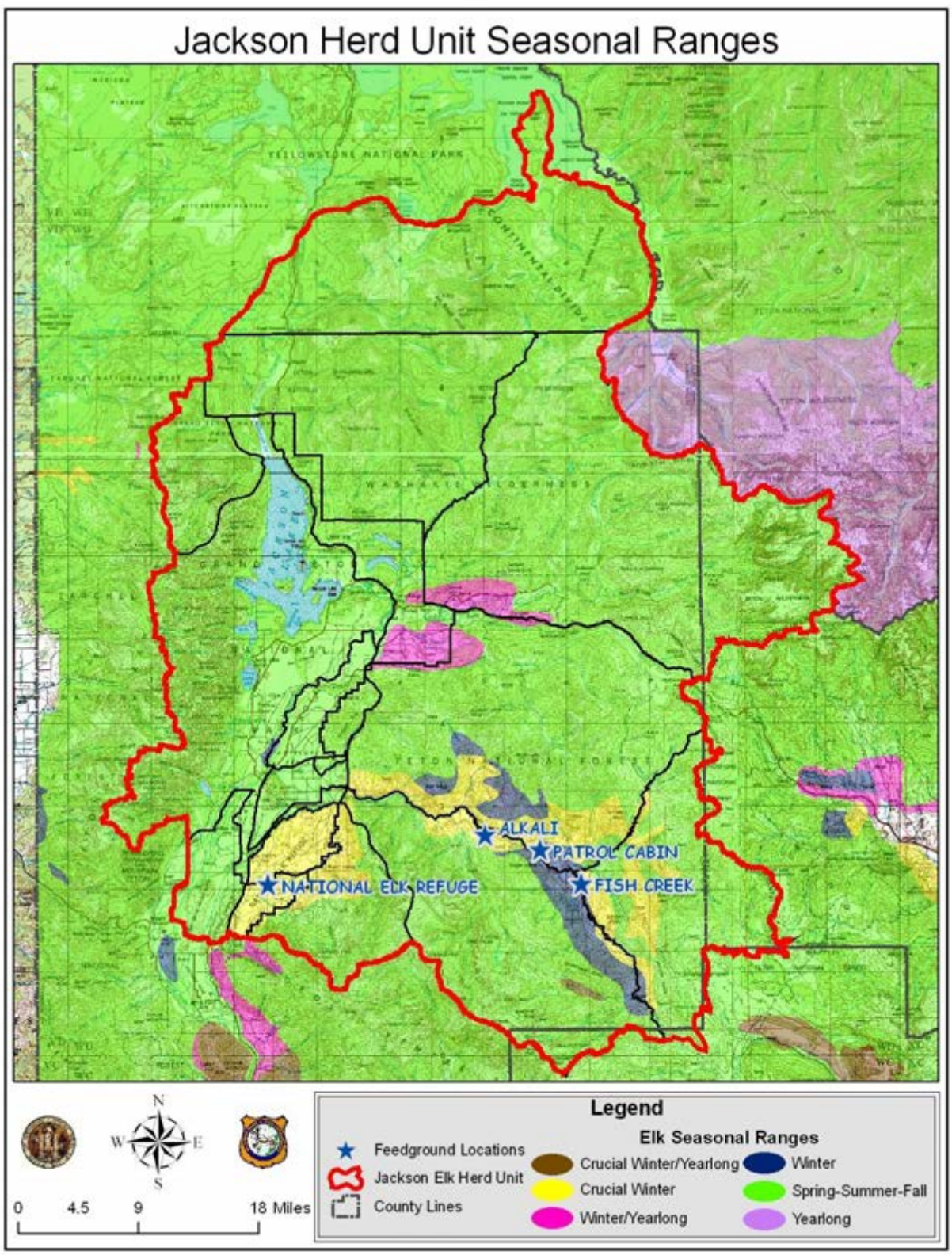

Figure 2. Areas delineated by WGFD as specific seasonal ranges of elk on the Jackson EHU, Teton County, WY. Total area of the Jackson EHU is approximately 2,350 mi^2.

3. Brucellosis Literature Review

Brucellosis, caused by infection with the bacterium *Brucella abortus*, has sparked controversy because of its persistence in elk (*Cervus elaphus*) and bison (*Bos bison*) of the GYE of Wyoming, Montana, and Idaho (Thorne et al. 1978) and potential threat to domestic livestock (Kistner et al. 1982). Presumably, *B. abortus* was transmitted from domestic livestock to free-ranging bison and elk just prior to 1917 (Meagher and Meyer 1994) after repetitive commingling and subsequent contact with aborted fetuses contaminated with brucellosis. Subsequently, brucellosis was isolated from free-ranging bison (Mohler 1917) and elk (Rush 1932) of western Wyoming in 1917 and 1931, respectively.

Brucella transmission usually occurs via the oral route, with ingestion of bacteria that are shed by infected females in high numbers in aborted fetuses, fetal membranes and fluids, or uterine discharges (Thorne et al. 1982, Cheville et al. 1998). The role of lactation in brucellosis transmission is unknown (Gross et al. 2002). Although no study has attempted to determine if aerosol ingestion of *B. abortus* by elk is a viable means of transmission, aerosol transmission is known to occur in humans (Nicoletti 1980) and previous studies (Thorne et al. 1978, Herriges, Jr. et al. 1989) have found that elk contracted brucellosis and subsequently aborted for unknown reasons. These elk could have aborted because of stress from handling (Herriges, Jr. et al. 1989) or contracted brucellosis via aerosol ingestion and aborted thereafter. Infection usually results in reproductive failure (abortion of the first pregnancy) and other clinical syndromes (Thorne et al. 1982).

Diagnosis of brucellosis in elk is complicated. Seroprevalence is determined by use of four tests as determined by the Animal & Plant Health Inspection Service (APHIS 1998). The following four tests are used to determine if an animal is seropositive: 1) Card test, 2) Standard plate agglutination (SPT) test, 3) Complement-fixation (CF) test, and 4) Rivanol test. An animal is considered "seropositive" if 1) either two or more tests react at certain dilution rates, or 2) if the CF test alone shows a reaction at a dilution rate of 2+ 1:20 or higher. The criteria used to determine what is called a positive reactor (positive) for the four serology tests is as follows: 1) Card – positive or negative (no dilution), 2) SPT – 1:100 dilution or greater, 3) CF – 2 + 1:20 dilution or greater, 4) Rivanol – 1:25 dilution or greater.

Once serostatus is determined using the four standard tests, another test called cELISA (competitive enzyme-linked immunosorbent assay) is conducted on seropositive animals to differentiate between Strain 19 vaccine and field strain *Brucella abortus* (Van Houten et al. 2003). Infection is determined by killing the animal(s) and culturing *Brucella* from host tissues. Based on *preliminary* data collected from the first two years of the pilot Test and Removal project, the infection rate of elk identified as seropositive is about 37% (n = 26/71; WGFD unpublished data).

Currently, 23 winter elk feedgrounds exist in western Wyoming. The NER is maintained by the USFWS near Jackson, Wyoming; the other 22 feedgrounds are scattered throughout western Wyoming and are maintained by WGFD. All feedgrounds in western Wyoming are used as substitutes for native winter range and to minimize winter mortality of elk. Most feedgrounds additionally serve to minimize depredation of private hay stores and pastures and elk-cattle commingling (Thorne et al. 1991). Feeding of about 13,000 elk on WGFD feedgrounds occurs typically from December to April (WGFD 2004). Although the Wyoming Livestock Board (WLB 2006) recently defined the "period of exposure" for cattle as 1 January to 1 May, *Brucella*-induced abortion events in captive and feedground elk have been documented

from late February to June (Thorne et al. 1991, Roffe et al. 2004, WGFD unpublished data; see Appendix 3, section E-3 for more discussion on these dates). The concentration of elk on feedgrounds during most of this period likely increases the rate of intraspecific brucellosis transmission and prevalence (Thorne et al. 1979), either from density-dependent (WGFD unpublished data) and/or frequency-dependent effects (Cross et al. 2007). This likely explains why seroprevalence levels average 25%, 2.4%, and 0% in elk on, adjacent to, and completely independent of feedgrounds, respectively. Additionally, public grazing allotments where cattle and feedground elk are present during the latter stages (i.e., May and June; Roffe et al. 2004) of the transmission period may provide conditions for interspecific transmission. To date, commingling of elk and cattle has been documented on only 1 of 12 public grazing allotments that "turn-on" prior to 15 June and overlap with WGFD-delineated elk parturition areas within the brucellosis endemic area of western Wyoming (WGFD unpublished data). Elk from this allotment are assumed to be mostly independent of feedgrounds, ultimately posing little risk of interspecific transmission to livestock.

To control and eventually eliminate brucellosis from elk, a vaccination program was initiated in 1985 (Herriges Jr. et al. 1991). Almost all (>95%) calves on feedgrounds are vaccinated annually (WGFD unpublished data) using Strain 19 biobullets on every feedground except Dell Creek, which serves as a "control" site to assess efficacy of the program (Clause et al. 2002). 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. Brucellosis seroprevalence levels average 25% among all feedgrounds; comparison of seroprevalence in vaccinated and non-vaccinated elk are not significantly different (WGFD unpublished data). Thus far, it seems vaccination of elk with Strain 19 is unlikely to reduce brucellosis seroprevalence on feedgrounds sufficiently to satisfy the concerns of APHIS and the livestock industry about the risk of transmission from elk to cattle (Smith 2005).

Enhancement of aspen, sagebrush, and conifer communities typically increases production of herbaceous species selected by elk. Habitat treatments (e.g., prescribed fire, mechanical, herbicide) implemented with the purpose of increasing forage production may reduce length of supplementary feeding season (WGFD unpublished data), reduce elk density on feedgrounds, reduce intra-specific disease transmission, and also influence spatial distributions (Gross et al. 1998). Habitat improvements have also been implemented near feedgrounds with some success of reducing the length of the supplemental feeding season (WGFD unpublished data). Brucellosis seroprevalence rates of elk attending those feedgrounds with substantial habitat treatments and/or access to native winter range appear to be lower than those on feedgrounds with minimal to no access to additional feeding opportunities (WGFD unpublished data). Among the recommendations produced by the BCT was a call for further enhancement of winter elk habitat (Wyoming BCT 2005).

Scavengers will typically consume carrion opportunistically, and often focus foraging efforts on areas (e.g., roads, land-fills) where carrion is readily visible and accessible. Field studies have documented scavengers consuming pseudo-aborted bovine and elk fetuses faster on (33hr, 18.9hr) than off (57.5hr, 33hr) feedgrounds (Cook et al. 2004, Maichak unpublished data). Primary scavengers (based on total amount of fetus consumed and/or removed) include coyotes, foxes, and eagles, with magpies and ravens as secondary scavengers. Coyotes can be infected with brucellosis, presumably from ingestion of contaminated tissues and/or fluids (Davis et al. 1979). Transmission of brucellosis from scavengers (i.e., coyotes) to cattle has been documented under experimental conditions of close confinement (Davis et al. 1988), but no confirmed case of

natural interspecific transmission has been observed (Forbes 1990). Likewise, wolves have been documented to carry infection of B. abortus, but bite transmission of the disease from wolves to elk appears unlikely (Tessaro and Forbes 2004). Because consumption rates of fetuses are faster on than off feedgrounds, scavengers may act as a biological control of brucellosis, reducing intraspecific transmission of brucellosis. Seroprevalence rates in elk on feedgrounds with high vs. low scavenger densities have not been evaluated.

B. Brucellosis Management Options

WGFD currently employs several methods to minimize intraspecific transmission of brucellosis among elk (BMAP, Sections G, H). Elk feeders are encouraged to feed hay on clean snow when possible and recover aborted fetuses to reduce inadvertent ingestion of contaminated feed and exudates. To reduce abortion events and seroprevalence levels, elk are vaccinated ballistically with Strain 19 on 21 of 22 state feedgrounds, including the three Gros Ventre feedgrounds within this EHU, and on the NER. Attempts have been made to reduce the duration of the feeding season on each feedground. However, damage and elk/livestock commingling concerns typically determine the duration of supplemental feeding on most feedgrounds.

Damage and elk-to-livestock commingling contribute to increased risk of intraspecific disease transmission among elk. In most circumstances, elk are not tolerated consuming private crops and commingling with cattle. Strategies to hold elk on artificial feed longer and hazing elk to feedgrounds are often employed to minimize these conflicts. These practices increase the chance that an aborted fetus contaminated with *Brucella* will be contacted by elk wintering on feedgrounds, thus increasing exposure rates among elk.

Feedground management should continue to include the aforementioned methods currently utilized to minimize interspecific disease transmission. However, given current seroprevalence rates for feedground elk and the recent brucellosis occurrences in cattle, these methods alone are not sufficient to reduce incidence of the disease in elk to acceptable levels and prevent future interspecific transmissions. Alternative management options should be developed and evaluated.

To reduce prevalence of brucellosis in elk on feedgrounds, given current technologies and efficacy of vaccines, feeding durations (and densities of elk on feedgrounds) would have to be decreased or ceased, if possible, during periods of high transmission risk. Reduced feeding durations could increase commingling if implemented abruptly, but substantial reductions in elk numbers through hunting prior to initiating the option could reduce these situations. Each feedground is unique and was established to address a site-specific management problem. Thus, each feedground will potentially require a different approach if reducing the duration of feeding and/or eliminating feeding are to be pursued as viable options. Some feedgrounds may have no alternative options to supplemental feeding and/or no option to reduce the feeding duration given current herd objectives and other conditions. To reduce the risk of interspecific transmission, cattle and elk need to be separated both temporally and spatially during the risk period. Livestock producers may have the potential to alter management to maintain this separation. As with feedgrounds, each producer and their operation are unique and what may work on one ranch may not work on another.

Based on current brucellosis research findings, WGFD personnel experience, and political and social ramifications, 8 potential options for managing brucellosis on the three WGFD-operated feedgrounds in the Jackson EHU have been developed and are listed below.

1. Relocating feedgrounds to sites with increased geographic area for elk to disperse and increased distance from winter cattle operations.
2. Elimination of feedgrounds.
3. Reducing numbers of elk on feedgrounds through increased harvest.
4. Reducing numbers of susceptible cattle and stored crops in areas where commingling/damage are likely to occur 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. Extensive habitat enhancement projects in suitable winter range areas that will reduce commingling/damage and/or will reduce elk dependence on feedgrounds.
7. Acquisition of native winter range through fee-title purchase, conservation easements, or other methods.
8. Continuing Strain 19 elk vaccination.

Short-term objectives of these options are to reduce commingling of elk and cattle and the prevalence of brucellosis in elk. Long-term objectives include eliminating the reservoir of brucellosis in wildlife in the GYE 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.

C. Discussion of Options

1. Feedground Relocation

The feedgrounds this option would be applicable to are the three state-operated feedgrounds in the Gros Ventre drainage. This option would initially require a suitable area lower in elevation, in a lower precipitation zone, with no winter cattle operations in the vicinity. If an area/areas is identified, current habitat conditions should be evaluated to determine production, health of vegetation, and approximate potential of the area

There would potentially be benefits to increasing the feeding area of the Gros Ventre feedgrounds. Since wolves recolonized the Gros Ventre drainage in 1998, elk movement among and between the feedgrounds in the Gros Ventre has become unpredictable, frequently with the consequence of all Gros Ventre elk on feed being concentrated on just one of the feedgrounds (WGFD 1999, 2005). This is despite WGFD attempting to separate elk among all three feedgrounds by allocating less feed (or not feeding at all), proportionally, at the feedground of highest elk density. Commission quotas for Alkali, Patrol Cabin and Fish Creek are 800, 650, and 1,000, respectively. It is believed that the feeding area on Fish Creek feedground is

sufficient for the times when there are >1,000 elk there (feeding area of about 71 acres). The problem usually occurs on Patrol Cabin, where the feeding area is only about 40 acres. This creates a situation with undesirably high densities of elk. Avenues WGFD could take for expanding the Patrol Cabin feeding site are USFS or private land. Surrounding landowners have discussed WGFD personnel the possibility of feeding elk on their private land.

WGFD was issued a short-term permit from the Bridger-Teton National Forest (BTNF) for the Fish Creek feedground to be used in the winter of 2006-2007. That permit expired on April 15, 2007. USFS will be writing an Environmental Impact Statement (EIS) prior to long-term permitting of feedground structures. The permits from the BTNF allow the State to utilize the National Forest system lands for the activities associated with winter feeding. These activities include maintaining structures such as horse corrals, hay sheds, tack sheds, and elk traps. As this BMAP is being drafted, it appears that the scope of BTNF's feedground EIS will be very narrow (i.e., an analysis of the structures only). The more narrow the scope of the EIS, the less likely it will be that additional options such as feedground expansion would be incorporated. Thus, it does not appear likely at this time that feeding areas could be expanded on USFS lands.

Additionally, while cattle producers appeared supportive of creating new feedgrounds (e.g., in the Buffalo Valley), the Department is not supportive of this, and will not be pursuing it.

Options for relocating any of the state-operated Gros Ventre feedgrounds not only appear to be limited, but also unnecessary at this time. It appears that the feedgrounds are in as optimal locations as they can be for the purposes they serve. If more optimal locations for these feedgrounds existed, the following should be considered.

<u>Pros:</u>

- may reduce brucellosis prevalence
- reduced elk density over geographic scale
- increased area for elk feeding (i.e., sanitary conditions)
- maintain current elk herd objectives
- reduced browsing on local native woody vegetation

<u>Cons:</u>

- may maintain brucellosis prevalence
- 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 animal species

Future opportunities to implement this option for feedgrounds in the Jackson EHU would be facilitated by combining with options 3 through 7.

2. Feedground Elimination

If current conditions and herd objectives change, through implementation of one or more options 3, 4, 6, 7, and 8, this option might become more realistic. The WGFC has the authority to make this decision.

In April 2006, WGFD assembled a document evaluating the proposal for a phase-out of elk feeding in the Gros Ventre drainage (WGFD 2006). This document was a comprehensive assessment of the Gros Ventre feedground phase-out proposal submitted to Governor Freudenthal in response to a request by the Greater Yellowstone Coalition, Wyoming Outdoor Council, and Jackson Hole Conservation Alliance (2005). Based on that evaluation, the Department does not support a trial phase-out of feedgrounds and believes that a continuation of supplemental feeding is necessary. It was concluded that the only way a trial phase-out of feeding could be attempted is if the current population of elk wintering in the Gros Ventre is reduced by 1,000-1,500 animals, mitigation measures to prevent livestock and elk commingling are implemented by landowners in areas of highest potential for damage and commingling, and the NER agrees to accommodate any additional elk that would move from the Gros Ventre drainage to the NER. WGFD will continue to monitor conditions in the Gros Ventre drainage. If any of the factors preventing a trial phase-out change, the Department may reevaluate that proposal.

Pros:

- reduced risk of intraspecific transmission of brucellosis and other diseases
- facilitate efforts to eliminate brucellosis in elk in the Jackson EHU
- reduced feedground and vaccination expenses incurred by WGFD

Cons:

- increased 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 may increase financial and personnel resources from WGFD
- potential increase in elk winter mortality
- reduced number of elk that could be maintained in the Jackson EHU
- potential long-term reduction in license sale revenue
- potential long-term reduction in hunter opportunity
- may increase potential for vehicle-elk collisions
- reduced feasibility of Strain 19 vaccination program

3. Elk Population Reduction

Reducing elk numbers on the feedgrounds in the Jackson EHU through liberalized hunting seasons could allow more flexibility to pursue options 2, 5, 6, and 7. Reductions beyond the current, Commission-established, elk herd unit population objectives would require a public input process to discuss the issue and determine the level of support. Thus, authority over this option ultimately lies with the WGFC. Elk herd unit reviews occur every 5 years. Elk herd unit management, including population objectives, for the Jackson EHU was reviewed and discussed

in public meetings during the spring of 2006. Following that process, the WGFC chose to table their formal decision on the Jackson EHU population objective until the completion of the Bison-Elk Management Plan and EIS (BEMP-EIS). At that time, the Commission would be able to analyze what impacts the preferred alternative might have on the Jackson elk population. The WGFD will continue to design and implement harvest strategies to ensure elk populations are maintained at established Herd Unit objectives.

The current population objective for the Jackson EHU is 11,029 animals. The population is currently estimated (post 2006 hunting season) to be 12,904 elk. After several years of managing for population reduction in the Jackson EHU, WGFD management strategy is transitioning to one of population maintenance. Further reductions to bring the population down to objective will occur by targeting elk that summer in GTNP (Appendix 2); about 1,600 elk would summer in the Park under the management strategy of the BEMP-EIS preferred alternative (USFWS and NPS 2007). While the number of elk on the three Gros Ventre feedgrounds is over quota (Appendix 3; about 2,900 elk were counted in February 2007 and the Commission-established quota is 2,450), the total number of elk counted in the Gros Ventre drainage has been stable over the last five years (Appendix 2). The number of elk counted on native winter range in the upper Gros Ventre has been declining over the last few years. Thus, reducing the number of elk on the feedgrounds, through increased harvest, would most likely lower the elk population below the Commission-established objective while not necessarily increasing the number of elk on native winter range. Current WGFD objectives are to manage for the overall number of elk in the Gros Ventre, not simply targeting the number of elk on feedgrounds. For the Jackson EHU as a whole, harvest strategies that focus pressure on early migrants out of GTNP will continue to move total elk numbers towards objective.

Pros:

- may reduce brucellosis prevalence
- increased short-term hunting opportunities and license revenues
- decreased elk densities and duration on feedgrounds
- potentially reduce conflicts on private lands
- reduced feedground and vaccination expenditures incurred by WGFD

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
- potentially continuing damage to private crops
- possible outcry from public, particularly outfitters and "sportsmen"
- success limited by skillfulness and efficiency of hunters
- minimal loss of long-term hunting opportunities and license revenues

4. Incentives for Cattle Producer Change of Operation

This is an option that would be facilitated by options 3 and 5 through 8. Producers in the Jackson EHU with chronic damage issues or otherwise defined as "high-risk" for commingling could implement this option 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 switched to spayed heifers and/or steers. Conversion to yearlings would also eliminate the need of storing most hay crops and winter feeding, eliminating winter elk conflicts. Ultimately, opportunity for disease transmission is reduced if cattle and elk do not commingle between early February and mid June (Thorne et al. 1991, Roffe et al. 2004). Implementing facets of this option would require changes by the producer and possibly a favorable decision by GTNP and/or USFS to alter grazing permits.

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

5. <u>Fencing Stackyards, Feedgrounds and Other Areas</u>

This is an option that would facilitate implementing all other options. Fencing of winter cattle feedlines could prevent elk from commingling with cattle. Elk-proof fencing around private stackyards reduces "attractiveness" to and likelihood for damage by elk. New fencing would require favorable decisions by the landowner. Where fencing stackyards is considered beneficial at reducing damage/commingling, WGFD provides fencing materials to landowners.

Large-scale, elk-proof fencing around feedgrounds can contain most elk within a given area, as evidenced by fences in Jackson Hole (along west boundary of NER), Star Valley (along west boundary of Greys 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.

The Department has, in the past, resisted fencing private lands. WGFD could support large-scale projects such as fencing fall and spring pasture, but would not be able to fund them. If a specific proposal were developed, with an interested and supportive landowner, Natural Resources Conservation Service (NRCS) or APHIS could potentially provide the money for implementation. WGFD could facilitate in locating funding sources for landowners that have the desire to implement a large-scale fencing project. Similar to option #4, NRCS has the potential to become an available source of funding for fencing projects where brucellosis concerns are the impetus.

<u>Pros:</u>

- may reduce damage problems and complaints
- may reduce interspecific risk of brucellosis transmission
- may be successful in fencing off stored hay and small-scale livestock operations
- reduced attractiveness of particular operations to elk may reduce damage in a broad geographic area

<u>Cons:</u>

- costs may be prohibitive for construction, maintenance and monitoring
- congregating all or most of the elk or livestock within the fence may be unfeasible
- long lengths of fencing could impede movements of other wildlife, livestock and humans
- increased wildlife and/or livestock mortalities associated with entanglement
- does not completely address persistence of brucellosis in elk

- increased disease risks for elk or livestock in enclosure
- landowners (private, state, and or federal) may be unwilling to erect fences
- might detract from land value
- will likely require National Environmental Policy Act (NEPA) compliance
- reduces wildlife viewing opportunities

6. Habitat Enhancement

Implementation of options 2, 3, 4, and 7 would facilitate this option. Habitat enhancement projects might 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 (Appendix 4). Habitat enhancement projects also create vegetative diversity and improve range conditions for other floral and faunal species (including livestock).

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.

The interagency group Jackson Interagency Habitat Initiative (JIHI) has spearheaded much of the progress on enhancement of elk winter range and transitional range in the last few years in the Jackson EHU. JIHI was formed in the fall of 2001 by several wildlife biologists from the BTNF, NER, WGFD, and GTNP. The JIHI group reports its progress and takes recommendations at the annual Advisory Group meeting of the Jackson Cooperative Elk Studies Group (CESG). WGFD involvement with those groups, and habitat enhancement projects, is ongoing (Appendix 4). The proposed Lower Gros Ventre habitat enhancement includes 17,000 acres of burn units between Ditch Creek and Slate Creek. Implementation will cover several years, but should begin sometime in 2007. Planning is ongoing for the Upper Gros Ventre habitat enhancement as well.

Pros:

- reduced feeding duration and brucellosis prevalence
- reduced risk of intraspecific brucellosis transmission
- benefit many species of vegetation, wildlife, and cattle
- funding available through government and non-government agencies

Cons:

- limited effectiveness in reducing dependency on supplemental feed in years of average or greater snow accumulations that make forage unavailable
- may increase commingling and/or damage situations
- may require short-term changes (i.e., rest) in livestock management for treatment area
- may increase likelihood of invasive species establishment

7. Acquisition/Conservation Easements

Options 1 through 6 would facilitate implementation and effectiveness of this option. Risk of intraspecific brucellosis transmission on all feedgrounds in the Jackson EHU 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 in the Jackson EHU. This option also could be used to facilitate purchase of a forage reserve, securing habitat for wildlife species in addition to elk. 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 floral and faunal populations. Decision authority is with the private landowner. Land transactions involving the WGFD (e.g., conservation easements) would have to proceed ultimately through the WGFC.

Pros:

- secures areas for all vegetation and wildlife
- long-term solution
- helps secure future revenues for the WGFD
- could reduce brucellosis prevalence in elk
- can be used as forage reserve – thus facilitating option 6
- 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

8. Continuation of Strain 19 Elk Vaccination Program

The WGFD initiated this program in 1985 on Greys River feedground, and has vaccinated approximately 72,000 elk to date on 22 state-operated feedgrounds and the NER (WGFD unpublished data). Female and juvenile elk were vaccinated during the first two years of the program on all feedgrounds, then only juveniles thereafter, assuming adequate coverage is maintained. Dell Creek feedground serves as a control population (i.e., no elk are vaccinated) to assess effectiveness of the vaccination program in reducing brucellosis seroprevalence in elk (Appendix 3, Section D-1, a-e).

Brucellosis seroprevalence data from elk on Dell Creek and Greys River feedgrounds indicate no significant difference (WGFD unpublished data). 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 unpublished data; Appendix 3, Section B-1) and that the infectious dose may overwhelm antibody protection (Cook 1999).

The BEMP-EIS preferred alternative states that WGFD would be permitted to vaccinate elk for brucellosis on the NER as long as it is logistically feasible, but NER management actions

would not be specifically designed to facilitate vaccination (i.e., vaccination would not be the impetus to start or continue feeding operations). Decision authority lies with the WGFC.

Pros:

- effective delivery system is in place for vaccinating elk on feedgrounds
- may reduce total number of *Brucella* induced, infected elk fetuses aborted on feedgrounds
- perceived by the public to be an active disease management tool

Cons:

- financially and logistically expensive
- has not shown to reduce seroprevalence in elk on feedgrounds
- elk must be concentrated on feedgrounds to ensure delivery is feasible; maintains brucellosis in elk
- development of effective vaccine has not yet occurred

D. Coordination Meetings

1. WGFD Intra-Agency Meeting

On 7 March 2007, a WGFD intra-agency meeting was held at the Jackson Regional Office to provide an overview of the current Jackson EHU BMAP draft and discuss alternative management options to elk feedgrounds and brucellosis management. All options were discussed individually. Pertaining to option #1, feedground relocation, much of the discussion involved methods to spread elk out over larger feeding sites on the Gros Ventre feedgrounds. Concomitant with an increase in wolf activity in the Gros Ventre over the last few years, elk movements between the three state-operated feedgrounds have become unpredictable. Frequently, every elk on feed in the Gros Ventre will be concentrated on just one of the three feedgrounds (usually Patrol Cabin or Fish Creek). The more ideal situation is to have elk spread among the feedgrounds, reducing intraspecific densities. Ideas offered to enlarge the feeding area at the Patrol Cabin site consisted of: 1) feeding on private hayfields up drainage, 2) feeding in Coal Mine Draw, or 3) building an additional stackyard/feeding on Yellowjacket Flats. If Forest Service land would be used, a major issue to be dealt with is the EIS that the BTNF will be conducting on the WGFD feedgrounds. Habitat degradation was brought up as a drawback of feeding in new sites. The area for feeding elk at Fish Creek was deemed sufficient. The question was asked whether the Alkali feedground was necessary; the response was that it is essential because it is the last feedground to stop elk before drifting down drainage to the Red Hills and Red Rock Ranches. Additionally, while cattle producers appeared supportive of creating *new* feedgrounds (e.g., in the Buffalo Valley), the Department is not supportive of this idea, and will not be pursuing it.

For option # 2, feedground elimination, WGFD personnel recommended referencing the document that WGFD completed in April 2006, "Evaluation of a Proposal…". This document, from the Wildlife Division, was a comprehensive assessment of the Gros Ventre feedground phase-out proposal submitted by the Wyoming Outdoor Council, Greater Yellowstone Coalition, and Jackson Hole Conservation Alliance. Based on that evaluation, the Department does not support a phase-out trial of feedgrounds and firmly believes that a continuation of feeding is

necessary. WGFD personnel also pointed out that they intend to re-analyze some of the data included in that evaluation (e.g., forage production, winter range delineation).

Pertaining to option #3, reducing elk numbers on feedgrounds, WGFD personnel suggested we articulate in the document that all but the GTNP segment of the population is at objective. Additionally, we should emphasize that WGFD will continue to manage towards objective through hunting. Once the objective is reached, further reductions beyond the objective would have to be re-analyzed through the public review process. As the objective is being approached, the emphasis in management will be shifted to population maintenance. Another important point to make is that the preferred alternative in the BEMP-EIS states a target population of GTNP elk, and we should refer to this in our document. The question was raised of number of elk on the Gros Ventre feedgrounds currently. There were about 3,200 elk on the Gros Ventre feedgrounds in 2006; in 2007 about 2,900 were counted. The quota for those feedgrounds (combined) is 2,450. It was also noted that the number of elk counted on native winter range in the Gros Ventre drainage has been on a declining trend over the past few years, probably because those elk are on the feedgrounds instead. A shift in elk distribution off native winter ranges adjacent to the three feedgrounds has been noted in recent years (since 1999) when wolves began moving elk between feedgrounds (WGFD 2000, WGFD unpublished data).

For option #4, cattle producer changes, group consensus was that no changes needed to be made to the description of this option in Section C. There was discussion on whether WGFD should be involved in requesting producers to make changes to their operations. The consensus was that WGFD should not be requesting producers to make changes, and that this was not implied in the option. Before option #4 was left, it was brought up that Sublette County NRCS has developed methods for using Environmental Quality Incentives Program (EQIP) as financial incentive for producers involved in brucellosis mitigation. This is not yet an option for Teton County producers, but could be if the local work group that sets NRCS priorities decides to pursue it.

The next option, fencing, prompted discussion on what WGFD has been willing to fund in the past, and what the Department would potentially be willing to fund. The Department has, in the past, resisted fencing private lands. It was felt that WGFD could support large-scale projects such as fencing private lands- but not fund them. It was also mentioned that if a specific proposal were developed, with an interested and supportive landowner, NRCS or APHIS could probably come up with the money for implementation. In other words, if a landowner had a plan and the desire, WGFD could facilitate finding funding. As with option #4, NRCS has the potential to become a more involved source of funding for fencing projects where brucellosis is the driving factor.

There was minimal discussion on option #6, habitat enhancement. Consensus was that WGFD supports habitat enhancement projects developed by JIHI and the CESG. WGFD involvement with those groups, and habitat enhancement projects, is ongoing.

There was some discussion on option #7, land acquisition/conservation easements. First, the point was made that Teton County holds easements on land, and since the Land Trusts are involved, the County should also be involved in the BMAP process as a cooperator. It was asked of the group to better develop this option, and articulate better how conservation easements could be used as a tool for mitigating brucellosis. There was some discussion that maintaining open space is good, but wintering livestock automatically makes land off-limits to elk presence. Perhaps a conservation easement could include incentives to winter livestock elsewhere.

Pertaining to option #8, strain 19 elk vaccination, it was stated that WGFD policy is to continue vaccinating elk on feedgrounds. Some discussion was held on the effectiveness of the vaccine, and whether the system has been statistically modeled. Several answers suggested that there are too many unknown variables (e.g., abortion rates, contact rates with aborted fetuses) to develop a realistic model. However, some unknown variables might be filled in with ongoing WGFD research projects. It was also stated that in the final BMAP document, we should include wording in this option referring to WGFD's agreement with the NER to allow vaccination of elk on the NER.

2. <u>Inter-Agency Meeting</u>

On 8 March 2007, an inter-agency meeting was held at the Jackson Regional Office to provide an overview of the Jackson EHU BMAP process and discuss alternative management options to elk feedgrounds and brucellosis management. Agencies attending were WGFD, NRCS, NER, and GTNP. USFS was unable to attend on the same date; a meeting was held between WGFD and USFS personnel on 12 March. During each meeting all options were introduced by WGFD personnel.

For feedground relocation, option #1, USFWS commented that a feedground in the Buffalo Valley would most likely preclude some elk from coming all the way to the NER. WGFD personnel stated continued support for USFWS spreading elk out at multiple feeding sites on the NER. USFWS replied that they feed in much larger areas than state feedgrounds, and that there are too many animals on the NER in too small of an area for too long of a time period. In the meeting attended by USFS, WGFD asked about the potential for feeding in expanded areas around the current feedgrounds in the Gros Ventre drainage, particularly at Patrol Cabin. USFS personnel pointed out that they will write an EIS for feedgrounds and feedground facilities placed on USFS land. They suggested WGFD explore this as both an avenue for expanding feeding areas, while at the same time cautioning that the process will be complicated. They also mentioned that USFS has acquired a section (640 acres) of land north of the Gros Ventre River, near the Fish Creek feedground, that could potentially be a feedground location. USFS also presumed that, although unlikely, moving elk among feedgrounds on a multi-year rotation could lessen impacts on individual sites.

During an annual coordination meeting between BTNF and WGFD personnel on 15 March, the topic of the upcoming Feedground EIS and its effects on altering feeding locations on USFS land was again covered. (Due to the time-appropriate nature of that discussion, those conclusions are included here also.) Personnel attending that meeting thought that BTNF would try to make the scope of the Feedground EIS very narrow so as to not make it overwhelming. The more narrow the focus of the EIS, the less likely it will be that it can be used as an avenue to increase feeding area of feedgrounds. From the Forest Supervisor's perspective, feedgrounds are a controversial enough issue that potential for expanding feeding area on USFS land doesn't look promising.

Regarding option # 2, feedground elimination, USFWS questioned the validity of some points made in the Department's presentation of pros and cons of feedground elimination. First, he thought that the risk of vehicle-elk collisions resulting from closing feedgrounds would only be a short-term risk. Second, he asked if there was a model showing that fewer elk numbers equates to fewer hunter numbers, and contended that if that relationship existed, it also was a short-term risk. WGFD went on to mention that the Gros Ventre feedground phase-out proposal

was already evaluated, and the Department identified three main objections to the proposal: damage/commingling potential, elk numbers would have to be reduced substantially, and NER would have to accept additional elk. In the meeting with USFS, USFS personnel wondered what the affects of wolves would be on this option.

For option #3, reducing elk numbers, USFWS personnel stated that both elk and bison numbers need to be substantially reduced on the NER. Concern was expressed that habitat destruction was due to both elk and bison, and population densities were directly causing dramatic disease issues. There were also comments from USFWS that high numbers of elk did not necessarily equate to quality hunting experiences, and that WGFD's strategy of separating BMAPs by Elk Herd was taking a myopic view of the overall problem.

Regarding option #4, cattle producer changes, GTNP personnel made it clear that they are required to accommodate grazing in the Park. WGFD personnel expressed concerns over the turn-on date of one cattle grazing allotment on the BTNF. USFS personnel stated that they would discuss the matter with the permittee, express that WGFD has concerns because of brucellosis transmission, and determine whether turn-on dates could be altered. USFWS personnel suggested that vaccination of cattle be required and that a post-July 1 turn-on to federal allotments also be required. USFWS also charged that Idaho is "making ground" in brucellosis management because $5,000 fines are assessed when ranchers fail to report elk-cattle commingling. Also on the topic of cattle operation changes, USFWS personnel stated that, from a taxpayer's point of view, "society would be money ahead to purchase the livestock and hay of small operations and donate them back to the original owner with the caveat that elk may be in the area".

There were neither supportive nor opposing comments regarding option #5, fencing. USFS asked what costs are currently for elk-proof fencing. WGFD answered that the 1.5 miles of new fence west of the Muddy Creek feedground cost about $60,000. USFS also stated that they are planning on removing the fenced exclosure above Upper Slide Lake soon, and there would be potential for WGFD to re-use the salvaged materials. USFS personnel also pointed out that large-scale fencing projects on federal lands would require NEPA documentation.

Pertaining option #6, habitat enhancement, WGFD also commented on this topic that we should be thinking of innovative ways to get acceptance from landowners to having more tolerance for elk on winter range that is adjacent to their land. USFWS commented that as long as elk continue to be fed, the potential for habitat enhancements to reduce supplemental feeding would be masked. WGFD also pointed out that wolf activity might limit the use of habitat enhancements. USFS stated that they appreciate WGFD involvement with JIHI and support for projects that enhance big-game wildlife habitat, but would like to see more support for habitat enhancement projects that fall outside the realm of big-game range (e.g., fuels reduction, timber sales, wildland-urban interface). USFS also expressed their concern with habitat conditions proximate to feedgrounds and the effect that elk have had on reducing mountain shrub communities and aspen stands to remnants.

There was minimal discussion on option #7, acquisitions/conservation easements, in either meeting. USFS simply stated support for the concept, but that it was not in their sphere.

On option #8, elk vaccination, USFWS made it clear that they "do not support the current ineffective elk vaccine program." Some discussion was held, in both meetings, on how effective Strain 19 is in reducing abortions and affecting seroprevalence on feedgrounds, and what research is being done on brucellosis vaccines.

In a line of discussion outside the realm of the eight options, USFWS asked if it was the mission of WGFD to maintain livestock producer viability. USFWS personnel went on to point out that, if this was the case, it might be in direct conflict of the stated BMAP objective of reducing elk to cattle disease transmission. Concern was also expressed that the BMAP process was precluding the voices of many non-ranching members of the community that may have just as much or more economic interest in its outcomes.

3. <u>Producer Meetings</u>

Each cattle producer in the Jackson EHU was contacted by WGFD personnel in January-February of 2007 to inform them of the drafting of this document. Twenty-two producers and/or grazing permittees were contacted. Most of these cattle producers own and/or manage land within the area comprising the Jackson EHU. Two additional operations simply hold grazing permits on the surrounding BTNF and/or GTNP. Each of these producers had the opportunity to meet with WGFD personnel, on a one-on-one basis, to discuss brucellosis issues and the options contained in this BMAP.

On 22 February 2007, a livestock producer meeting was held in Jackson to provide an overview of brucellosis ecology/etiology and discuss management options for elk feedgrounds and brucellosis. The objective of this meeting was to gather additional suggestions from producers. WGFD, NRCS, Teton Conservation District (TCD), Jackson Hole Land Trust (JHLT), Wyoming Stock Growers Agricultural Land Trust (WSGALT), USDA-APHIS, and WLB personnel along with 15 livestock producers were in attendance. A background presentation on brucellosis was given which covered the biology of the disease, an overview of the Governor's BCT, human health concerns, and a summary of the test and removal pilot project. Next, the BMAP process was explained, and what the status was of the other six EHU BMAPs. Then an explanation of each option was presented, along with corresponding summaries of numerical and written responses from the producer surveys (Section E).

For several options, no producers commented. Pertaining to option #3, reducing the number of elk on feedgrounds, producers commented that the National Parks should control of diseases within their boundaries. There was concern expressed that the elk population continues to grow in GTNP, and without involvement from the Park, those numbers can't be reduced through hunting.

No producers commented on option #4, cattle producer changes. However, the NRCS District Conservationist took the opportunity to encourage producers with ideas to come and talk to them. She went on to say that NRCS might be able to assist producers, through cost-sharing, with fencing, range improvements, or providing incentives for implementing Individual Ranch Herd Plans (Section C, 4).

Pertaining to option #6, habitat enhancement, the only discussion involved the question of when the last range survey was completed by USFS.

No producers commented on option #7, acquisitions/conservation easements. However, JHLT and WSGALT representatives took the opportunity to state that their organizations could try to find ways to help landowners with the issue of brucellosis. Neither was sure of what exactly could be done about the problem of brucellosis with this option. Some ideas they gave were: easements as a tool to help with separation of elk and cattle, range improvements, or assisting with operation changes.

For option #8, strain 19 elk vaccination, there were a handful of technical questions from producers. How effective is strain 19 in elk and cattle? Has RB51 ever been used in elk? Is RB51 live bacteria? And why do elk respond differently to these vaccines? WGFD and APHIS personnel responded to these questions.

Outside of the eight options, questions were asked about the test and removal pilot project, detecting brucellosis in elk and bison, and the potential to use (non-feed) supplements to keep elk on native winter range or away from cattle operations. One producer suggested that despite everyone's best efforts to reduce brucellosis prevalence in [feedground] elk, the reservoir will persist in YNP. This line of discussion went on to include comments on APHIS regulations being outdated, and a complaint that regulations against brucellosis were put into place because of human health concerns that are no longer an issue. A producer followed this by stating that WGFD should force APHIS to update their regulations. Another producer suggested that WGFD initiate dialog between the federal agencies (e.g., APHIS and NPS) to develop consensus on brucellosis mitigation and what the appropriate level of concern should be for brucellosis in wildlife.

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On 20 March 2007, a second livestock producer meeting was held. The objective of this meeting was to present a brief overview of the current draft BMAP, and foster additional discussion from producers. Ten livestock producers attended, along with several WGFD personnel, and representatives of USDA-APHIS, and TCD. WGFD personnel began by presenting each of the eight options, explaining the likely actions the Department would take relative to each option with the caveat that the document was still a work in progress.

Regarding feedground relocation, a producer pointed out that a state-owned section near Fish Creek feedground could potentially be used if feedground permits are revoked through the feedground EIS process.

Producers voiced support for the Department's current stance of not eliminating feedgrounds. One producer stated that he could remember a time when there weren't feedgrounds in the Gros Ventre, and expressed that the situation with feedgrounds in place is much more desirable from his standpoint.

No producers commented on the option of reducing the number of elk on feedgrounds.

Regarding option #4, cattle producer changes, some discussion took place. One producer stated to have looked at NRCS programs, and the paperwork involved to sign up, extensively. A criticism was that the paperwork was too burdensome. Another criticism was that changing from a mother-cow operation to a steer operation would forfeit too much financial profit, and the only way to make steers as profitable as cow-calf is to increase AUMs. Producers also commented that with mother-cow operations, ranchers take care of stock long-term, whereas yearling operations are unstable. In other words, ranches disappear with the loss of mother-cow operations.

Regarding fencing, there were some questions on where and under what circumstances WGFD would provide fencing to ranchers. WGFD personnel clarified the difference between fencing built for damage, and fencing built to reduce the risk of commingling. Producers commented that this program has gotten better over time with better materials.

No producers commented on habitat enhancement during the presentation.

Regarding option #7, land acquisition/conservation easements, personnel explained that the Department does hold conservation easements. There was a question as to whether WGFD puts on easements or fee-titles on its own land. It was explained that there are usually limitation

on uses of Commission-owned land dependent on the source of funding for that land (e.g., federal hunter and angler money).

After WGFD personnel completed presenting likely actions on each of the eight options, there was a good deal of discussion on a wide range of topics. Some producers expressed concern for the amount of human presence allowed on closed winter range, especially by wildlife researchers. Additionally, it was noted that both snowmobile and non-motorized winter activity in the vicinity of Atherton Creek (an area that has seen an increase in elk use during the winter) might be pushing elk into commingling and damage situations.

One producer stated concern that, as was presented currently, the BMAP would not bring about change in reducing elk-cattle brucellosis transmission risk. He felt that WGFD was asking cattle producers to do all the work.

More than one producer stated gratitude for ongoing efforts by WGFD to prevent damage and commingling. One went on to comment, however, that the language used by those involved in brucellosis issues should change from "preventing" commingling to "discouraging" commingling. One producer stated concern that hazing elk, and running them too hard, is not the way to manage against commingling. Kill permits have been used as a last resort, but then the problem becomes blood trails and gut piles near cattle that can draw in predators.

There were some comments made about wolves, and the impacts that wolves are having on elk distribution in the Gros Ventre.

One producer commented that the three Gros Ventre feedgrounds were critical in maintaining elk and cattle separation, and wanted to see the same strategy put in place in the Buffalo Valley. WGFD personnel explained that creation of new feedgrounds is not an option for the Department.

There was also a question on whether the Department considered cattle grazing an effective habitat treatment, and if so, why the Blackrock cattle allotment was closed. WGFD personnel explained that the Department advocates maintaining open spaces, and while ranches are a critical component of that, there are some instances in which cattle grazing does not benefit wildlife. The underlying wildlife issue with closing the allotment in question was that it has been identified as a critical area for carnivores- thus we saw the benefit in removing cattle, and in turn relieving predator-cattle conflicts.

E. Producer Survey

1. Goals/Objectives of Producer Survey

A standardized survey was presented to each cattle producer in the Jackson EHU in order to quantitatively assemble his or her opinions. The goals of the survey were to collect quantifiable data regarding 1) the opinions of cattle producers regarding the 8 options currently listed in the BMAP, and 2) risk of damage from and/or commingling with elk. WGFD personnel met with almost every producer on an individual basis. During these meetings, producers were asked to complete the survey. Producers not met with in person, but contacted by phone, were able to complete the survey and return it to WGFD by mail. Sixteen surveys were completed, representing almost every land-owning cattle producer, ranch, and/or grazing permittee within the Jackson EHU.

The first objective of the survey was to quantify the percentage of cattle producers within the Jackson EHU comprising defined opinions (Strongly Opposed, Moderately Opposed, Indifferent, Moderately Support, Strongly Support) regarding individual BMAP management options. The percentages of the various opinions and results of cattle producer operations were then compared to qualitative data (i.e., written responses to management options from questionnaire; verbal responses from meetings). A summary of responses is included here (Table 1); written responses in their entirety are included in Appendix 1.

The second objective was to quantify various aspects of livestock operations in the Jackson EHU, particularly those that are related directly (Damage, Y/N) and indirectly [Hay Production (Y/N), Amount of Hay produced (acres), Stackyards Present (Y/N), Total Stackyards, Winter Feeding (Y/N), Distance to Nearest and Next Nearest Feedgrounds] to damage from, and potentially commingling with, elk. Those data are presented in Appendix 2, Section A.

2. Producer Responses to Brucellosis Management Options

The majority of producers appear supportive of fencing, habitat enhancement, and continuing elk vaccination (Table 1). Caveats given in written comments concerning fencing were that large-scale projects would be unsightly, expensive, and detrimental to migrations of other wildlife (Appendix 1). However, there were some supportive comments regarding building fence for non-stackyard areas (pen for the feed team or weaned calves, large areas for calving or feeding), but careful planning would have to be done, and those projects would be expensive. Support for WGFD policy of providing stackyard-fencing materials appeared to be very strong.

Individuals expressing opposition or indifference to habitat enhancements pointed out that deep snow could preclude elk from utilizing treated areas. Several individuals indicating moderate support for habitat enhancements also stated that deep snow would occasionally cover winter forage.

Continuation of the Strain 19 elk vaccination program drew mostly strong and moderate support. Some of the written comments stated that we would never reach 100% coverage on wild elk, continued research is needed, and every little bit of effort like vaccination helps, for example.

Opinions were very mixed on the options of feedground relocation and cattle producer changes, but were mostly on the supportive side. Regarding feedground relocation, much of the support was for additional feedgrounds. Support for relocation was also given on a more general basis, with the caveat that there are no better sites available. Regarding cattle producer changes, much of the opposition was to mandates to change, or influence from outside interests. Several producers stated that they had made all of the changes to their operations they could. Several producers indicated support for the idea as well.

Table 1. Percent response (Opinions) regarding individual BMAP options in the Jackson EHU. The number of producers providing a numerical response is given in parentheses.

	Opinion				
Option (*n*)	**Strong Opp.**	**Mod Opp.**	**Indifferent**	**Mod Sup.**	**Strong Sup.**
1 (16)	12.50	0	31.25	25.00	31.25
2 (16)	81.25	12.50	0	6.25	0
3 (15)	33.33	6.67	20.00	40.00	0
4 (16)	25.00	6.25	18.75	37.50	12.50
5 (16)	0	12.50	18.75	43.75	25.00
6 (16)	0	6.25	25.00	37.50	31.25
7 (16)	0	15.63	59.38	12.50	12.50
8 (15)	6.67	0	20.00	33.33	40.00

Option #7, acquiring habitat, drew the greatest number of marks of "indifferent", but no producers were strongly opposed. Multiple individuals wrote something to the effect that there was already enough public ground, or there wasn't enough (affordable) private land available to make this a feasible option.

Opinions were mixed on option #3, reducing elk numbers, but no individuals strongly supported the idea. Multiple individuals wrote that there are some geographic segments of the Jackson EHU that could be reduced. Multiple individuals also wrote that they are concerned about predators, not hunting, removing too many elk from the population.

The clearest opposition was to option #2. An obvious majority of individuals marked that they were strongly opposed to feedground elimination. Most producers also provided written comments with this option. Generally, producers feel that feeding elk is necessary to: 1) winter elk in Jackson Hole, 2) prevent elk-cattle commingling, and 3) maintain population size. Comments provided by individuals marking only moderate opposition, or moderate support for feedground elimination indicated that it could work, if additional measures were taken (Appendix 1).

F. WGFD Proposed Management Actions

1. Feedground Relocation

The WGFD will not pursue wholesale relocation of any of its feedgrounds in the Jackson EHU in the immediate future. Cattle producers and landowners in the vicinity of each of the feedgrounds are supportive of the current locations. The current locations of each of the Gros Ventre feedgrounds have been 'fine-tuned' through operating in many different locations in the past (Appendix 2). The ranges of other species and geographical boundaries have to be taken into consideration. The Department will attempt to use larger feeding sites, if possible, by working with BTNF and/or nearby private landowners.

Additionally, while cattle producers appeared supportive of creating new feedgrounds (e.g., in the Buffalo Valley), the Department does not support this, and will not be pursuing it.

2. Feedground Elimination

The WGFD will not pursue this option in the immediate future given existing conditions. In April 2006, WGFD assembled a document evaluating the proposal for a phase-out of elk feeding in the Gros Ventre drainage (WGFD 2006). WGFD concluded the only way a trial phase-out of feeding could be attempted is if the current population of elk wintering in the Gros Ventre is reduced by 1,000-1,500 animals, mitigation measures to prevent livestock and elk commingling are implemented by landowners in areas of highest potential for damage and commingling, and the NER agrees to accommodate any additional elk that would move from the Gros Ventre winter range to the NER. WGFD will continue to monitor conditions in the Gros Ventre drainage. If any of the factors preventing a trial phase-out change, the Department may reevaluate that proposal.

3. Elk Population Reduction

WGFD manages for current, Commission-established, elk herd unit population objectives. The current population objective for the Jackson EHU is 11,029. Reductions beyond the current, Commission-established, EHU population objectives would require a public input process to discuss the issue and determine the level of support. Thus, authority over this option ultimately lies with the WGFC. Elk herd unit reviews occur every 5 years. Management, including population objectives, for the Jackson EHU was reviewed and discussed in public meetings during the spring of 2006. Following that process, the WGFC chose to table their formal decision on the Jackson EHU population objective until the completion of the Bison-Elk Management Plan and EIS. At that time, the Commission would be able to analyze what impacts the preferred alternative might have on the Jackson elk population. The WGFD will continue to design and implement harvest strategies to ensure elk populations are maintained at established Herd Unit objectives.

4. Cattle Producer Change of Operation

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

5. Fencing Stackyards, Feedgrounds, and Other Areas

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

6. Habitat Enhancement

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 Jackson EHU (Appendix 4). WGFD will emphasize

coordination among NER, BTNF, GTNP, and WGFD through JIHI. These projects will focus on areas designated as winter and transitional ranges.

7. Acquisition/Conservation Easements

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.

8. Continuation of Strain 19 Elk Vaccination Program

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. WGFD will continue to work with the NER, through their feeding operations, to deliver Strain 19 vaccine to elk wintering there.

G. Best Management Practices

In addition to the 8 options (BMAP, Section C) 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 not be viable options for individual feedgrounds.

1. Encourage feeders to feed on clean snow.
2. Insist feeders recover any aborted fetus encountered and immediately submit to a regional WGFD office for testing.
3. Minimize feeding duration to maximum extent possible.
4. Where possible, implement large-scale habitat treatments at strategic locations near feedgrounds.
5. Maintain the ballistic Strain 19 elk vaccination program.
6. Prevent elk/cattle commingling.
7. Eliminate predator/scavenger hazing and/or control on and adjacent to feedgrounds by WGFD employees or any other personnel associated with feedground operations.
8. Conduct habitat enhancements to improve forage conditions on feedgrounds, when possible and beneficial, such as harrowing and noxious weed control.

H. Additional Actions

In working with producers to develop ideas for the BMAP, our focus was on the eight options (Brucellosis Management Options) listed above. Some suggestions, and discussions, fell outside the realm of those eight options. One line of discussion, pertinent to brucellosis, was on minimizing disturbances to elk that may lead to pushing elk into commingling situations. There was concern from cattle producers that on- and off-trail, motorized as well as non-motorized

activity in the Gros Ventre drainage during winter was causing too much disturbance for elk on native winter range. WGFD will continue to work with the BTNF in its travel plan process to minimize those kinds of disturbances.

WGFD will also continue the following activities.

1. Brucellosis Surveillance

The WGFD currently traps and tests elk for exposure to brucellosis on 4 to 6 feedgrounds annually. Given current funding and status of the disease, this practice should continue annually to monitor prevalence of the disease. Surveillance enables assessments of the efficacy of the Strain 19 vaccination program and other strategies in use. Additionally, hunter-harvested elk brucellosis surveillance will occur annually in an effort to survey the entire state over a 4-year period. Hunter-harvest brucellosis surveillance also has occurred in the Jackson EHU since 1987 (Appendix 3, Section 2). Surveillance for brucellosis in the Jackson EHU has also occurred in the last few years during various elk research projects (Appendix 3). Hunter surveillance won't be pursued this year as sample sizes were deemed sufficient from the last two years. Seroprevalence estimates from the last two years were in the expected range.

2. Information and Education

WGFD personnel regularly inform and educate various public factions about wildlife diseases, including brucellosis. Outreach, particularly from the Information & Education (I&E) branch, has included group presentations, regular news releases, interpretive signs at feedgrounds and crucial winter ranges, Game and Fish brucellosis website (http://gf.state.wy.us/wildlife/Brucellosis/), and various brochures and publications. Participation in the Greater Yellowstone Interagency Brucellosis Committee (GYIBC) and the Wyoming Brucellosis Education Team (WBET) has increased I&E brucellosis efforts on statewide and regional levels. The Brucellosis I&E Specialist works closely with the Veterinary Services branch of WGFD and the Wyoming State Veterinary Lab to dispense information. The I&E branch also works to inform elk hunters of brucellosis surveillance in order to increase participation in both statewide and regional efforts.

The importance of quality wildlife habitat, habitat enhancement, disease research, as well as the role of feedgrounds and elk damage management activities are presented to the public by WGFD personnel at various meetings and conferences. WGFD personnel make numerous private landowner contacts regarding habitat improvement projects, wildlife-friendly management techniques, or ways to prevent commingling of elk and livestock. Additionally, efforts are focused on area school groups and educational exhibits at events such as the Wildlife Heritage Foundation of Wyoming's annual Hunting and Fishing Expo and the annual elk antler auction in Jackson to inform children and their parents of the Brucellosis-Feedground-Habitat (BFH) program and brucellosis management.

These efforts should be continued to inform the public of WGFD's active and cooperative role in brucellosis management. Additionally, should any of the aforementioned options (Sections C and F) be adopted, I&E efforts should focus on why the options are being 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.

3. Progress Reporting

Efforts associated with this plan and/or the Wyoming Governor's Brucellosis Coordination Team (Wyoming BCT 2005) will be summarized and reported on an annual basis.

4. 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. Much of the research concerning brucellosis, feedground elk, and feedground management has focused on elk vaccination. Many aspects of feedground elk ecology, brucellosis transmission and pathology, and feedground management have not been investigated or sufficiently evaluated. Potential research topics that could assist in management decisions are listed below.

1. Relationship of seropositive vs. culture positive, and strain of *Brucella*, in feedground elk.
2. Characteristics of scavenging of aborted fetuses on feedgrounds; relationship of coyote densities and scavenging rates on feedgrounds.
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. Abortion and viable birth rates, and temporal and spatial distribution of abortions and births, in seropositive feedground elk.
7. Relationship of brucellosis seroprevalence and feeding duration of elk.
8. Impacts of wolves on distribution of elk using feedgrounds.
9. Snow-water equivalency measurements in areas of habitat enhancement projects, both past and future, and explore relationships with elk use and distribution.
10. Comparison of serology in feedground elk known to be vaccinated and unvaccinated.
11. Alteration of feeding patterns on feedgrounds and effect on contact rates of elk with aborted fetuses.
12. Brucellosis social survey examining attitudes and knowledge of brucellosis issues among the Wyoming public, in order to focus information and education efforts.

I. Literature Cited

Animal & Plant Health Inspection Service. 1998. Brucellosis in *Cervidae*: Uniform methods and rules, effective September 30, 1998. APHIS 91-45-12.

Cheville, N.F., D.R. McCullough, and L.R. Paulson. 1998. Brucellosis in the Greater Yellowstone area. National Research Council, Washington, D.C., USA.

Clause, D., S. Kilpatrick, R. Dean, and B. Smith. 2002. Brucellosis-Feedground-Habitat Program: An integrated management approach to brucellosis in elk in Wyoming. Pages 80-96 *in* T.J. Kreeger, editor. Brucellosis in elk and bison in the Greater Yellowstone area.

Wyoming Game and Fish Department, Greater Yellowstone Interagency Brucellosis Committee, Cheyenne, USA.
Cook, W.E. 1999. Brucellosis in elk: studies of epizootiology and control. Dissertation, University of Wyoming, Laramie, USA.
Cook, W.E., E.S. Williams, and S.A. Dubay. 2004. Disappearance of bovine fetuses in northwestern Wyoming. Wildlife Society Bulletin 32:254-259.
Cross, P.C., W.H. Edwards, B.M. Scurlock, E.J. Maichak, and J.D. Rogerson. In press. Effects of management and climate on elk brucellosis in the Greater Yellowstone Ecosystem. Ecological Applications.
Davis, D.S., W.J. Boeer, J.P. Mims, F.S. Heck, and L.G. Adams. 1979. *Brucella abortus* in coyotes. I. A serologic and bacteriologic survey in eastern Texas. Journal of Wildlife Diseases 15:367-372.
———, F.S. Heck, J.D. Williams, T.R. Simpson, and L.G. Adams. 1988. Interspecific transmission of *Brucella abortus* from experimentally infected coyotes (*Canis latrans*) to parturient cattle. Journal of Wildlife Diseases 24:533-537.
Forbes, L.B. 1990. *Brucella abortus* infection in 14 farm dogs. Journal of the American Veterinary Medical Association 196:911-916.
Greater Yellowstone Coalition, Wyoming Outdoor Council, and Jackson Hole Conservation Alliance. 2005. Brucellosis solution for elk and cattle in Wyoming. Submitted to Governor Dave Freudenthal January 12, 2005.
Gross, J.E., M.W. Miller, and T.J. Kreeger. 1998. Simulating dynamics of brucellosis in elk and bison. Final report to the U.S. Geological Survey, Biological Resources Division, Cooperative Agreement #1445-CA09-96-0017, Fort Collins, Colorado, USA.
———, B.C. Lubow, and M.W. Miller. 2002. Modeling the epidemiology of Brucellosis in the Greater Yellowstone Area. Pages 24- 37 *in* T.J. Kreeger, editor. Brucellosis in elk and bison in the Greater Yellowstone area. Wyoming Game and Fish Department, Greater Yellowstone Interagency Brucellosis Committee, Cheyenne, USA.
Herriges, J.D. Jr., E.T. Thorne, S.L. Anderson, and H.A. 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.
———, ———, and ———. 1991. Brucellosis vaccination of free-ranging elk (*Cervus elaphus*) on western Wyoming feedgrounds. Pages 107-112 *in* R.D. Brown, editor. The biology of deer. Springer-Verlag, New York, New York, USA.
Kistner, T.P., K.R. Greer, D.E. Worley, and O.A. Brunetti. 1982. Diseases and parasites. Pages 181-217 *in* J.W. Thomas and D.E. Toweill, editors. Elk of North America: Ecology and management. Stackpole Books, Harrisburg, Pennsylvania, USA.
Meagher, M. and M.E. Meyer. 1994. On the origin of brucellosis in bison of Yellowstone National Park: a review. Conservation Biology 8:645-653.
Mohler, J.F. 1917. Report of the chief of the Bureau of Animal Industry, Pathological Division. Pages 105-111 *in* Annual reports of The Department of Agriculture (1917). U.S. Department of Agriculture, Washington, D.C., USA.
Nicoletti, P. 1980. The epidemiology of bovine brucellosis. Advances in Veterinary Science and Comparative Medicine 24: 69-98.
Roffe, T.J., L.C. Jones, K. Coffin, M.L. Drew, S.J. Sweeny, S.D. Hagius, P.H. Elzer, and D. Davis. 2004. Efficacy of single calfhood vaccination of elk with *Brucella abortus* strain 19. Journal of Wildlife Management 68:830-836.

Rush, W.M. 1932. Bang's disease in Yellowstone National Park buffalo and elk herds. Journal of Mammalogy 13:371-372.

Smith, B.L. 2005. Disease and winter feeding of elk and bison: a review and recommendations pertinent to the Jackson Bison and Elk Management Plan and Environmental Impact Statement. Prepared for the Greater Yellowstone Coalition.

Tessaro, S.V. and L.B. Forbes. 2004. Experimental *Brucella abortus* infection in wolves. Journal of Wildlife Diseases 40:60-65.

Thorne, E.T. 1982. Brucellosis. Pages 54-63 *in* E.T. Thorne, N. Kingston, W.R. Jolley, and R.C. Bergstrom, editors. Diseases of wildlife in Wyoming. Second edition. Wyoming Game and Fish Department, Cheyenne, Wyoming, USA.

———, J.K. Morton, F.M. Blunt, and H.A. Dawson. 1978. Brucellosis in elk. II. Clinical effects and means of transmission as determined through artificial infections. Journal of Wildlife Diseases 14:280-291.

———, ———, and W.C. Ray. 1979. Brucellosis, its effect and impact on elk in western Wyoming. Pages 212-220 *in* M.S. Boyce and L.O. Hayden-Wing, editors. North American elk: Ecology, behavior, and management. University of Wyoming, Laramie, USA.

———, ———, and ———. 1991. Brucellosis vaccination of free-ranging elk (*Cervus elaphus*) on western Wyoming feedgrounds. Pages 107-112 *in* R.D. Brown, editor. The biology of deer. Springer-Verlag, New York, New York, USA.

United States Fish and Wildlife Service, and National Park Service. 2007. Final bison and elk management plan and environmental impact statement for the National Elk Refuge/ Grand Teton National Park/ John D. Rockefeller, Jr., Memorial Parkway. http://www.fws.gov/bisonandelkplan. Accessed 2007 April 6.

Van Houten, C.K., E.L. Belden, T.J. Kreeger, E.S. Williams, W.H. Edwards, E.T. Thorne, W.E. Cook, and K.W. Mills. 2003. Validation of a Brucella abortus competitive enzyme-linked immunosorbent assay for use in Rocky Mountain elk (*Cervus elaphus nelsoni*). Journal of Wildlife Diseases 39: 316-322.

Wyoming Brucellosis Coordination Team. 2005. Report and recommendations. Presented to Governor Dave Freudenthal 11 January 2005.

Wyoming Game and Fish Department. 1999. 1998 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.

———. 2000. 1999 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.

———. 2004. Annual feedground report, 2003-2004. Cheyenne, Wyoming, USA.

———. 2005. Annual feedground report, 2004-2005. Cheyenne, Wyoming, USA.

———. 2006. Evaluation of a proposal from the Wyoming Outdoor Council, Greater Yellowstone Coalition and Jackson Hole Conservation Alliance for a phase out of elk feeding in the Gros Ventre. Cheyenne, Wyoming, USA.

Wyoming Livestock Board. 2006. Brucellosis exposure policy. Memorandum 06-BRC-0007.

Jackson EHU BMAP
Appendix 1
Cattle Producer Input

A. Producer Responses to Brucellosis Management Options

Individual quantitative and qualitative responses (edited for grammar and punctuation) to the survey are reported below. In order to directly compare written comments to the quantitative level of support, the matching numerical responses are shown in parentheses. Responses are reported in order from Strongly Opposed (1) through Strongly Support (5). If no written response was given with the numeric response, only the number is shown. Some respondents left some options blank, thus, there are some options where fewer than 16 responses are reported.

1. Feedground Relocation

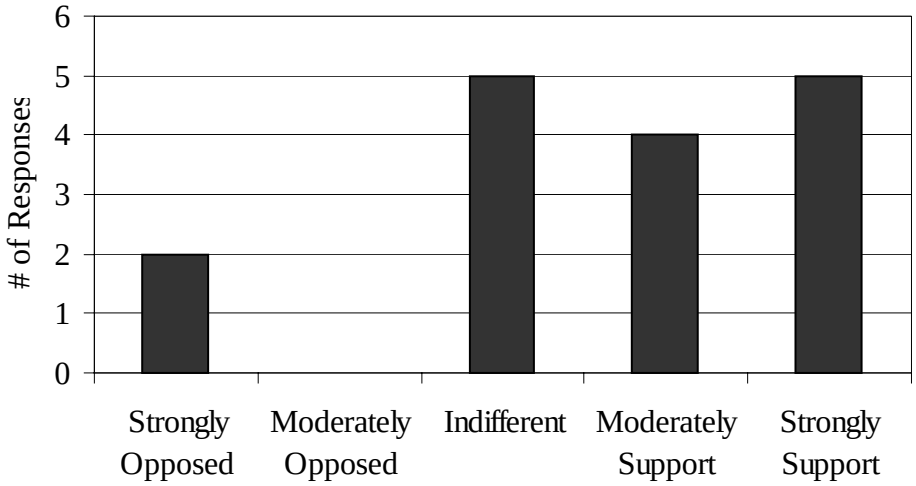

Figure 3. Distribution of quantitative responses to option #1, feedground relocation (n = 16).

1. We do not think there are any better sites. (1)
2. Not many options available. (1)
3. The current locations are about as far from wintering cattle as they can be. (3)
4. (3)
5. (3)
6. (3)
7. We don't have a feedground in our area, however we feel one is needed as there are lots of elk (250-400 or more) around that we feel would benefit from supplemental feeding in most years and would help keep them a good distance from our livestock. We have had damage claims in the past and the elk have been repeatedly hazed away from our operations. (3)
8. (4)
9. We think relocation of feedgrounds may be a good idea, but we do not know where you would relocate them. (4)

10. It makes sense to feed small groups in various locations. (4)
11. (4)
12. Every biologist/scientist I've heard thinks animal concentration increases infection rates. (5)
13. The feed needs to be more scattered out and probably in more spots. (5)
14. We believe that additional small-scale (50-100 head) feed locations located from the Buffalo Valley area to the Refuge would help reduce large-scale concentrations of elk in a couple general areas. This scenario could mimic a more natural pattern for wintering elk in this region. It would also reduce the impacts of elk commingling with cattle in the northern valley. Both public and private land locations could be used for this situation, compensating private landowners. (5)
15. To decrease co-mingling. (5)
16. (5)

2. Feedground Elimination

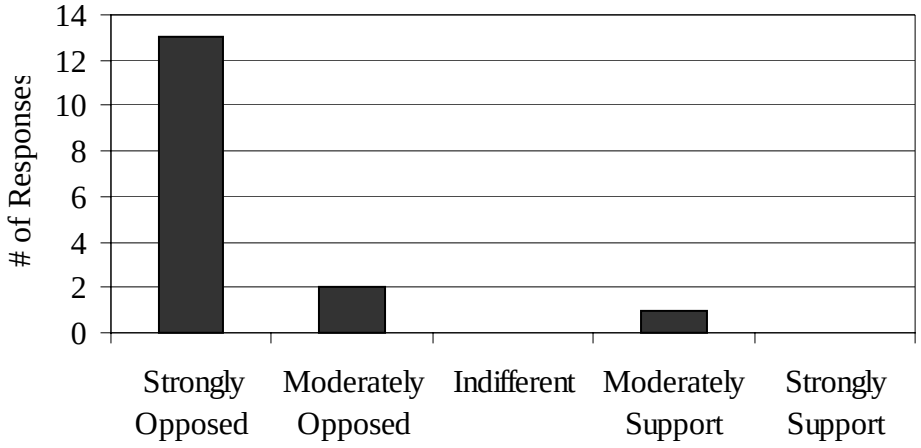

Figure 4. Distribution of quantitative responses to option #2, feedground elimination (n = 16).

1. This will only push more elk onto private operations causing a lot of damage other than brucellosis. (1)
2. (1)
3. Any elimination will increase conflicts with cattle feeding areas. (1)
4. Not feeding the elk would induce elk into cattle that are being fed. In Jackson Hole, if elk are to winter here, they need to be fed. (1)
5. They are needed in this heavy snow country to help maintain healthy populations, especially when the population is being challenged by predation from grizzly bears and wolves. Available foods during heavy snow years are not available, causing impacts on private lands and cattle operations. (1)
6. The elk need to be taken care of! The influence of the wolves would be devastating without the feedgrounds. (1)

7. We think that feedgrounds for the elk would be the only way to maintain a healthy and huntable size elk population. (1)
8. (1)
9. (1)
10. Elimination of the feedgrounds will result in: elk dispersing to the feed lines of livestock producers; this will lead to the transmission of Brucellosis from elk to cattle, which will lead to the slaughter of all the livestock, which will lead to ranches being sold and subdivided. (1)
11. If feedgrounds are eliminated the elk will be forced to co-mingle with livestock on their feedline. (1)
12. Anyone who has lived in JH for any length of time recognizes that winters can be severe and long. Even with a moderate amount of snow, we can have thick icy crust. Also as 2007, it can be very cold. All conditions especially hard on young elk, and older as well. (1)
13. (1)
14. Our location on valley floor would load us with elk throughout the winter months. (1)
15. Unless elk numbers have been reduced significantly and alternative feed established, this would not work. But in the long run, it might work. (2)
16. (2)
17. Only if done on a consistent basis with cooperation from all federal and state Agencies and short-term efforts to physically prevent co-mingling. (4)

3. Elk Population Reduction

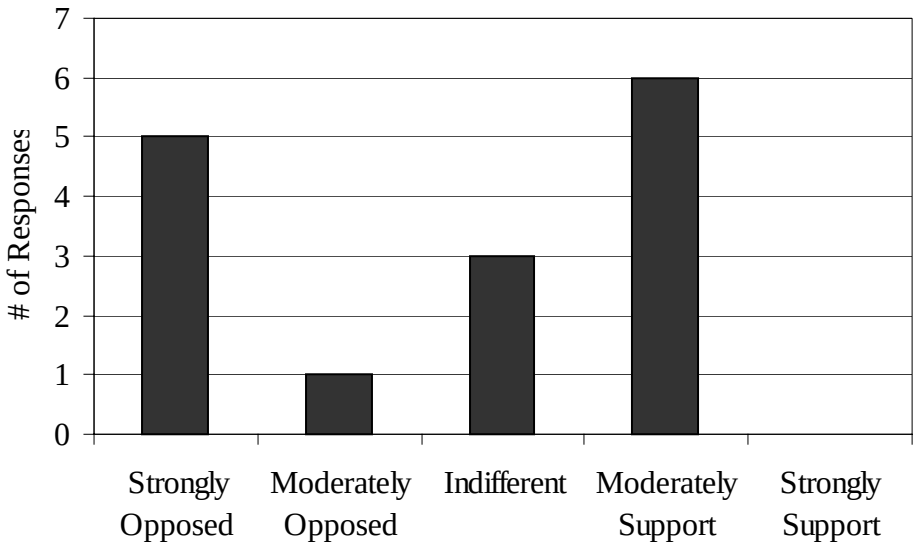

Figure 5. Distribution of quantitative responses to option #3, elk population reduction (*n* = 16).

1. Too much predation to decrease elk by harvest. (1)

2. There is not enough elk left in the Gros Ventre let alone quality elk. The herds that need reduced are just the park herds. They need to hunt them like the wilderness elk and do away with their shooting gallery. (1)
3. (1)
4. The elk herd is already being increasingly pressured by predators- more grizzlies, and a wolf population that we did not used to have to put into the equation. (1)
5. We have at least four major predators in our part of the country that we feel are having a substantial impact on elk numbers. They pose a great risk in the future. These are in the order of the highest risk 1) wolves, 2) grizzly, 3) black bears, and 4) lions. I can't see stepping up the taking of elk as these listed predators are doing the job very well. (1)
6. Not so much reducing numbers on specific feedgrounds by harvesting, but scattering them across the landscape in smaller bunches. Will cost more to manage, but the benefits could outweigh the negative impacts. (2)
7. Depends on what segment of elk the harvest is intended to reduce…cow-calf?…(bulls NO). I would question that reducing numbers of elk through harvest would decrease numbers of elk on feedgrounds, especially with the pressures that are being exerted daily by the increased wolf population. (N/A)
8. (3)
9. (3)
10. I think the number of elk is okay. (3)
11. (4)
12. (4)
13. (4)
14. We think that an increased harvest in some areas is appropriate and in other areas not. We think that in areas like South Park, and GTNP the elk herd needs reduced. However we do not think this is the case throughout the area. (4)
15. I support an increase in the harvest only if it does not affect landowner's rights to regulate who enters their land. I do not support landowners becoming outfitters and their land becoming a hunt ground. (4)
16. (4)

4. Cattle Producer Change of Operation

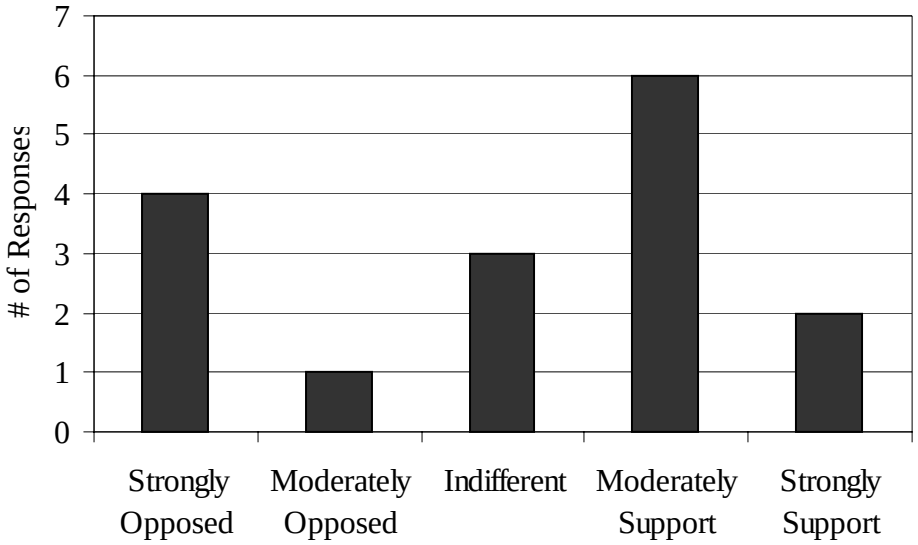

Figure 6. Distribution of quantitative responses to option #4, cattle producer change of operation (n = 16).

1. Any effort to dictate changes will only increase resistance by producers. I am not aware of any practical "incentive." Producers worry that the word incentive is code for "mandate." (1)
2. Some producers maybe could change their operation to lessen the risk of co-mingling or damage from elk invasion. We don't see any feasible way to reduce risk further other than feeding the elk that are in the valley here away from our stock. We would hate to see an elk kill program to stop the problem. We try to feed our stock in the winter where there is offensive activity to elk. (1)
3. Incentives are limited and could be very expensive. Some producers are probably quite reluctant to have interference by outside interests- especially if money is involved. (1)
4. Only change left to us and most of producers here is to not winter feed. (1)
5. (2)
6. As long as the individual member/producer does not have to pay the entire amount. (3)
7. Ranchers need to change to fit each situation. (3)
8. (3)
9. [The ranch] allows hunting, which helps in the management of the elk. (4)
10. Only so much can be done to reduce impacts on cattle operations while providing an environment of compatibility between the two. Especially when many of the private lands are a component of the migration corridors. It goes back to providing a place for elk to stay without conflict with the cattle. (4)
11. Incentives might include leasing winter range for elk. (4)
12. Within reason/with funding. (4)
13. There are incentives you can give livestock producers: a) give incentives for providing wildlife habitat, b) dedicate licenses to landowners to obtain herd objectives, and c) pay producers for feeding wildlife. (5)

14. (4)
15. A good idea as long as it is not something that is legislated, to force the landowner. (4)
16. The [WWNRTA (Wyoming Wildlife Natural Resource Trust] could be used to help landowners. (5)

5. Fencing Stackyards, Feedgrounds, and Other Areas

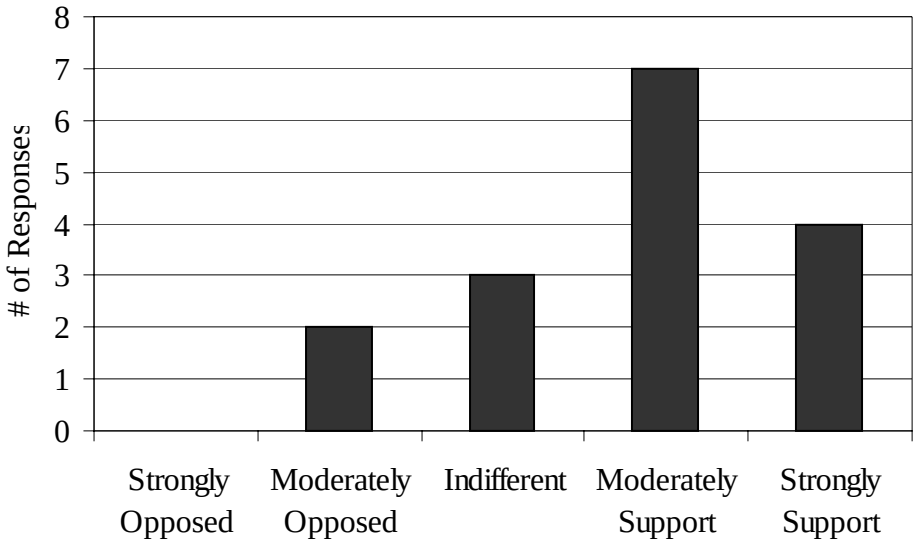

Figure 7. Distribution of quantitative responses to option #5, fencing stackyards, feedgrounds, and other areas (n = 16).

1. Large pastures or hay fields where cattle are often fed would present an expensive and unsightly fence to keep elk out. Often they come in from a highway right-of-way in our area and that isn't something that people want to see or WYDOT would allow. There are a few smaller areas such as where we keep our feed team or weaned calves that an elk-proof fence may serve as a good way to eliminate damage claims and the need to remove the elk. (2)
2. Should be used as little as practical. Fencing stackyards is okay; fencing private land would not work. (2)
3. I think this is easier said than done. If elk are fed they do not, as a rule, choose to co-mingle with cattle. Unless elk-proof fencing was over an entire ranch it would force cattle to be on a very clustered, dirty feedground, not good for calving. (3)
4. Stackyards are already fenced. Fencing feedgrounds does not seem feasible. (3)
5. Most haystacks are already elk proof! Elk-proofing feedgrounds could work, but would have to be very carefully planned, and would be very expensive. (3)
6. We have done some fencing in the past to limit elk problems during calving. Again, funding would be an issue. (4)
7. Stackyards need to be fenced and maybe when cattle are next to a feedground. (4)
8. Fencing major feeding/calving areas for ranchers, to minimize contact could work, if migration areas were not affected and financial assistance was available to the rancher to

develop the necessary needs for cattle within the fenced area such as water, shelter, and space. (4)

9. I support elk-proofing private stackyards, I don't think it's feasible to elk-proof cattle feedlines. It is important to producers that they move cattle around during the winter to fertilize and prevent damage to riparian areas. (4)
10. (4)
11. (4)
12. Haystacks- sure; private feedgrounds- no. (4)
13. We have done this and it has worked very well. (5)
14. (5)
15. We think that if fence can reduce commingling it should be built. (5)
16. I support the G&F supplying material to landowners to use to protect their hay. (5)

6. Habitat Enhancement

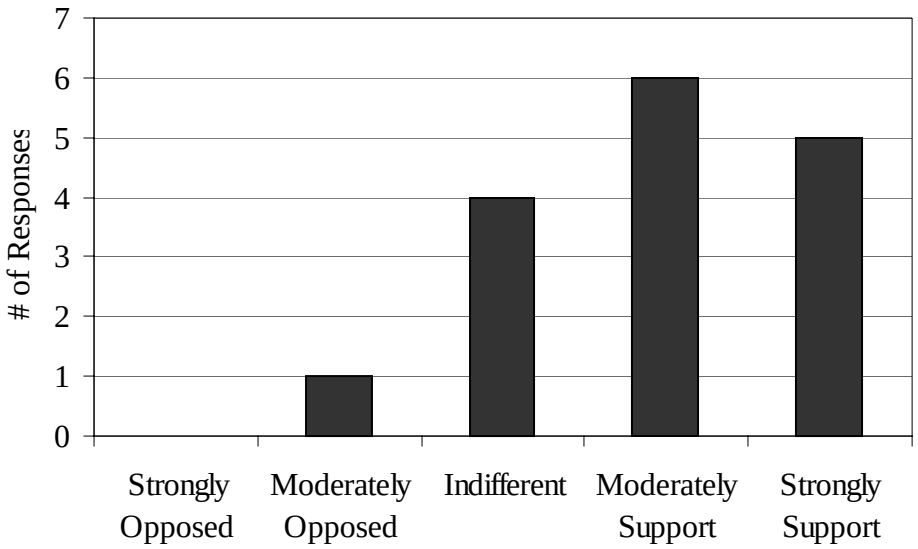

Figure 8. Distribution of quantitative responses to option #6, habitat enhancement (n = 16).

1. What I have seen in the past has not been very successful. In hard winters wildlife has to do what it has to for survival. (2)
2. The problem with winter habitat in our area is the snow depth and/or iced-over grass. (3)
3. Depends. We do not think it is a good idea if it results in closure or restricted use of public or private land. (3)
4. We have plenty of summer feed that is not used already. (3)
5. (3)
6. (4)
7. Might help some during years of mild winter but when heavy winter occurs, they still see the cattle feedlines as the major resource. (4)
8. Parts of our ranch might be suitable. (4)

9. Now matter how much you enhance areas there are going to be winters that just cover everything up. (4)
10. (4)
11. No harm in trying; I don't think there's enough money to make a huge dent in the problem with habitat enhancement. (4)
12. We support habitat enhancement on winter range as well as fall and summer range to preserve the winter range. (5)
13. The key here is suitable winter range- no need to spend time and money on areas the elk cannot use when covered by too much snow. (5)
14. I strongly support this measure, but wolves will dictate where elk winter out. (5)
15. (5)
16. We have watched a resident herd of elk grow from 30 to over 450 in 20 years. The damage to our summer pasture has been devastating. (5)

7. Acquisition/Conservation Easements

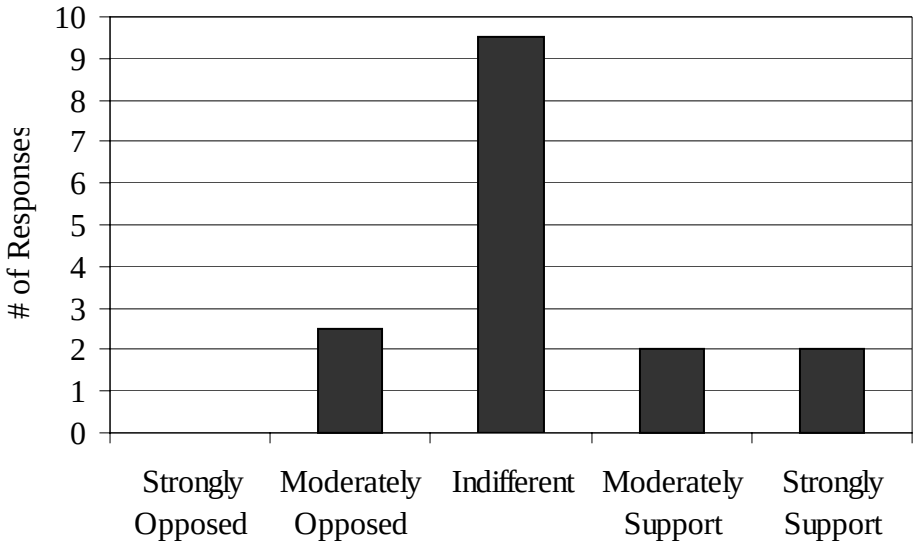

Figure 9. Distribution of quantitative responses to option #7, acquisition/conservation easements (n = 16).

1. I think this option is economically impractical. (2)
2. [Our ranch] has a conservation easement- I see where it helps for migration purposes. Generally, easements seem to be politically driven and are for control purposes only- and not very well cared for, e.g., TNC. (2)
3. (2/3)
4. (3)
5. (3)
6. (3)
7. There is a lot of habitat here, but again, it gets snowed over. Another big factor in our area is wolves. They cause the elk herds to move to areas where there is some kind of

feed line or closer to human activities. The wolves in cases we have seen cause more of a close-together herding pattern in our herds. (3)
8. (3)
9. Teton County is already 97% government owned. (3)
10. (3)
11. We do not know exactly what this would involve. We are not convinced you have enough money to successfully go down this road. (3)
12. Private property is very limited and very expensive. Pretty much have to depend on public ground for additional winter range. Habitat improvement the only option here. (3)
13. (4)
14. (4)
15. Leases could work well for some lands. (5)
16. As long as there is a willing seller. (5)

8. Continuation of Strain 19 Elk Vaccination Program

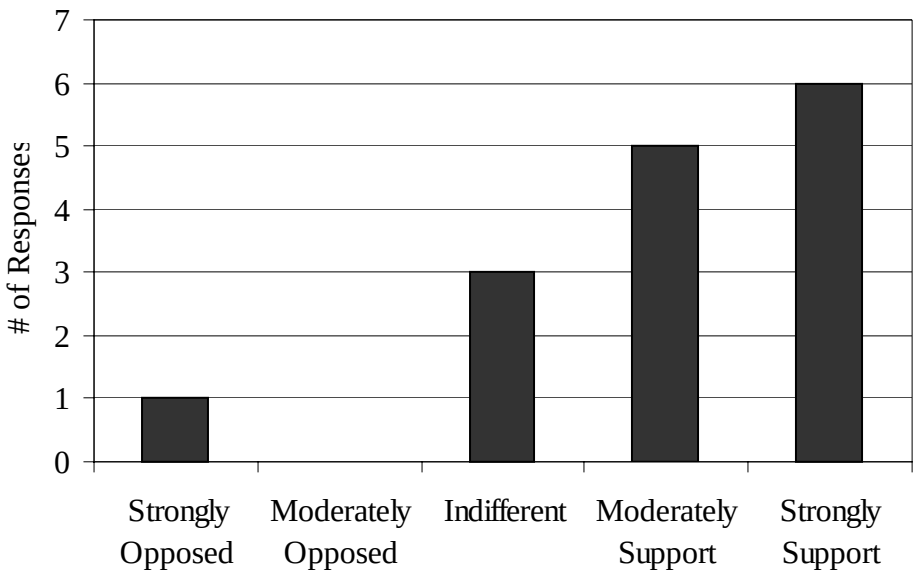

Figure 10. Distribution of quantitative responses to option #8, continuation of Strain 19 elk vaccination (n = 15).

1. Elk are wild animals, let's not try to impose vaccines on a wild herd. (1)
2. (3)
3. We don't think your program can vaccinate enough elk to make a difference. (3)
4. (3)
5. (4)
6. (4)
7. Every little bit helps. (4)
8. You have to start somewhere to protect our brucellosis-free status. (4)
9. Vaccination helps, but to eradicate [brucellosis] you need 100% vaccination, which in wild elk you are not going to get. (4)

10. Some form of a vaccination program is needed and continued research with the disease is needed to be successful with brucellosis. Test and slaughter is not the only answer…guess the researchers will have to start thinking outside the box compared to traditional thoughts. (5)
11. (5)
12. (5)
13. If it works, we think as many elk as possible should be vaccinated. (5)
14. I see the creation of a vaccine as the only true answer to the brucellosis problem. As long as wildlife is allowed to spread the disease unabated the problem will never go away. (5)
15. (5)

B. <u>Proposed Additional Options</u>

In addition to the 8 Options presented in this BMAP, producers were provided the opportunity to list additional options on the Questionnaire. Individual additional options provided by producers responding to the Questionnaire are listed below (edited for grammar and punctuation).

1. The problem of [brucellosis] to wildlife is not going to be cured. The Feds need to take the regulations off [brucellosis] and let the rancher treat the disease as they do any other disease.
2. Get control of the wolves, they keep the elk moving so much that they are bound to end up on some ranch when normally they are up on the hillside.
3. Talk to the County. Every time they subdivide a hillside or a river bottom we lose habitat.
4. The wolves need to be controlled or there will be no wildlife to worry about.
5. Allow vaccination of mature cattle.
6. I strongly support the Governor's stand for wolf control. Example- elk and moose are being run off native winter range onto private land. I see this as a major problem.
7. An ongoing concern to us is how to keep the elk on the feedgrounds with the wolves continually harassing them off the feedgrounds.
8. We believe that the current Game & Fish management of the elk is crucial to our plans [with our cattle]. We support the current feeding program.
9. The disease as a whole in this country needs to be reviewed and updated to current standards of the day (21st century). The disease is not a human threat today that it was over 50 years ago and should be looked at in that perspective. I agree that measures are needed to monitor and control its spread but I do not believe the disease will ever be *eradicated* in wildlife ever, as long as Yellowstone & Grand Teton Parks are managed as parks! So, let's learn to live with it and provide some measures that cattle producers can live with in the areas that it still exists. If a cow does get it, kill her, and move on; not kill the entire cattle herd!
10. Combinations [of all Options] would be better than one Option. And any changes should be phased in. Most importantly, this should be a plan that will work for chronic wasting disease.

11. The livestock industry certainly needs a better vaccine. Every effort should be made to re-establish the use of Strain 19 vaccine for cattle- most producers think this will never happen, but we should not give up!
12. More extensive study on the effectiveness of both vaccines- RB51, Strain 19. We have been witness to recent new study with collared elk as to habits, brucellosis infection rates, etc. We feel this is time and money well spent.
13. We feel that the National Elk Refuge has been a major contributor to the high infection rate in that herd. The elk for the most part are fed in the same places for long periods of time and by a method that pulls them tightly together. The buffalo may also be a factor given their higher infection rate and abundant numbers.
14. The big problem we see is: there is a 0 tolerance level with Brucellosis in livestock, and there is a 100% tolerance level in elk and buffalo. We do not see an end to the Brucellosis problem until the acceptable tolerance levels in livestock and wildlife are in line.
15. Research & development needs to be supported and funded as much as possible. The creation of a vaccine is the magic bullet that is needed to truly control the brucellosis problem.
16. Must take into account how increased predators put a strain on our elk herd. Get their numbers under control so that wherever the elk are they are not put under extreme conditions through the long winter months, as well as during the spring when they are calving.
17. Increase harvest- license cost- at some point people stop buying because of cost, so revenue falls. A reduction in license fees may then sell more licenses and increase revenues. I feel that this is starting to occur and Game & Fish may need to take a serious look at their fee structure.

Jackson EHU BMAP
Appendix 2
Elk Herd Management

A. Historic Elk Herd Management

There are many accounts on the history of the Jackson elk herd. As this particular document could only skim the surface of the large amount of literature devoted to the natural and social history of the Jackson elk herd, the interested reader should refer to those other sources. A section is included below on Elk Feeding History because of the relationship between winter elk feedgrounds and brucellosis prevalence (Thorne et al. 1979).

Early accounts of elk feeding, population estimates, winter range areas, and hunter harvests are covered by Preble (1911), Nelson and Graves (1919), and Sheldon (1927). Craighead (1952) wrote a biological and economic appraisal of the Jackson Hole elk in 1952. Anderson (1958) is a heavily cited source for information up to the 1950s. Anderson reports very thoroughly on every aspect of the herd, including natural history, migration patterns, population estimates, winter distribution and winter feeding, harvests, and habitat.

In 1958, the Cooperative Elk Studies Group (CESG) was formed, composed of representatives from WGFD, NER, BTNF, and GTNP (WGFD 2004). All four agencies have legal responsibilities pertaining to the management of the Jackson elk herd. The group meets annually to share information and coordinate management and research of elk. Boyce (1989) probably has written the most thorough account of the Jackson elk herd to date. His book covers every aspect of the herd, including history, seasonal ranges, migrations, population size, the agencies that manage the elk, and recommendations for management. The data he synthesizes is mostly from 1959 on, based on the formation of the CESG. Finally, WGFD assembled a document in 2004 specifically on elk feedgrounds in Wyoming. That document contains a brief history of the feedground program, and generally explains how, and when, the feedgrounds came to be. Countless other sources exist as well in the form of books, theses, dissertations, research articles, and government reports.

1. Elk Feeding History

Historically, the Jackson elk herd wintered in the southern portion of Jackson Hole, and some of the elk possibly used areas outside of Jackson Hole (Preble 1911, Sheldon 1927, Anderson 1958). Historic accounts of anecdotal observations are not sufficient to determine if any migration occurred out of Jackson Hole or to what degree it may have occurred. Feeding was started to mitigate the conversion of former winter range to other uses. Elk were trying to survive on traditional winter range in Jackson Hole but were dying of starvation due to loss of winter range and severe winter conditions. While humans in numerous locations throughout Jackson Hole certainly have fed elk in winter, the major areas have been the NER, the Gros Ventre, and the Buffalo Valley.

a. National Elk Refuge

Preble wrote his report (1911) just as feeding on what is now the NER was made into a permanent, and federal, effort. Feeding began on what is currently the NER in 1909 with the State of Wyoming appropriating $5,000 to fund the entire operation. Congress appropriated $20,000 for hay for elk in 1911 (Sheldon 1927). Congress appropriated $50,000 in 1912 and 1913 to purchase 1,760 acres of land immediately north of Jackson. Along with 1,000 acres of public land adjacent, this was the official beginning of what is now the NER. In 1925, an additional 1,760 acres owned by the Izaak Walton League was deeded to the Refuge. By 1927 the total area of the Refuge had grown to slightly over 4,500 acres.

Today, the NER totals about 25,000 acres. A 1974 Memorandum of Understanding (MOU) between the WGFC and NER calls for a maximum of 7,500 elk on feed in any given winter on the Refuge. Each year, WGFD and NER personnel monitor forage conditions regularly. The decision of when to start and stop feeding is made jointly.

b. Gros Ventre (excerpt, WGFD 2006)

Elk have been fed at no less than 10 different sites in the Gros Ventre River drainage. Anonymous (1941) reported the NER Superintendent as stating "our Department" started two feedgrounds near the Gros Ventre River in the upper portion of the NER to keep elk from private ranches (presumably in the Kelly area) and 483 elk were fed. Elk were fed at the Glenn Taylor ranch near Lower Slide Lake during the winters of 1967-68 and 2005-06. The feeding sites at the Taylor ranch and along the Gros Ventre River near Kelly were temporary and in response to damage and commingling problems. A permanent feeding site was established at the Goosewing Ranger Station in 1929 (Anonymous 1929-30). In 1933 and 1934, metal sheds (Hocker, 1933-34) were put at Goosewing and the "rolling hills" just below Alkali (G. Taylor, personal communication 2004). In 1936 or 1937 elk were fed at the mouth of Crystal Creek (Anonymous 1938a). In 1939, the Department bought the "Spaulding Place" near the mouth of Coal Mine Draw. The feeding site was then moved to this location from the Goosewing Ranger Station. This is the present site for the Patrol Cabin feedground. In 1947, the feedground at the Rolling Hills was moved to a location about ¼ mile from Alkali Creek into the draw on the south side of the road. Also in 1947, the Fish Creek feedground was established. Finally, in 1970, the feedground below Alkali Creek was moved to its present location. The relocations of this feedground were in response to increasing human activity along the Gros Ventre road.

The permanent feedgrounds were located in, or adjacent to, areas that probably wintered the most elk during the winter months, i.e., Bacon Ridge/mouth of Fish Creek, Goosewing area, and the Rolling Hills below Alkali Creek and lower Crystal Creek.

Few details are known about the actual feeding of elk in the Gros Ventre prior to 1949. It appears that efforts to prevent starvation were mostly "token" and were not always successful. Anderson (1958) stated that feeding in the Gros Ventre was done on an emergency basis and the number fed remained small until 1956. This is supported by reports of elk starvation during this time period. Hocker (1933-34) reported that losses were greater on feedgrounds than on native ranges for years other than drought years. This suggests that feeding was not adequate. The modest amounts of feed stored also indicate that continuous feeding throughout the winter was not intended. For example, in 1929, only 10 ton of concentrate was stored at Goosewing. Further evidence that feeding was more symbolic than effective comes from 1938, when large

numbers of elk died of starvation. During that winter, elk at Goosewing were only fed for 5 days (beginning April 11th) and elk at the mouth of Crystal Creek were fed for 9 days (beginning April 7th)(Anonymous 1938a).

The efforts to prevent starvation appear to have intensified in the late 1940s. A cabin was built at Alkali for an elk feeder, hay was stored at Fish Creek, and the quantities of stored feed were increased significantly. The winter of 1958-59 began with 153 tons at Alkali, 33 tons at the Patrol Cabin, and 122 tons at Fish Creek.

Regular feeding began in the late 1940s when a feeder lived in the cabin at Alkali and fed elk in throughout the winter. During that same time period, a local rancher fed elk at Fish Creek. Documentation of feeding activities for the Patrol Cabin is sparse until 1958. In 1958, the Department hired a feeder to feed at all three feedgrounds. This feeder lived at Patrol Cabin and used a "Bombardier" to feed elk at this location and to provide transportation to Fish Creek and Alkali. Feeding at Alkali and Fish Creek was done on alternating days. Daily feeding at all three locations began in the mid 1960s.

c. Other feeding sites

The Blackrock feedground was used on an annual basis beginning in the early 1930s. This feedground was located in the Buffalo Valley area. It was moved several times and was finally terminated in 1971 (North 1990, WGFD 1991). Feeding was discontinued in an effort to compel the elk into using the larger feedgrounds of the Gros Ventre and NER instead. It was felt that elk would overuse the willow bottoms if their numbers were to increase dramatically, which would have a negative impact on the moose depending on the area.

B. Elk Damage

1. Damage Prevention Activities and Damage Claims

Techniques for preventing elk damage in the Jackson EHU have included fencing haystacks, hazing animals away from the damage source with pickup trucks, snowmobiles, helicopters, WGFD personnel on snowshoes, and/or noise-making devices, and institution of hunting seasons on lands (primarily privately owned) located in areas of chronic damage. The North Jackson Game Warden conducts most of the damage prevention activities. The 2006 and 2007 winters are reasonable representations of the amount of time spent on damage by the Game Warden in hard and mild winters, respectively. In 2006, 134 hours were attributed to damage prevention, while 62 hours were attributed to monitoring potential damage situations (WGFD unpublished data). In 2007, just 73 hours were spent on damage prevention, but 85 hours were spent on monitoring. Thus, it appears that there is only a small difference in the amount of time spent on damage activities due to winter severity. Generally in heavier winters there is more time spent on the ground preventing damage, but in milder winters there is more monitoring.

In some years, not all damage has been preventable and some landowners have received monetary compensation (Figure 11). In addition, damage to standing crops or stored crops can be synonymous with commingling when test-eligible cattle are present. Thus, techniques for preventing damage are often the same techniques used from preventing commingling (Appendix 3, E-3).

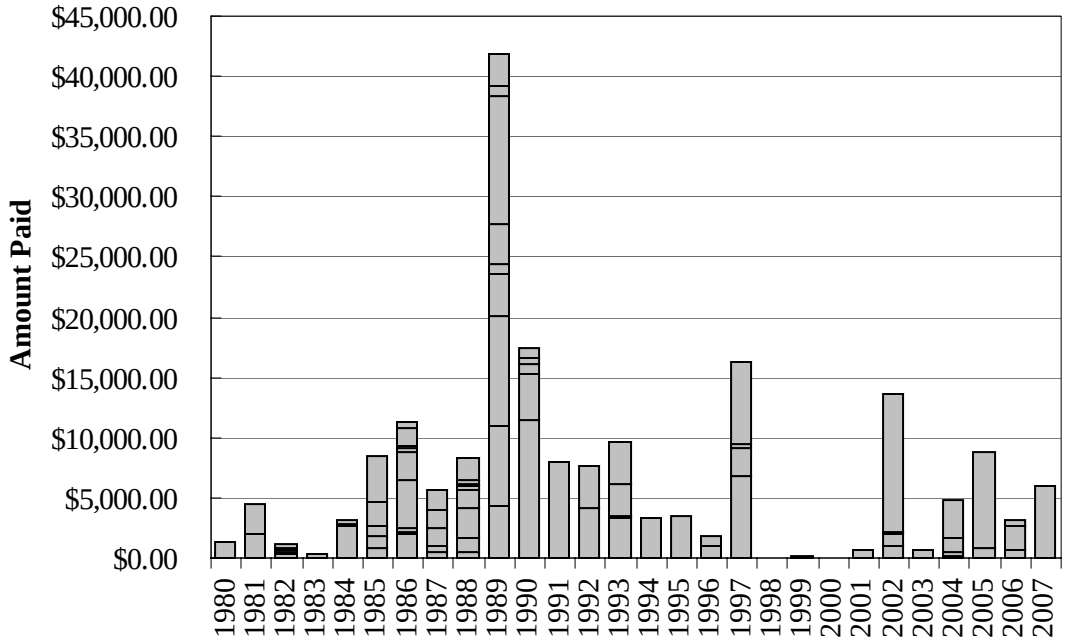

Figure 11. Monetary claims paid to landowners in the Jackson EHU by WGFD for elk-specific damage from 1980 through present (labeled by fiscal year). Claims do not reflect expenses incurred by WGFD for damage prevention activities.

Countless hours are spent by WGFD personnel moving elk away from livestock feed lines to prevent damage and commingling, and livestock operators are often faced with the problem of finding replacement forage for hay consumed by the elk. In some years replacement forage is not available so livestock operators have insufficient hay to meet their feeding needs. Costs associated with damage and commingling prevention average six to seven times the cost of damage payments each year (WGFD 2006). Without feeding, we would anticipate damage claims and costs of damage prevention activities to be much higher.

2. Gros Ventre Drainage (Excerpt, WGFD 2006)

Damage prevention is a major concern in the Gros Ventre drainage because most of the private holdings are on or near the river bottom, which also serves as an elk migration corridor and provides winter forage to elk. Damage concerns along the Gros Ventre River date back at least to 1919-20. Anonymous (1919-20) reported that three damage claims totaling $8,900 were made near Kelly. The lack of detailed reports between the 1920s and 1950s do not allow for an assessment of the damage situation during those years. Elk damage to standing and stored crops in the Gros Ventre occurring prior to the establishment of feedgrounds was partially responsible for the establishment of feedgrounds. The first known damage claim in the upper Gros Ventre was filed in 1957, and was associated with several homesteads near the current location of the Fish Creek feedground. Since 1957, approximately $68,000.00 has been paid to landowners claiming damage in the Gros Ventre drainage. Occasional damage has occurred on stored crops at the Goosewing private holdings, near the current location of the Patrol Cabin feedground. During the winter of 1968-69, elk were fed at the Glenn Taylor Ranch adjacent to Lower Slide

Lake to reduce damage problems. Because of brucellosis transmission concerns, the Department has responded aggressively to prevent elk/livestock commingling since the early 1990s.

Today, most of the concerns in the Gros Ventre are the result of commingling with livestock on feed lines on three ranches located on or below Crystal Creek. The Red Rock Ranch began claiming elk damage, for elk on horse feed lines, beginning in the mid 1980s. Elk were not fed at the Alkali Feedground during 2004-05; concomitantly, the Red Rock Ranch experienced considerable damage to standing crops that year. A damage claim amounting to approximately $8,500 was paid for loss of fall pasture. Lasson (personal communication 2005) also reported more elk on the Red Hills Ranch than in previous winters. Both of these locations are west of the Alkali feedground.

3. Other Areas

Occasionally, emergency feeding has been warranted in the Buffalo Valley to keep elk from commingling with cattle on private property. Emergency feeding was authorized in the Buffalo Valley in 2006 from early February through mid-April (WGFD 2006). During classification flights in February 2004, 90 elk were counted on feed in the Buffalo Valley (WGFD 2004). In 1999, approximately 80 elk were fed on the Brad Luton Ranch in the Buffalo Valley (WGFD 1999). That year, feeding started on February 12 and ended in mid-March. That was the fourth consecutive year that elk were fed by WGFD in Buffalo Valley. In 1998, approximately 95 elk and 11 moose were fed at Brad Luton's.

4. Analyses of Producer Survey

Of the 16 surveys returned from producers in the Jackson EHU (BMAP, Section E-1-4), 75% reported damage to some portion of their operation at one time or another; type of operation appears to be unrelated to damage (Table 2). Overall, 69%, 81%, and 81% of producers in the Jackson EHU produce hay, have 1 or more stackyards, and feed livestock throughout winter, respectively. Damage appears unrelated to stackyard ownership and winter feeding of livestock (Table 3). Hay production, on the other hand, does appear at least correlated with occurrence of damage (Table 3). All three producers reporting no damage also do not produce hay within the Jackson EHU. Among producers reporting damage from elk, amount of hay production (acres) varies from 0 to 750 acres (Figure 12). Due to missing data in some of the surveys, sample size is less than 16 for some of the analyses. For example, one survey respondent chose to not mark whether or not they have ever had damage occur, and two producers that indicated they incurred damage did not indicate how much hay they produced, thus their data is not included in Figure 13.

Table 2. Occurrence of damage to livestock operations in the Jackson EHU.

	Damage*	
Operation	Yes	No
Cow-Calf	10	1
Steer	2	2
Spayed Heifer	2	1
Lease Pasture	2	0
Total[$]	12	3
% of Total	80%	20%

*One producer did not answer yes or no to damage.
[$]Most producers reported more than one operation type; thus the sum of each column does not equal the total.

Table 3. Occurrence of damage to livestock operations with hay production, stackyards, and winter feeding in the Jackson EHU.

	Damage*		
Factor	Yes	No	% of Total
Hay Production Yes	11	0	73
Hay Production No	1	3	27
Stackyard(s) Yes	11	1	80
Stackyard(s) No	1	2	20
Winter Feeding Yes	11	1	80
Winter Feeding No	1	2	20

*One producer did not answer yes or no to damage.

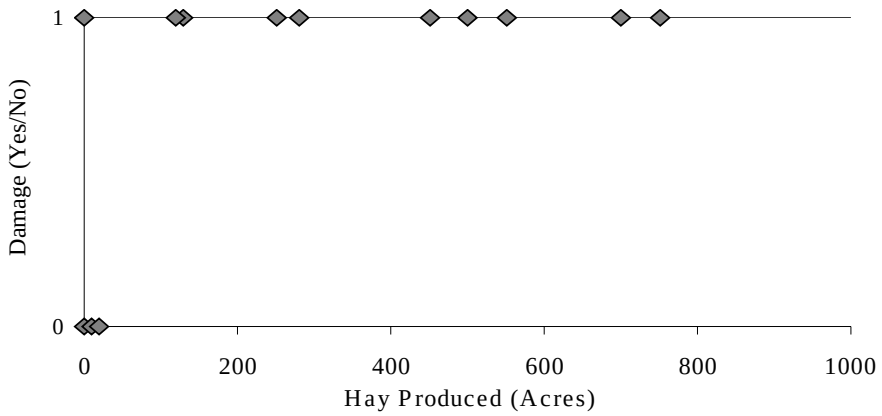

Figure 12. Occurrence of damage (yes = 1, no = 0) with respect to amount (acres) of hay produced for individual producers in the Jackson EHU.

Throughout the Jackson EHU (and all EHUs within the brucellosis endemic area of western Wyoming), WGFD personnel (and other agencies) have assumed that risk of damage and/or commingling increases as distance of livestock production operation decreases with respect to individual feedground(s); producers closest to feedgrounds are presumed to be at "high" risk of incurring damage and/or commingling situations. Based on results of the survey, livestock producers incurring damage are slightly farther from nearest and next-nearest feedgrounds than producers not incurring damage (Table 4). Average distance for all producers reporting damage is 10.42 miles. Distance to nearest and next-nearest feedgrounds do not appear to be associated with occurrence of damage (Figure 13 A, B). Ultimately, risk of damage (regardless of type of operation, hay production, and proximity to feedgrounds) and/or commingling appears ubiquitous among all producers within the Jackson EHU, and may be more

accurately predicted by proximity to migration routes, elk home-range sizes, or some other combination of factors.

Table 4. Average distance to nearest and next-nearest feedgrounds for producers reporting damage/no damage in the Jackson EHU.

	Distance to Feedground (miles)		
Damage	Nearest	Next-Nearest	Mean
Yes	8.45	12.39	10.42
No	7.70	10.50	9.10
Mean	8.30	12.01	

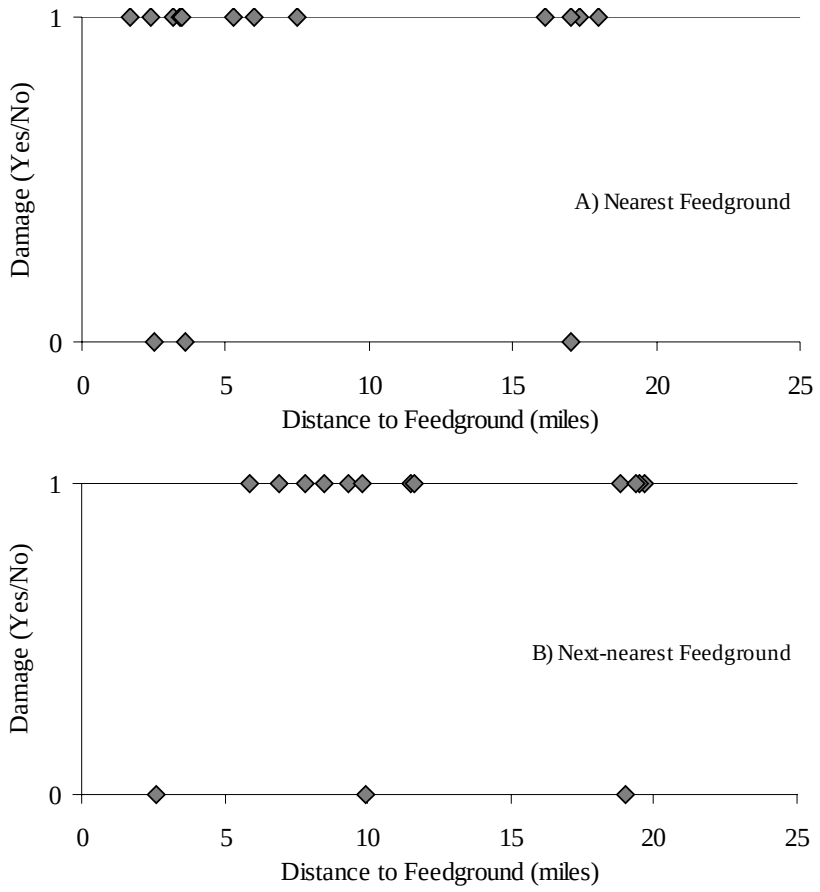

Figure 13. Occurrence of damage (yes = 1, no = 0) on livestock operations with respect to (A) nearest and (B) next-nearest feedgrounds in the Jackson EHU.

C. Current Elk Herd Management

Based on summer elk distribution, managers have identified four herd segments in the Jackson EHU: the Gros Ventre, Teton Wilderness, GTNP, and YNP. Each herd segment varies in vulnerability to hunter harvest. The Gros Ventre herd segment encompasses elk that summer east of GTNP and south of Highway 26/287 at Togwotee Pass. The majority of these elk winter on the three Gros Ventre feedgrounds, although some move west down drainage to winter on the NER. Elk that summer in the Teton Wilderness often mix with YNP elk to avoid hunting pressure during the fall. Teton Wilderness elk that remain in the wilderness during the fall are highly vulnerable to harvest there as well as during their migration to the NER or the Buffalo Valley. Prior to the expansion of GTNP in 1950 there were few elk summering in this part of the EHU. It was thought that elk were displaced by agricultural development in the valley (Anderson 1958, Cole 1969). Since then the GTNP segment likely makes up 1/3 to 1/2 the wintering elk on the NER (Boyce 1989). Elk summering in the southern portions of GTNP near the JY Ranch, R Lazy S Ranch, and the Whitegrass Ranch migrate east to the NER through private lands and areas closed to hunting in the Park. These elk are the least vulnerable to harvest by hunters. Elk in the Central Valley and Berry Creek in the Northwest corner of GTNP also migrate to the NER. These elk also spend most of the year in closed areas and migrate through open hunt areas quickly and so are not sensitive to hunting pressure. The majority of the elk that summer in the southern 1/3 of YNP migrate to the NER with the remainder wintering in the Buffalo Valley and Spread Creek areas. These elk are vulnerable to harvest during migration through the Teton Wilderness and on winter ranges.

Managing the various herd segments is critical as managers attempt to move this population toward objective. Over-hunting has occurred on some segments during migration in the past both in the Togwotee Pass and Buffalo Valley areas. In addition to over-hunting, segments that are sensitive to hunting pressure often change migration patterns because of hunting. Timing of fall migrations are important to managers in regulating harvest and targeting certain segments of the population. Between 1990 and 2000 the average date that 80% of the radio-collared elk summering in GTNP arrived on the NER was November 13, and 80% of the YNP radio-collared elk arrived by December 2. Hunting season opening and closing dates that are not timed right could have devastating effects. Radio-collar data from 1994-2000 indicate animals were harvested at disproportionate rates from each of the segments. Gros Ventre and Teton Wilderness elk were the highest with 23% of the collared animals being harvested, GTNP had 12% harvested, and YNP (albeit with a smaller sample of collars) saw 5% of the animals harvested. Even though YNP elk were harvested at a lower rate, our assertion is that these elk do not have the calf: cow ratios of the other areas that support high harvest levels.

1. Population Estimate

The postseason population objective for the Jackson EHU is 11,029 elk. The POPII simulation model indicated the 2005 postseason population to be 12,855 elk; the current model estimates the 2006 postseason population to be 12,904 (Figure 14). The population estimate over the last five years has averaged 13,522 elk (WGFD 2007). The current POPII simulation indicates that this population may have stabilized in 2006 (WGFD 2007). It is likely that the overall population decline observed in recent years is the result of lower calf production along with antlerless elk harvest. Population changes observed this past year might be the result of

lower harvest on NER and GTNP lands. Hunting seasons in 2006 focused hunting pressure on herd segments that summered in GTNP while reducing hunting pressure in the northern portions of the herd unit to address lower recruitment of calves from the Teton Wilderness and YNP.

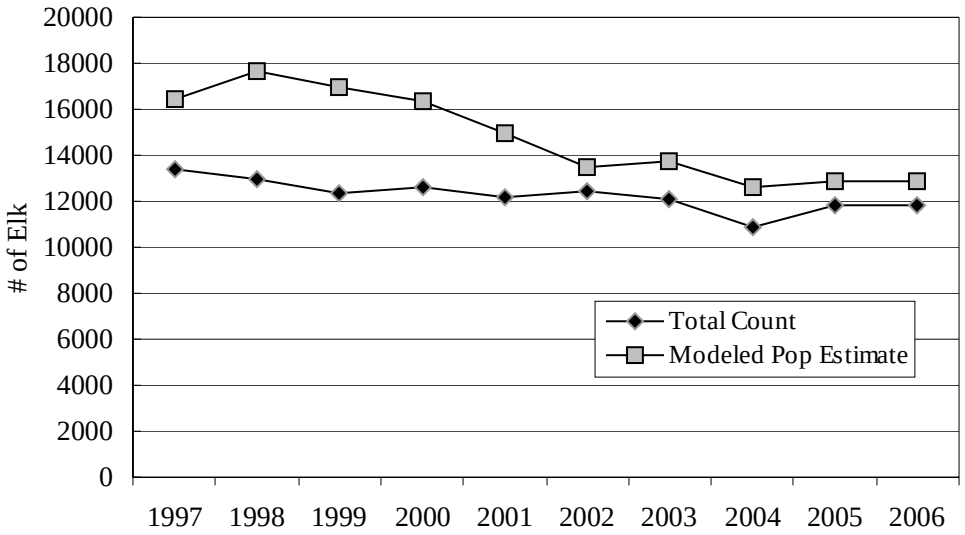

Figure 14. Postseason POPII estimate and corresponding trend count of Jackson EHU, 1997-2006. (Data from WGFD 2002 and 2007.)

2. Trend Counts and Demography

A total of 11,853 elk were counted in the Jackson EHU in February 2006 (Figure 15). There were 3,217 elk on feedgrounds in the Gros Ventre drainage, 6,730 elk on the NER, 331 elk being baited away from private feedlines, and 1,575 elk on native winter ranges.

Postseason (2006) classification flights were flown in late February of 2007 and ground counts were completed on the NER and the three Gros Ventre feedgrounds (Figures 15 and 16). A total of 11,786 elk were counted including 7657 females, 1,917 calves, 390 yearling males, and 1,234 adult males. Herd unit ratios were 25 calves:100 cows, 16 adult males:100 cows, and 5 yearling males:100 cows (Figure 17). Despite the lack of snow, elk were located on isolated winter range complexes including wind swept ridges in the Gros Ventre and riparian bottoms along the Gros Ventre and Buffalo Fork Rivers. During surveys it was apparent that the number of elk on native winter ranges was again lower. On the north end of the NER, a total of 157 elk were observed compared to 119 elk last year and 921 during the 2004-05 winter. East of the NER on native winter range, a total of 578 elk were observed compared to 490 elk last winter and 1,471 elk the winter prior. In the Gros Ventre drainage, a total of 508 elk were observed compared to 579 elk last winter, and 1,394 the winter prior. Meanwhile, the ratio of elk on feed versus native winter range in the Gros Ventre continues to skew towards feedgrounds. A total of 2,921 elk were on feed in the Gros Ventre in February of 2007 compared to 3,217 in 2006 and 2,941 in 2005 (Figure 16).

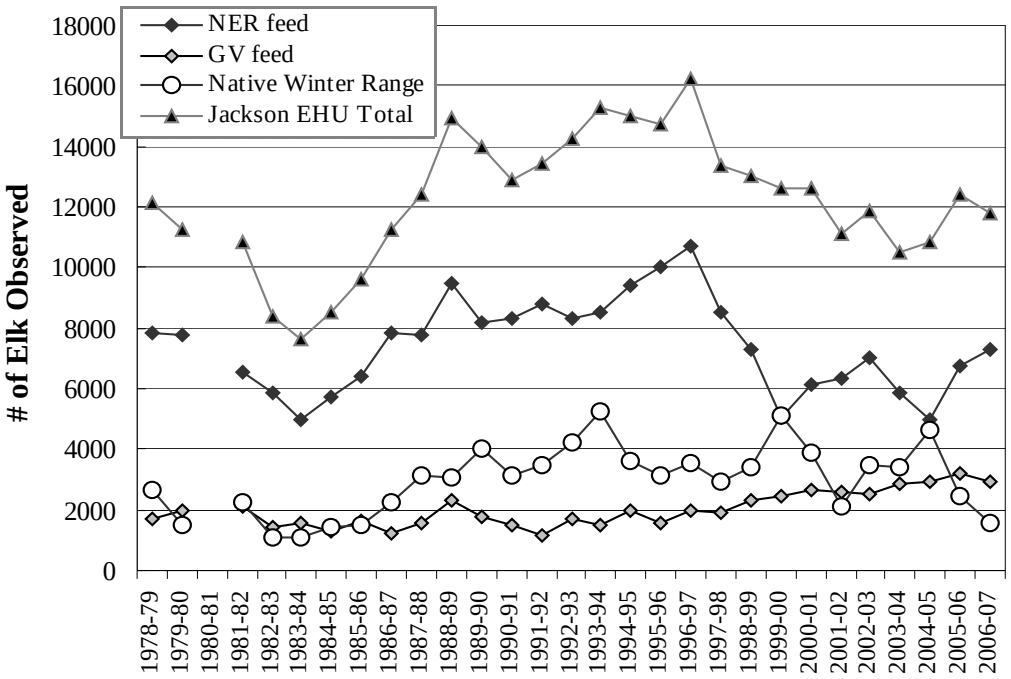

Figure 15. Number of elk counted in the Jackson EHU on the NER, Gros Ventre feedgrounds (combined), and on native range during annual post-hunt trend counts, 1978 to present. The herd objective is 11,029 elk.

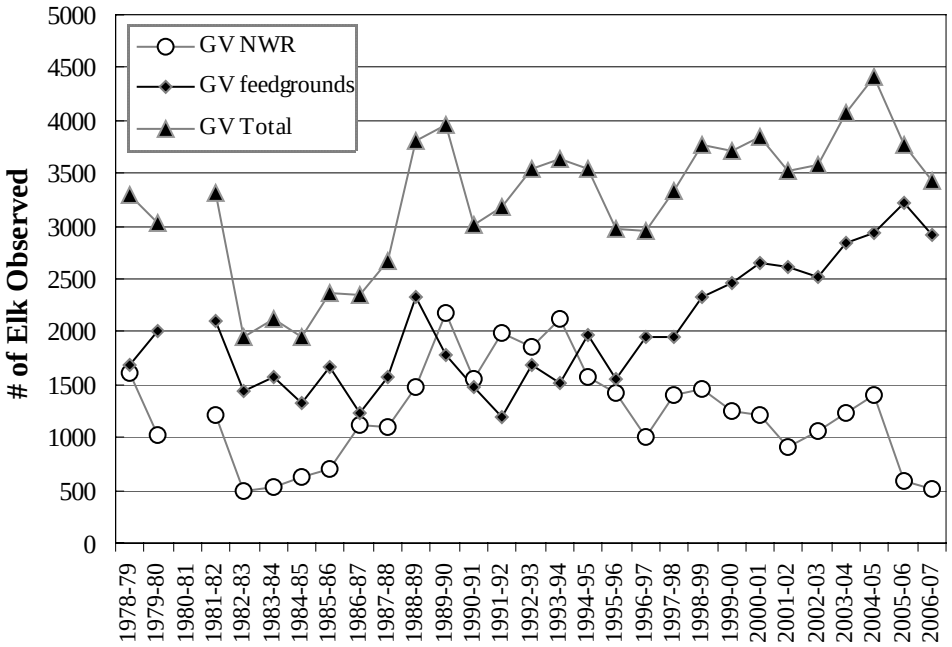

Figure 16. Number of elk counted on Alkali, Patrol Cabin, and Fish Creek feedgrounds combined, and native winter range in the Gros Ventre drainage during annual post-hunt trend counts.

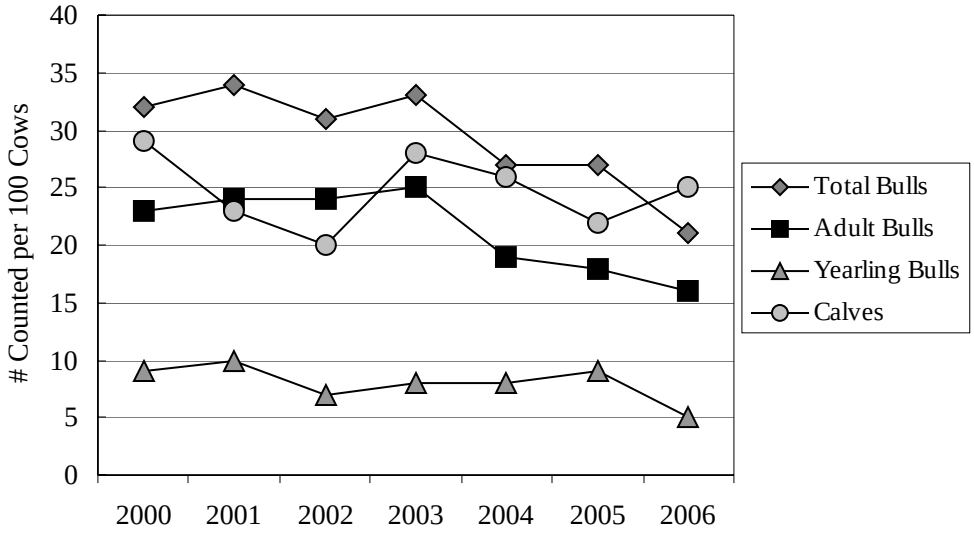

Figure 17. Ratio of calves, bulls, and spikes per 100 cows counted during annual post-hunt trend counts in the Jackson EHU, 2000-2006.

In the summer of 2006, aerial surveys were conducted in GTNP. Park personnel classified 1,365 elk in the central portion of the Park. This included 997 cows, 231 calves, 86 mature bulls, and 51 yearling bulls. GTNP summer ratios were 23 calves:100 cows, 9 mature bulls:100 cows, and 5 yearling bulls:100 cows. A downward trend in summer calf production has been observed since 1991.

3. Harvest & Hunter Success

Data from the preliminary 2006 harvest survey indicate a total of 4,794 hunters harvested 1,832 elk, including 844 adult males (46%), 122 yearling males (7%), 734 cows (40%) and 132 (7%) calves (Figure 18). Hunters had a 38% success rate and spent 18 days in the field per animal harvested. The harvest was lower than the 2001-2005 average of 2,166 elk. In GTNP a total of 215 elk were harvested including 59 mature males, 9 yearling bulls, 122 cows, and 25 calves. In 2005, a total of 238 elk were harvested in GTNP. On the NER, a total of 128 elk were harvested in 2006 including 13 mature bulls, 1 yearling bull, 100 cows and 13 calves. This compares to 129 elk taken during the 2005 hunting season.

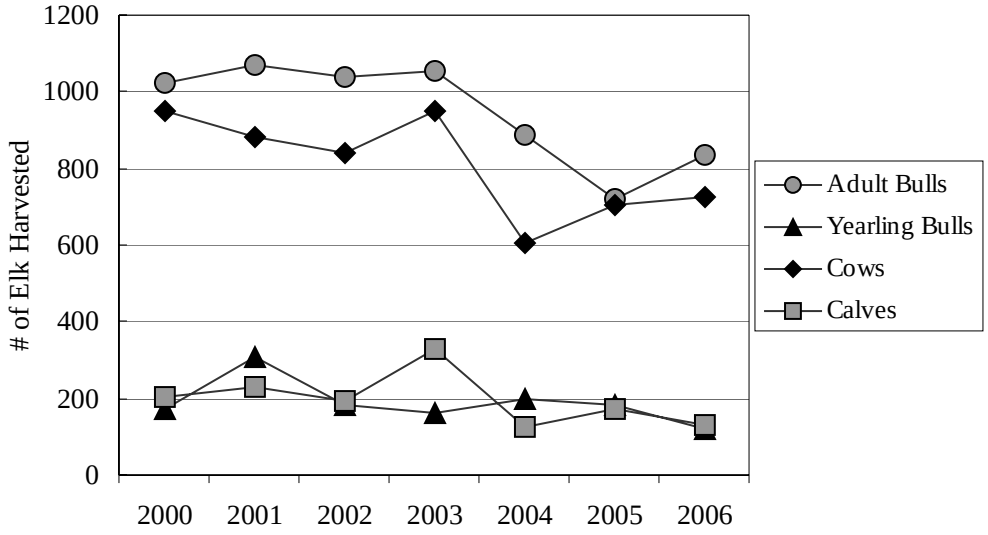

Figure 18. Number of elk harvested, by sex and age class, within the Jackson EHU, hunting seasons 2000-2006.

4. Hunting Seasons and Population Management

Management of this herd is complicated because occupied habitat includes two National Parks and the NER. Complex seasons are typically proposed to address management concerns for various population segments in this herd. It is important to note that elk that migrate the greatest distance are in an open hunt area the greatest amount of time (60 miles from YNP to NER). Conversely, the elk that have the shortest migration are often vulnerable to harvest for only a few days, if any at all. Elk that summer in the core area of GTNP, which is closed to hunting, can effectively move to the NER before the season opens or at night when the season is open.

Grand Teton National Park was established in 1929 and was expanded in 1950 to include lands on the Valley floor east of the Teton Range. The expansion of the Park was accompanied by controversy and heated debate, which centered on the management of the elk. In the end, compromise legislation was reached that allowed the expansion to occur. The enabling legislation (public law 81-787) also allowed elk hunting east of the Snake River and directs the WGFD and NPS to meet annually to determine if a reduction hunt is warranted. The necessity of this hunt has been debated since its inception (Murie 1953, P. Wood 1984) and has been conducted since 1951 except in 1959 and 1960. One area in the Park currently closed to hunting is HA 72. The area was open to hunting for eight seasons from 1950 –1967 when between 4 and 29 elk were harvested annually. The area was closed because the NPS felt that not enough elk were being harvested to warrant it being open.

Hunting on the NER is jointly managed by the USFWS and WGFD, through the 1974 cooperative agreement between the two entities (USFWS and WGFD 1974). The agreement was drafted so that the USFWS and WGFD would cooperate on aspects of management where there was mutual concern, i.e., elk hunting regulations, elk feeding, herd numbers, habitat conditions, research, etc. Article III of the cooperative agreement states that, annually, the Refuge Manager and WGFD District Supervisor will jointly prescribe dates, permit quotas, and other pertinent

regulations if a hunting season is deemed necessary. The WGFD must then approve of the plans, as the Department of Interior "operates in conformance with state fish and game laws on federally-owned lands…"(USFWS and WGFD 1974).

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The proposed 2007 seasons should continue to maintain hunting pressure on elk that summer in GTNP while reducing hunting pressure on elk from the northern portions of the herd unit. This will be accomplished by allowing HA 79 type 2 and 6 hunters to hunt in HA 75 until November 25 (see BMAP, Figure 2 for Hunt Areas). In the past two years, radio-collared elk that summer in GTNP were on the NER by November 20. Although some of the Yellowstone elk migrated earlier again this year, HA 79 will close on November 15. The earlier closure in 79 should afford additional protection on migrants from HAs 70, 71 and YNP while encouraging elk to stay north of the open hunt areas. The earlier closure in HA 75 will also help to reduce hunting pressure on late migrants.

This past hunting season (2006), radio-collared elk from GTNP began moving on to the NER shortly after the hunting season opened and were in HAs 75 and 77 for a brief period of time before entering the closed area on the south end of the NER. Conversely, when the Yellowstone elk began migrating, they move through Areas 70, 71, 75, 77, and 79 during an open hunting season. Managers propose to close hunting in the north end of GTNP November 15 because, in a typical year, Yellowstone elk will be moving into this area. HA 75 will remain open until November 25 in an effort to maintain hunting pressure on elk from the southern end of GTNP.

In the Gros Ventre drainage, the "any elk" season will close six days earlier on October 25 (*and* spikes cannot be harvested) and the Type 2 antlerless licenses will be valid through the month of October to maintain hunting pressure on antlerless elk in this herd segment. These changes are proposed in an effort to reduce hunting pressure on bull elk. Although the number of elk observed on feedgrounds is higher than the combined feedground quota for the Gros Ventre, fewer elk were again observed on native ranges. Calf:100 cow ratios in the Gros Ventre improved over the 20 calves:100 cows observed last winter. Type 2 licenses will be reduced in HAs 81-83 in response to the antlerless elk seasons proposed during the last six days of the season. Last fall, antlerless animals accounted for 374 elk in the harvest while the license sale information indicated that 34 of the 225 Type 2 licenses sold. Proposed hunting seasons should maintain adequate pressure on this population segment.

5. Ear Tag Returns

A tagging program has been conducted in conjunction with essentially all elk trapping and capture operations in the Jackson EHU. Tagging animals helps to increase understanding of elk movements in and out of the Jackson EHU. Elk trapping on feedgrounds has occurred almost annually on the NER since 1971, plus several times on each of the feedgrounds in the Gros Ventre River drainage (*also see* Appendix 3, Section E-2). Between February of 1993 and March of 2005, approximately 1,200 elk were tagged in the Jackson EHU. An evaluation of all known-location tag returns from recent years (1998-2005; $n = 187$) indicates that 94.1% ($n = 176$) of tagged elk were killed inside the Jackson EHU boundaries (Table 5). The most tags returned from outside the EHU have come from the Upper Green River EHU (E107) to the south. In recent years, just one tag has been returned from out of state; a bull harvested north of Ashton, Idaho in 1996.

During the 2004 and 2005 hunting seasons, 14 elk tagged in the Jackson EHU were recovered. One tag was recovered from an elk harvested outside the EHU in HA 73 (E101-Targhee EHU) and all other tags were recovered from HAs within the Jackson EHU.

Table 5. Known harvest locations (hunt seasons 1998-2005) of elk trapped and tagged in the Jackson EHU. From 1993-2005, 1,053 elk were trapped and tagged on the NER, and 114 elk were tagged on the Alkali feedground in 1999. Additional elk were tagged during radio-collar studies (tagging records are incomplete). Compiled from WGFD JCRs (WGFD 1999-2006) and unpublished data.

Location of Harvest	# of Tagged Elk Harvested	% of Tag Returns
Jackson EHU	176	94.1
Green River EHU	4	2.1
Hoback EHU	2	1.1
Wiggins Fork EHU	2	1.1
Targhee EHU	1	0.5
Fall Creek EHU	1	0.5
Idaho	1	0.5
Total	**187**	**99.9**

D. Literature Cited

Anderson, C.C. 1958. The elk of Jackson Hole: a review of Jackson Hole elk studies. Wyoming Game and Fish Commission Bulletin No. 10. Cheyenne, Wyoming, USA.

Anonymous. 1929-30. Elk feeding. Pages 17-25 *in* Biennial report of the State Game and Fish Commissioner, State of Wyoming. Cheyenne, Wyoming, USA.

———. 1938. Investigation of elk losses in the Gros Ventre drainage. Wyoming Wildlife 3(8): no page numbers.

———. 1941. Wyoming elk population. Wyoming Wildlife 6(8): 1-2.

Boyce, M.S. 1989. The Jackson elk herd: Intensive wildlife management in North America. Cambridge University Press, Cambridge, UK.

Cole, G.F. 1969. The elk of Grand Teton and southern Yellowstone National Parks. Research Report GRTE-N-1, Office of Natural Science Studies, U.S. Department of Interior, National Park Service. Washington, D.C.,

Craighead, J.C. 1952. A biological and economic appraisal of the Jackson Hole elk herd. New York Zoological Society & the Conservation Foundation. New York, New York, USA.

Graves, H.S., and E.W. Nelson. 1919. Our national elk herds- With special reference to the herds on the National Forests adjacent to Yellowstone National Park. U.S. Department of Agriculture, Department Circular 51. Washington, D.C.

Hocker, R.A. 1931-32. Biennial report of the State Game and Fish Commissioner of the State of Wyoming. Cheyenne, Wyoming, USA.

Murie, O.J. 1953. Teton's elk problem continues. National Parks Magazine 27(113): 56-67.

North, D. 1990. The Buffalo Valley elk enhancement project, 1990 annual report. Wyoming Game and Fish Department. Cheyenne, Wyoming, USA.

Preble, E.A. 1911. Report on condition of elk in Jackson Hole, Wyoming, in 1911. U.S. Department of Agriculture, Biological Survey, Bulleting No. 40. Washington, D.C.
Sheldon, C., chairman. 1927. The conservation of the elk of Jackson Hole, Wyoming. National Conference on Outdoor Recreation, Washington, D.C.
Thorne, E.T., J.K. Morton, and W.C. Ray. 1979. Brucellosis, its effect and impact on elk in western Wyoming. Pages 212-220 *in* M.S. Boyce and L.O. Hayden-Wing, editors. North American elk: Ecology, behavior, and management. University of Wyoming, Laramie, USA.
U.S. Fish and Wildlife Service, Wyoming Game and Fish Department. 1974. Cooperative agreement between the U.S. Department of the Interior, Fish and Wildlife Service, and the Wyoming Game and Fish Department relative to management of the National Elk Refuge. Denver, CO and Cheyenne, WY, respectively.
Wood, P. 1984. The elk hunt goes on at Grand Teton. National Parks 58(9-10): 29-31.
Wyoming Game and Fish Department. 1999. 1998 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.
———. 2002. 2001 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.
———. 2004. Elk feedgrounds in Wyoming. Cheyenne, Wyoming, USA.
———. 2004. 2003 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.
———. 2006. 2005 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.
———. 2007. 2006 Annual big game herd unit job completion report. Cheyenne, Wyoming, USA.

Jackson EHU BMAP
Appendix 3
Feedground & Brucellosis Management

A. Feedground Management – Populations, Seasons, and Expenditures

Feeding on the WGFD-operated Gros Ventre feedgrounds in the winter of 2006-07 started in late December (Figures 19C and 21). Feedground classification counts were conducted in mid-February. [Feedground data from the current year is still being compiled as this document is being drafted; therefore comparisons across the entire feedground program are limited to previous years.] While fewer elk were counted on the Gros Ventre feedgrounds this winter (2,921) than last (3,221), the total number of elk on the three feedgrounds still exceeded the WGFC-established quota of 2,450 elk. The Commission set the quotas to guide management of the feedgrounds; they are based on amount of feeding area and population objectives. The Commission last modified the quotas for the Gros Ventre feedgrounds in 1985. The current quotas are: Alkali) 800, Patrol Cabin) 650, and Fish Creek) 1,000.

The Gros Ventre feedgrounds typically operate for a shorter feeding season than the rest of the Jackson-Pinedale Region (JPR). In 2005-2006, the Jackson EHU had the shortest feeding season of any EHU in the Region (WGFD unpublished data). However, only the Fall Creek EHU (E103) exceeds the Jackson EHU by number of elk fed (on state-operated feedgrounds). Counts indicated that 9,951 elk were fed in the Jackson EHU in 2005-2006 (Appendix 2- Figure 15). This was comprised of 3,221 elk on the three Gros Ventre feedgrounds, plus 6,730 elk on the NER. The number of elk on feed in the Gros Ventre was 30% over the quotas set by the Commission (2,450 elk). If including the elk that are fed on the NER, the Jackson EHU far exceeds all others. However, the proportion of the Jackson EHU on feed versus native winter range is relatively low. From 2000-01 to 2005-06, 70% of the Jackson EHU was counted on supplemental feed, whereas the rest of the Region's elk herds containing feedgrounds averaged 90% (range = 75% – 98% by EHU) over the same time period.

The number of elk fed in the Gros Ventre builds rapidly once feeding begins and decreases quickly once spring arrives (Figure 19A). In the winter of 2005-2006, most of the elk on the Gros Ventre feedgrounds were fed from December 28 through February 29 (Figure 19B). The average length of the feeding season for feedgrounds in the Gros Ventre ($\bar{x}$ = 62 days) that winter was less than half the overall feedground average ($\bar{x}$ = 125 days).

Elk feeding on the NER began January 13, 2007. Bison feeding was started two days earlier in an attempt to keep bison from hindering with elk-feeding operations. The 2007 winter elk classification count on the NER was conducted on February 16. There were 7,279 elk counted on feed, this was the highest number since 1999 (Figure 31). A total of 8,014 elk were counted on and adjacent to the NER; this was the highest number since 2003. The relatively low percentage of elk off feed (735 elk, 9.2%) was surprising given below average snow conditions prior to the classification count. Including the 157 elk counted off feed on the north end of the NER there were 7,436 total elk on the Refuge. This is only slightly below the 7,500 maximum level discussed in the 1974 cooperative agreement between USFWS and WGFD. Feeding continued on the NER through March 21, a total of 68 days of feeding.

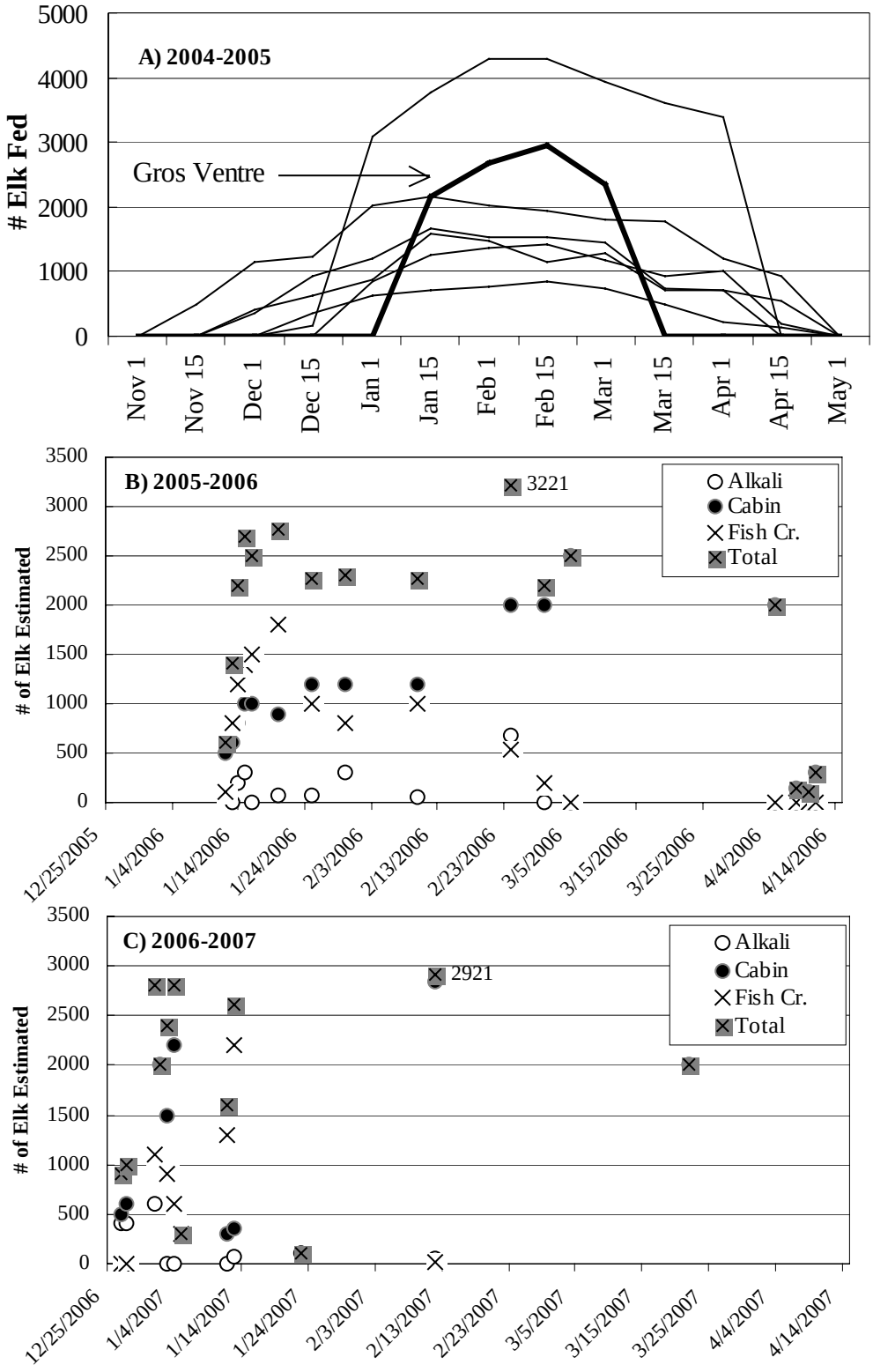

Figure 19. Estimated number of elk on feedgrounds over the length of the feeding season. A) 2004-2005 feeding season, grouped by EHU, B) 2005-06 and C) 2006-07 feeding seasons in the Jackson EHU only. Labeled data points in B and C represent annual postseason trend counts.

The cost to feed elk on WGFD-operated feedgrounds in the Jackson EHU in the winter of 2005-06 ($\bar{x}$ = $37, range = $14 to $62 per elk) was below the overall feedground average ($68 per elk; WGFD unpublished data). Also in the winter of 2005-06, about 19% of all elk fed, but only about 10% of the total costs, were associated with these feedgrounds, making them some of the more cost-efficient (not including administrative costs) in the feedground program (Table 6).

Table 6. Feeder and hay costs (per elk), and rate of feeding (tons/elk) at each WGFD-operated elk feedground in the winter of 2005-06.

Feedground	**Cost/Elk ($)**[1]	**Feedground**	**Tons/Elk**
Finnegan	141	Finnegan	0.90
Dell Creek	103	Jewett	0.79
Jewett	91	Dell Creek	0.78
Black Butte	84	Black Butte	0.70
Camp Creek	84	Camp Creek	0.70
Franz	83	Greys River	0.67
Fall Creek	80	Franz	0.65
McNeel	77	Fall Creek	0.63
Greys River	75	McNeel	0.63
Scab Creek	73	Scab Creek	0.58
Dog Creek	65	Dog Creek	0.58
Muddy Creek	63	Forest Park	0.58
Forest Park	62	Horse Creek	0.55
Fish Creek[2]	**62**	South Park	0.54
Horse Creek	60	**Fish Creek**[2]	**0.49**
South Park	58	Bench Corral	0.48
Bench Corral	55	Muddy Creek	0.47
Soda Lake	54	Soda Lake	0.46
Upper Green	49	Upper Green	0.35
Patrol Cabin[2]	**36**	**Patrol Cabin**[2]	**0.30**
North Piney	20	North Piney	0.14
Alkali[2]	**14**	**Alkali**[2]	**0.08**
2005-2006 Avg.	**$68**		**0.55**

[1] Costs include feeder compensation and hay, and do not include administration, management, or maintenance.
[2] Elk move among the three Gros Ventre feedgrounds throughout the winter.

Some key values used in describing the feedground program are presented on a per-elk basis. These numbers should be viewed with caution, as these values are traditionally based on the number of elk on the feedground during the one classification count held each winter. These counts are usually conducted when the peak number of animals is expected to be on supplemental feed. Variability in day-to-day numbers of elk attending each feedground in the Gros Ventre confounds simple comparisons. Several hundred elk could potentially leave one feedground for another in a matter of a day. Thus, data from the three Gros Ventre feedgrounds are presented here both individually and as a combined feedground complex.

1. Gros Ventre feedgrounds, combined

The number of elk counted on feed in the Gros Ventre has been climbing steadily since the early 1990s (Figure 20). The number of elk on each of the feedgrounds during the

classification counts, however, has been highly variable since the late 1990s. Since wolf reintroduction, there has been wolf activity on 17 of 22 State feedgrounds and on the NER. Wolves have not been present on all feedgrounds during all years, except in the Gros Ventre, where they have influenced elk distribution every year since 1998.

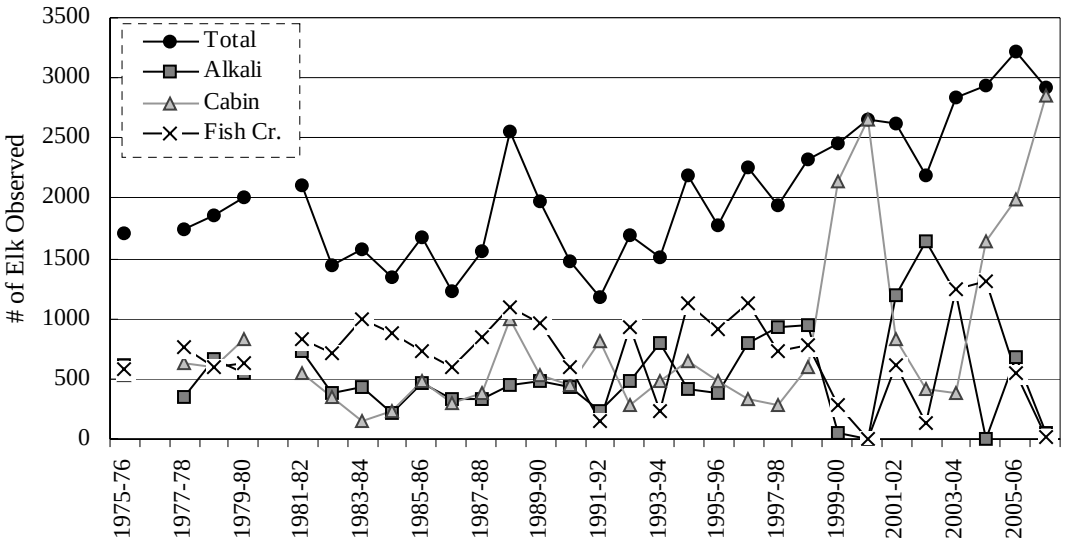

Figure 20. Number of elk counted on each of the Gros Ventre feedgrounds.

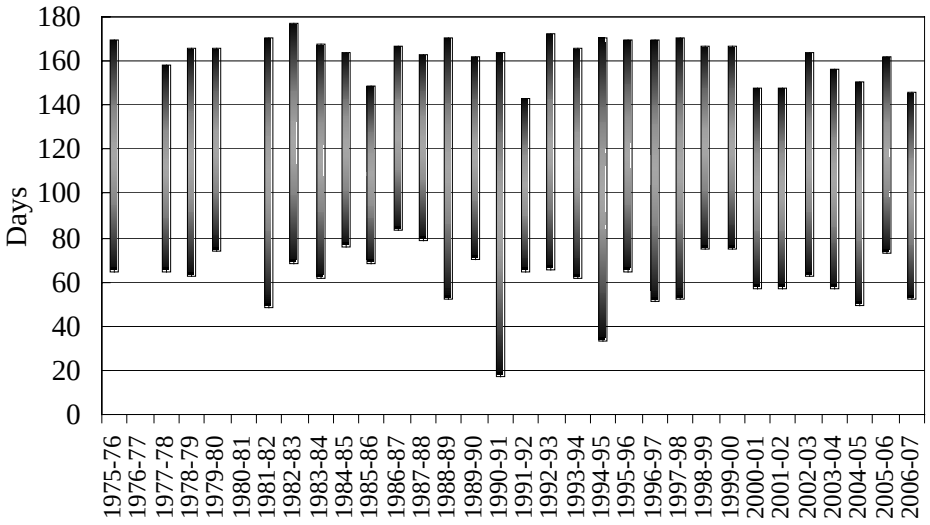

Figure 21. Earliest beginning date, latest ending date, and maximum days fed at the Gros Ventre feedgrounds since 1975-76 (0 on y axis = 1 November; 180 on y axis ≈ 28 April).

On average, the earliest feeding occurs in the Gros Ventre in the last days of December and the last days of feeding occur around the 11th of April (Figure 21). If one considers this to be the length of the feeding season in the Gros Ventre, the thirty-year average is about 103 days (Table 7). The average total number of days fed on the three feedgrounds combined was much lower over the last ten years (1997-98 through 2006-07: 231.5 days) than in the ten years prior (1987-88 through 1996-97: 289.9 days). Likewise, the maximum extent of feeding in the Gros

Ventre (the earliest beginning date through the latest ending date, irrespective of feedground) has been reduced from 110.5 days to 98 days over the same time period.

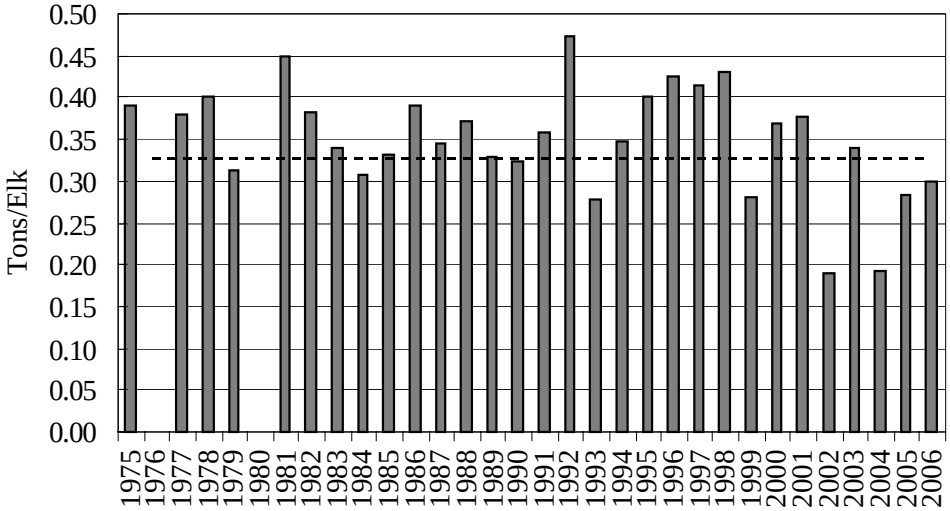

Figure 22. Maximum estimated tons of feed per elk per year at the Gros Ventre feedgrounds combined, since 1975-76. The dashed line indicates the long-term average for the Gros Ventre feedgrounds combined.

The amount of hay fed on the Gros Ventre complex has been below the long-term average each of the last three years (Figure 22). In addition, the Gros Ventre feedgrounds tend to feed a smaller amount of hay per elk when compared to all other feedgrounds in the JPR. The cost of feeding elk in the Gros Ventre has been highly variable since the early 1990s (Figure 23). The cost of feeding in the Gros Ventre correlates closely with the amount of hay fed, as hay costs are the primary expense of the feedground program.

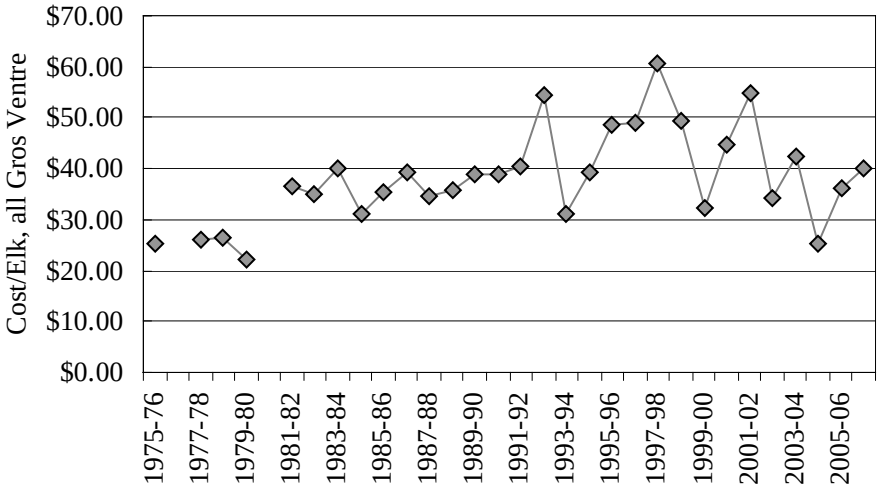

Figure 23. Cost of feeding elk at the three Gros Ventre feedgrounds combined since 1975-76. Costs only include hay (hay + hauling) and feeder (salaries, horse rental, mileage reimbursements, vaccination, tonnage payments) expenses, and do not include administration or permanent WGFD personnel.

Table 7. Combined data from the Gros Ventre feedgrounds since 1975-76.

Year	# Elk	Total Tons	Max Season[φ]	Total Days[Ψ]	Cost/Elk[$]	Tons/Elk
1975-76	1713	671	107	312	$25.29	0.392
1976-77	0	0	0	0	0	0
1977-78	1735	659	95	282	$26.16	0.380
1978-79	1854	745	104	299	$26.36	0.402
1979-80	2007	626	93	271	$22.07	0.312
1980-81	0	0	0	0	0	0
1981-82	2099	945	124	347	$36.72	0.450
1982-83	1437	548	110	294	$35.02	0.381
1983-84	1584	538	107	306	$40.06	0.340
1984-85	1338	413	89	218	$31.08	0.309
1985-86	1671	554	82	230	$35.30	0.332
1986-87	1225	479	85	253	$39.31	0.391
1987-88	1567	539	85	272	$34.80	0.344
1988-89	2550	948	120	353	$35.71	0.372
1989-90	1979	649	93	257	$38.70	0.328
1990-91	1469	477	148	307	$38.78	0.325
1991-92	1186	426	80	220	$40.55	0.359
1992-93	1688	799	108	323	$54.57	0.473
1993-94	1507	421	105	209	$31.06	0.279
1994-95	2186	757	139	341	$39.21	0.346
1995-96	1770	710	107	263	$48.56	0.401
1996-97	2260	963	120	354	$49.19	0.426
1997-98	1940	802	120	283	$60.78	0.413
1998-99	2325	1002	93	269	$49.45	0.431
1999-00	2462	688	93	226	$32.19	0.279
2000-01	2658	981	92	274	$44.69	0.369
2001-02	2621	985	92	221	$54.71	0.376
2002-03	2195	414	102	186	$34.06	0.189
2003-04	2839	967	100	267	$42.22	0.341
2004-05	2941	568	103	152	$25.13	0.193
2005-06	3221	917	90	187	$35.99	0.285
2006-07	2921	873	95	250	$40.24	0.299
Average	**2031.6**	**702.1**	**102.7**	**250.8**	**$38.27**	**0.3286**

[φ] Based on earliest beginning date and latest ending date among the three feedgrounds.

[Ψ] Sum of the season length across the three feedgrounds.

[$] Costs only include hay and feeder (salaries, horse rental, mileage reimbursements, vaccination, tonnage payments) expenses, and do not include administration or permanent WGFD personnel.

2. Alkali

In the winter of 2005-06, feeding was initiated on December 28 and continued until February 29 2006, resulting in a 48-day feeding season (Figure 24). Because of inconsistent attendance by the elk, however, feeding did not occur every day. The beginning date was slightly later than the long-term average, but in line with recent years. The ending date was much earlier than the long-term average (early April).

The Commission quota for Alkali is 800 elk. During the feedground classification in 2005-06, 675 elk were counted (Table 8). The total amount of hay fed (55 tons), and corresponding tons/elk (Figure 25) and cost/elk were very low. These low values were due to both the short season and highly variable day-to-day numbers of elk on the Alkali feedground.

In the winter of 2006-07, feeding was initiated December 22nd when WGFD personnel began feeding small amounts of hay (Figure 24). The last day that any supplemental hay was put out at Alkali was March 10th, resulting in an 85-day feeding season. Because of patchy attendance to this feedground by the elk, hay was only distributed a total of 23 days over the length of the season. During the official feedground count, just 55 elk were tallied. While this number is far under quota, elk move in large groups among the Gros Ventre feedgrounds, making the number of elk on Alkali highly variable through the winter. Feeders estimated as many as 600 elk were on the Alkali feedground on January 1st (WGFD unpublished data). Only 50 tons of hay were fed at Alkali in the winter of 2006-07 (Table 8).

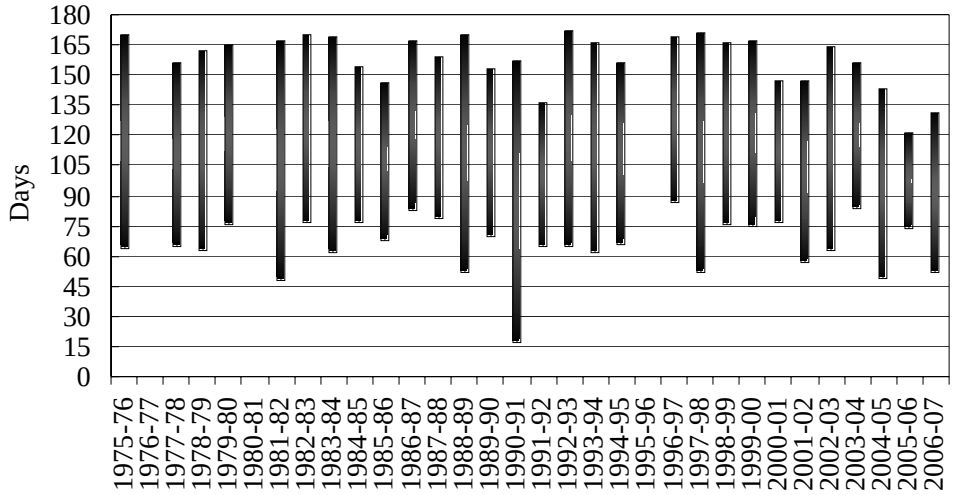

Figure 24. Beginning date, ending date, and days fed at Alkali feedground since 1975-76 (0 on y axis = 1 November; 180 on y axis ≈ 28 April).

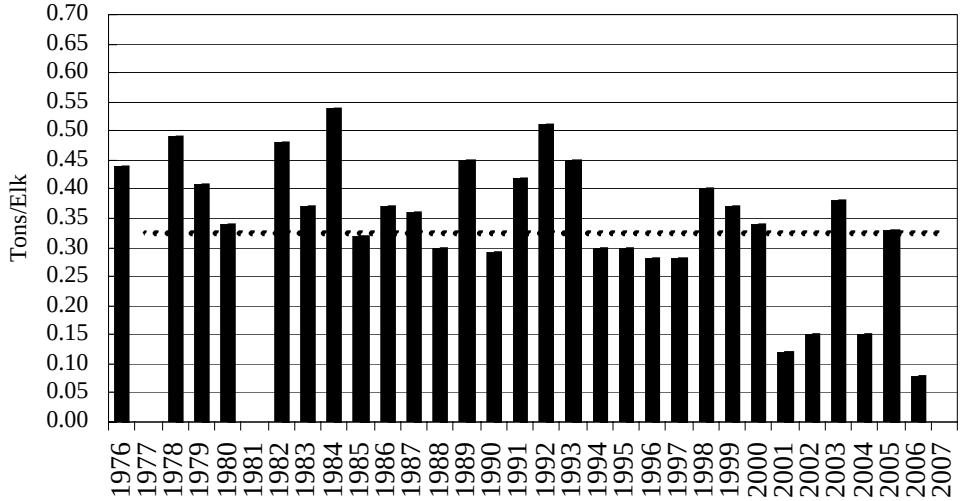

Figure 25. Maximum estimated tons of feed per elk per year at Alkali feedground since 1975-76. The dashed line indicates the long-term average for this feedground. Values for the 2006-07 season have not yet been calculated.

Table 8. Summary data from the Alkali feedground since 1975-76.

YEAR	ELK #*	TONS	DAYS	DEAD	COST/ELK	TONS/ELK
1975-76	608	269	106	3	29	0.44
1976-77	0	0	0	0	0	0
1977-78	349	170	94	4	34	0.49
1978-79	660	271	100	8	27	0.41
1979-80	542	185	91	1	23	0.34
1980-81	0	0	0	0	0	0
1981-82	724	350	124	6	40	0.48
1982-83	375	139	94	6	36	0.37
1983-84	437	236	109	3	46	0.54
1984-85	223	73	77	1	35	0.32
1985-86	466	173	78	1	36	0.37
1986-87	325	118	90	1	42	0.36
1987-88	336	100	86		36	0.3
1988-89	450	204	119	5	47	0.45
1989-90	480	138	84	5	36	0.29
1990-91	432	183	140	3	53	0.42
1991-92	225	115	73	0	60	0.51
1992-93	482	218	108	1	56	0.45
1993-94	800	240	99	0	32	0.3
1994-95	407	121	92	2	38	0.3
1995-96	380	106	84	0	36	0.28
1996-97	800	319	120	7	47	0.4
1997-98	930	342	99	5	53	0.37
1998-99	939	315	92	3	41	0.34
1999-00	1140^(46)	142^	70	7	16^	0.12^
2000-01	853^(8)	126^	91	2	21^	0.15^
2001-02	1188^	389^	102	16	47^	0.38^
2002-03	2100^(1650)	320^	73	1	28^	0.15
2003-04	1214	417	96	16	41	0.33
2004-05	0	0	0	0	0	0
2005-06	675	55	47	11	14	0.08
2006-07	55	50	80	2	*	*
Average	**473#**	**183#**	**85**	**4**	**37#**	**0.36#**

Number in () indicates number counted when the elk were classified.

^ Wolves chased the elk between the three GV feedgrounds, altering values and making year-to-year comparisons difficult.

Average values only comprise the years prior to 1999-2000.

* Values not yet calculated. Based on feeders estimates of elk numbers through the season.

3. Patrol Cabin

In the winter of 2005-06, feeding was initiated on January 12 and continued until April 10, resulting in a 90-day feeding season (Figure 26; WGFD unpublished data). The beginning date was within a few days of the long-term average, but the ending date was about one week later than average.

The Commission quota for elk on Patrol Cabin is just 650; almost 2,000 elk were counted there in the winter of 2005-06 (Table 9; WGFD 2006). The amount of hay fed per elk was very close to the long-term average, however, this value has been highly variable over the last decade (Figure 27). The amount fed per elk in the winters of 2001-02 and 2003-04 were much higher than average. This was because additional elk were present before and after classification counts were conducted, causing those values to appear higher than actual.

In the winter of 2006-07, feeding was initiated when WGFD personnel started feeding small amounts of hay December 26th (Figure 26). The last day of feeding was March 25th, resulting in a 91-day feeding season. During the official feedground count in February 2,845 elk were tallied (Table 9). While this number far exceeds the quota, put in place by the WGFC to guide management decisions on feedgrounds, the number of elk on each of the three Gros Ventre feedgrounds was highly variable through the feeding season. Out of the 91-day feeding season, supplemental feed was only put out at the Patrol Cabin site on 76 days (WGFD unpublished data).

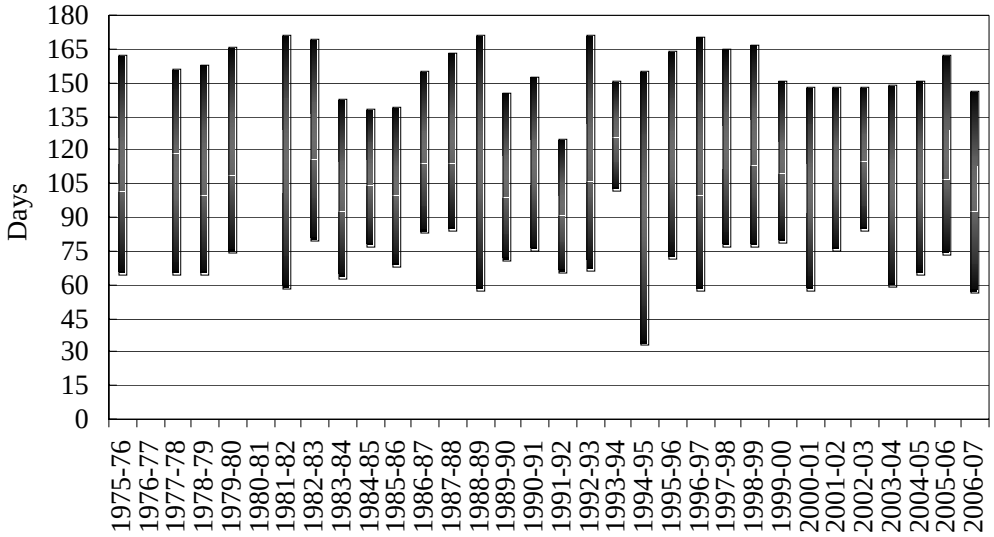

Figure 26. Beginning date, ending date, and days fed at Patrol Cabin feedground since 1975-76 (0 on y axis = 1 November; 180 on y axis ≈ 28 April).

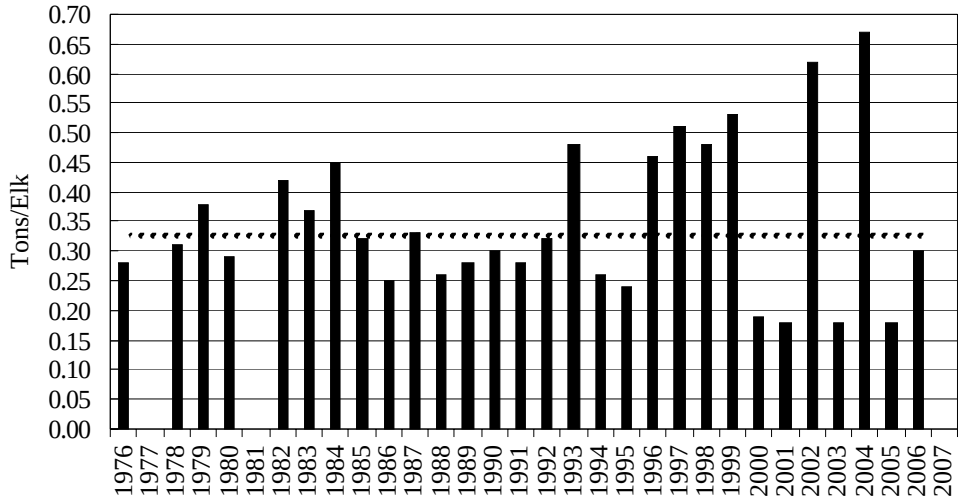

Figure 27. Maximum estimated tons of feed per elk per year at the Patrol Cabin feedground since 1975-76. The dashed line indicates the long-term average for this feedground. Values for the 2006-07 season have not yet been calculated.

Table 9. Summary data from the Patrol Cabin feedground since 1975-76.

YEAR	ELK #*	TONS	DAYS	DEAD	COST/ELK	TONS/ELK
1975-76	525	149	100	1	18	0.28
1976-77	0	0	0	0	0	0
1977-78	627	195	94	3	22	0.31
1978-79	594	226	96	5	24	0.38
1979-80	831	237	90	5	20	0.29
1980-81	0	0	0	0	0	0
1981-82	548	234	114	6	35	0.42
1982-83	342	126	90	2	34	0.37
1983-84	147	66	88	1	50	0.45
1984-85	240	76	64	2	35	0.32
1985-86	480	121	71	1	23	0.25
1986-87	300	100	74	2	33	0.33
1987-88	388	100	86	0	29	0.26
1988-89	1000	279	115	33	27	0.28
1989-90	538	163	80	0	37	0.3
1990-91	443	126	77	3	34	0.28
1991-92	808	262	66	3	36	0.32
1992-93	280	134	106	2	54	0.48
1993-94	477	123	50	0	30	0.26
1994-95	644	155	122	5	28	0.24
1995-96	477	221	73	1	52	0.46
1996-97	330	169	114	1	62	0.51
1997-98	281	134	92	0	73	0.48
1998-99	605	318	90	1	58	0.53
1999-00	2500^(2140)	466^	74	10	19^	0.19^
2000-01	2650^	483^	92	2	21^	0.18^
2001-02	2600^(823)	512^	90	27	86^	0.62^
2002-03	1200^(411)	74^	65	3	28^	0.18^
2003-04	1300^(379)	253	92	12	87^	0.67^
2004-05	1635	292	88	4	22	0.18
2005-06	1998	592	90	27	36	0.3
2006-07	2845	363	91	8	*	*
Average	448#	148#	82	5	33#	0.32#

Number in () indicates number counted when the elk were classified.

^ Wolves chased the elk between the three GV feedgrounds, altering values and making year-to-year comparisons difficult.

Average values only comprise the years prior to 1999-2000.

* Values not yet calculated. Based on feeders estimates of elk numbers through the season.

4. Fish Creek

In the winter of 2005-06, feeding was initiated on January 12 and continued until March 2, resulting in a 51-day feeding season (Figure 28). The feeding season length at Fish Creek had been on a downward trend over the last decade. The ending date has become substantially earlier in the spring. The ten-year average ending date for the decade ending with 2005-06 was March 21st; prior to 1996-97, the average ending date was a full 20 days later in the spring.

The Commission quota for Fish Creek is 1,000 elk; 548 animals were counted there in 2006 (Table 10). The amount of hay fed per elk in 2005-06 was close to the long-term average; this value was far below average for the five years preceding (Figure 29).

In the winter of 2006-07, feeding was officially initiated on December 28. The last day of feeding at Fish Creek was March 16th, resulting in a 79-day feeding season (Figure 28).

During the official feedground count, just 21 elk were counted (Table 10). This was because over 97% of the elk on supplemental feed in the Gros Ventre were at the Patrol Cabin feeding site on the day of the trend count. Feeders estimated 2,200 elk to be on the Fish Creek feedground in mid-January (WGFD unpublished data). The amount of hay fed at Fish Creek in the winter of 2006-07 was much higher than in past years (Table 10); all of the hay stored at Fish Creek was used. More hay was fed at Fish Creek this winter than at Patrol Cabin and Alkali combined. Mass movements of elk among the Gros Ventre feedgrounds has lead to highly variable attendance at each feedground over the last several years. Through the 79-day feeding season, hay was put out at Fish Creek on just 64 days (WGFD unpublished data).

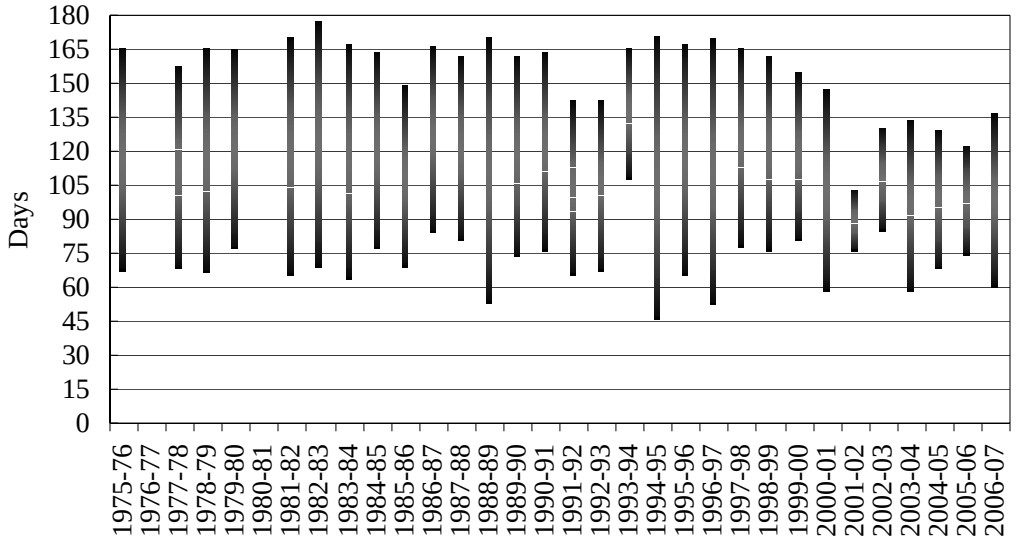

Figure 28. Beginning date, ending date, and days fed at Fish Creek feedground since 1975-76 (0 on y axis = 1 November; 180 on y axis ≈ 28 April).

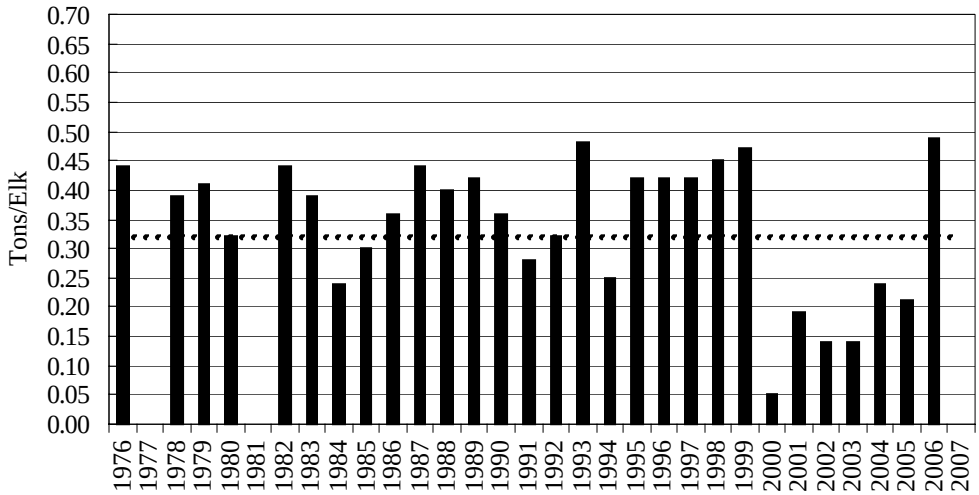

Figure 29. Maximum estimated tons of feed per elk per year at Fish Creek feedground since 1975-76. The dashed line indicates the long-term average for this feedground. Values for the 2006-07 season have not yet been calculated.

Table 10. Summary data from the Fish Creek feedground since 1975-76.

YEAR	ELK #*	TONS	DAYS	DEAD	COST/ELK	TONS/ELK
1975-76	580	253	106	4	28	0.44
1976-77	0	0	0	0	0	0
1977-78	759	294	94	6	26	0.39
1978-79	600	248	103	4	28	0.41
1979-80	634	204	90	5	24	0.32
1980-81	0	0	0	0	0	0
1981-82	827	361	109	7	35	0.44
1982-83	720	283	110	3	35	0.39
1983-84	1000	236	109	3	36	0.24
1984-85	875	264	77	5	29	0.3
1985-86	725	260	81	10	43	0.36
1986-87	600	261	89	3	41	0.44
1987-88	843	339	100	2	37	0.4
1988-89	1100	465	119	42	39	0.42
1989-90	961	348	93	3	41	0.36
1990-91	594	168	90	9	32	0.28
1991-92	153	49	81	3	36	0.32
1992-93	926	447	109	8	54	0.48
1993-94	230	58	60	0	30	0.25
1994-95	1135	481	127	4	46	0.42
1995-96	913	383	106	6	52	0.42
1996-97	1130	475	120	45	47	0.42
1997-98	729	326	92	8	66	0.45
1998-99	781	369	87	6	53	0.47
1999-00	1500^(276)	80^	82	1	8^	0.05^
2000-01	2000^(0)	372^	91	2	22^	0.19^
2001-02	610^	84^	29	6	18^	0.14^
2002-03	134^	20^	48	1	36^	0.15^
2003-04	1246	297	79	2	29	0.24
2004-05	1306	276	64	4	26	0.21
2005-06	548	270	50	19	62	0.49
2006-07	21	460	79	19	*	*
Average	697#	270#	84	7	35#	0.35#

Number in () indicates number counted when the elk were classified.

^ Wolves chased the elk between the three GV feedgrounds, altering values and making year-to-year comparisons difficult.

Average values only comprise the years prior to 1999-2000.

* Values not yet calculated. Based on feeders estimates of elk numbers through the season.

B. Feedground Operational Goals

On April 2, 1997, the Director of the WGFD issued a statement identifying feedground management goals:

1. Provide nutritional supplement to wintering elk that frequent elk feedgrounds
2. Prevent where possible, the commingling of elk on cattle and horse feedlines
3. Control brucellosis within elk on feedgrounds by vaccination
4. Minimize other damage conflicts on private lands

These directives do not differ from the Jackson-Pinedale Region's long-term goals. Long-term objectives are to supplement the winter diet of elk in a manner that prevents excessive starvation,

reduces risk of disease transmission to domestic livestock, and/or helps prevent damage to private property. Concurrently while accomplishing these objectives, opportunities to minimize the dependency of elk on supplemental feed have been taken.

Several management decisions must be made annually on each feedground. Depending on the situation, some decisions may be implemented and others may not. Some are in direct contrast with others; those given preference depend upon individual situations. The following are issues that should be considered at each feedground.

1. Can the dependency of elk on supplemental feed be reduced? Even though other issues may be given preference, reducing the dependency on feedgrounds should be considered when making all decisions regarding the operation of the feedgrounds. Reducing the length of the feeding season may reduce the spread of disease and will reduce feeding costs.
2. Does the feedground assist in preventing damage/commingling? Feeding elk is an effective method of keeping elk off of private property.
3. What can be done to keep feedground operating costs as low as possible? The amount of hay fed (influenced primarily by amount fed daily and the length of the feeding season) represents most of the cost to the feedground program. Any reduction in the amount of hay fed decreases the cost of the program.
4. How to feed in a manner that provides the most sanitary conditions? This usually involves keeping the feedgrounds as large as possible and feeding on fresh snow as much as possible.
5. Attempt to feed just enough to keep the elk in good body condition, but not low enough to compromise damage concerns. This level of feeding is less than what the elk can and will consume if offered more. Feeding should not be adjusted to attempt to keep old and/or crippled elk alive. A good rule of thumb is to feed enough to keep calves healthy for the first part of the winter, and then feed enough to keep pregnant cows in good nutritional condition during the later part of the winter. It is these two age groups (calves on the feedground and those that will be born in the spring) that are most susceptible to reduced nutrient intake.
6. Attempt to feed at rate that will satisfy the elk's appetite when the potential damage problems exist. This feeding rate is basically feeding "all they will eat" and is in excess of the physiological need of the animals, but the additional feed will keep the elk from wandering in search of more food (thus reducing the possibility of causing damage).

C. **Feedground Operational Plans** (Revised March 2001)

The Jackson EHU includes the three Gros Ventre feedgrounds and the National Elk Refuge (not operated by the WGFD). As a group, these four feedgrounds are the most intensively scrutinized of all the feedgrounds. Their proximity to Jackson, where interests in wildlife/public lands is varied and strong, coupled with wolves and the perception that regular supplemental feeding on these feedgrounds is not necessary, makes the management of these feedgrounds more sensitive.

The three feedgrounds located in the Gros Ventre are operated by the WGFD. This area is known for its mild winters and capability of sustaining free-ranging ungulates during the winter months. Because of the abundance of wildlife and its close proximity to Jackson, it is also a popular area for snowmachining. Should the NPS restrict snowmachine use in YNP, as proposed, the traffic in the Gros Ventre could increase dramatically. This could result in increased management problems, particularly at the Patrol Cabin feedground.

Alkali

The Alkali feedground is on USFS property near the Red Rock Ranch. This proximity to private property can be both beneficial (when the feedground keeps elk off of private land) and detrimental (keeping elk off of private land, but close to it). Also, it is small in size and is on rough terrain with very little flat area on which to feed. Commission quotas allow a maximum of 800 elk at this site.

Primary Management Issues

1. Elk that are not attracted to the feedground and kept there in the early winter pose a threat to cause damage at the Red Rock Ranch.
2. Wolf harassment of elk significantly increases the risk of elk commingling with domestic livestock, damaging stored crops, and/or moving to other feedgrounds.

Secondary Management Issues

1. Considerable amounts of winter range go unused each winter that could support additional elk.
2. Bighorn sheep utilize nearby areas and large numbers of free-ranging elk on these areas could create significant competition for these sheep.
3. Elk that migrate below the Alkali area could ultimately end up on one of three livestock operations located below the Red Rock Ranch or go to the NER.
4. Large numbers of elk on this feedground are not desirable because of the size and nature of the feeding site.

Management Suggestions/Criteria

1. Initiation of feeding is based on the location and activity of elk. Feeding should be initiated before the elk that migrate to the Alkali feedground leave the area and go on to the Red Rock Ranch. This will require frequent monitoring. Should livestock not be fed at this Ranch and stored crops protected with elk-proof fencing, then the initiation of feeding would depend on secondary management issues. In this case, the initiation of feeding could be delayed and the possibility of encouraging free-ranging elk could be weighed against the other secondary concerns. This would involve input from the Warden and Biologists.
2. Terminating feeding is also driven by concerns of feedground elk commingling with livestock at the Red Rock Ranch. Feeding will be terminated when enough country is free of snow and adequate residual and/or new growth is available for the feedground elk once they begin leaving the feedground. When about one half of the elk have left for about 5 consecutive days in the spring, feeding may be terminated to encourage the remainder to leave if conditions appear that these elk will not move on to the Red Rock Ranch.
3. Put in a maximum amount of hay in case extra elk winter at this site.

Patrol Cabin

The Patrol Cabin site is one of the most desirable of all feedgrounds. This feedground sits on Game and Fish property, has living facilities for feeders, and is located in an area where snow depths are normally low and, therefore, more native range is available during the winter. Commission quotas allow 650 elk to be fed.

Primary Management Issues

1. The main concern regarding elk feeding at this site is timing the initiation of feeding so that the elk are evenly distributed among the three Gros Ventre feedgrounds.
2. Wolf harassment of elk may result in large numbers of elk wintering at this location. The feedground is not large enough to support many more elk than the Commission quota (650 elk). Elk numbers in excess of this begin compromising sanitary conditions for feeding.

Secondary Management Issues

1. The opportunity to reduce the length of feeding season exists here, particularly the termination of feeding in the spring of the year.
2. The snowmachine trail runs across the northern part of the feedground. This is normally not a problem, but should large numbers of elk winter on this feedground, the snowmachine activity will reduce the area available for feeding.
3. Private property exists about one mile to the east of the feedground. Damage and commingling are not presently a concern because livestock are not being kept there and there is a minimal amount of stored crops. However, this could quickly change and should be monitored.

Management Suggestions/Criteria

1. Extra hay needs to be stored at this feedground to feed additional elk that may arrive after being displaced from native ranges or other feedgrounds.
2. Feeding should start when 200-400 elk spend several days on or near the feedground. The elk need to be allowed to use the native ranges as much as possible, but need to be fed before they begin moving down drainage to Alkali.
3. Feeding should be terminated when the elk begin trailing to the native range to the north of the feedground in the spring and do not return for 3-5 days. When the daily hay consumption drops off to about half of the amount fed during the winter, the feeder can initiate additional reductions to encourage the elk to leave.
4. When horses are moved to the Gros Ventre depends on who is feeding and the situation. If someone is staying at the Cabin prior to feeding, horses may be brought in while truck/trailer can still access the area. If no one is staying at the Cabin, horses can be led in just prior to elk feeding.

Fish Creek

Fish Creek is the best location in the Gros Ventre for feeding large numbers of elk. This feedground is operated on USFS property and is located about 5 miles above the Patrol Cabin feedground on the Gros Ventre River. However, because escape cover does not exist within a mile of the feedground, these elk will readily leave if disturbed and move to the Patrol Cabin feedground. It appears that elk migrating down drainage to other feedgrounds (including the NER) pass near this feedground. If feeding is started too soon, elk that would normally move to other feedgrounds could be held. On the other hand, if the initiation of feeding is delayed too long, then excessive elk may eventually end up on other feedgrounds. The Commission quota allows for 1,000 elk.

Primary Management Issues

1. Time the initiation of feeding to aid in equal dispersal of elk on the three feedgrounds.
2. The effects that wolves may have on these elk may have a significant influence on how this feedground is managed.

Secondary Management Issues

1. Private property is near to this feedground to both the north and south. Should livestock be fed at any of these locations during the winter, starting and stopping dates for feeding elk may have to be altered. Horses are fed on some private property generally from the time elk feeding starts until as late as mid-February (depending on their hay supply). The initiation of elk feeding partially depends on whether elk are causing damage on the nearby private holdings.

Management Suggestions/Criteria

1. Store a maximum amount of hay at this site in case wolves alter the distribution of elk, causing extra elk winter at this site.
2. Initiate feeding after 200-400 elk spend several days in the immediate area or if elk that have spent some time in the area are moving back and forth to Cottonwood Creek.
3. On years of heavy snowfall, feeding should begin before snow depths preclude the ability of horses to pull the sleigh.
4. The initiation of feeding also needs to consider elk distribution at the three Gros Ventre feedgrounds. Feeding too early can retain large numbers of elk at Fish Creek. Feeding too late can result in too many elk at the other two feedgrounds.
5. Feeding normally is terminated at Fish Creek in the spring a few days later than the other Gros Ventre feedgrounds because the snow is slower in leaving at this location. Feeding can be terminated when the elk begin leaving the feedground for native range and do not return for 2-3 days. When the daily hay consumption drops off to about half of what was fed during the winter, the feeder can begin to initiate further reductions in the amount fed to encourage them to leave.

D. Feeding on the National Elk Refuge

According to the 1974 Memorandum of Understanding between the USFWS-NER and WGFD, bi-weekly inspections of forage conditions and elk distribution take place on the NER. Biologists from each agency jointly evaluate forage use, elk numbers, distribution and climatic conditions to decide if and when to start supplemental feeding, and when to end supplemental feeding.

Elk are fed fewer days each winter at the NER than at state-operated feedgrounds. The feeding season on the NER has averaged about 72 days since 1981-82 (Figure 30). The longest feeding season on the NER in that time period was the winter of 1988-89 when elk were fed from December 7th to April 8th (122 days). Elk are fed alfalfa in pelleted form, rather than long hay as on the state-operated feedgrounds. The NER also makes a management priority of enhancing forage quantity and quality on Refuge lands in order to minimize feeding duration.

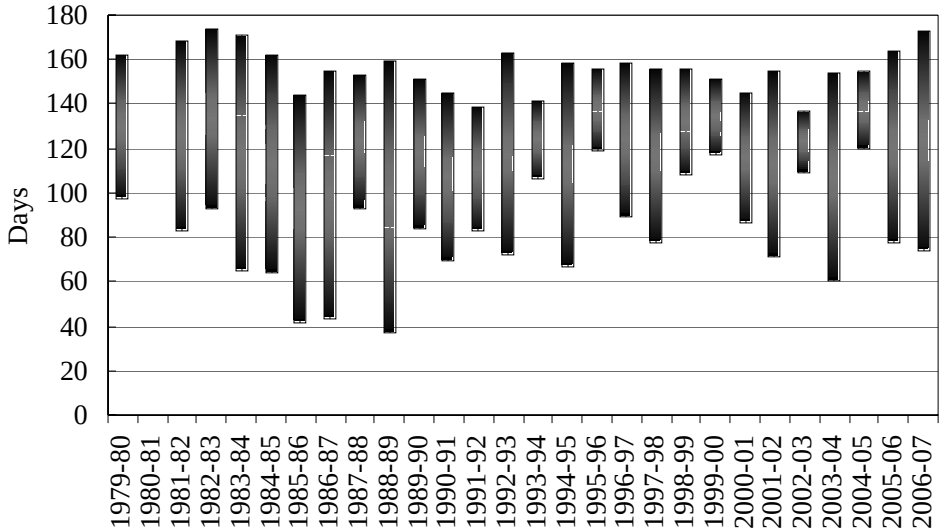

Figure 30. Beginning date, ending date, and days fed on the NER since 1979-80 (0 on y axis = 1 November; 180 on y axis ≈ 28 April).

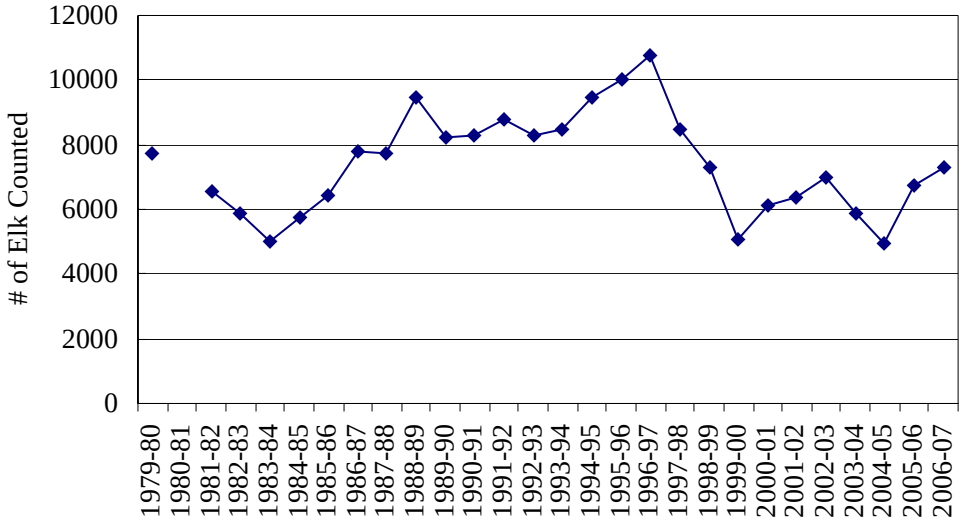

Figure 31. Number of elk counted on feedlines at the NER since 1979-80. (No supplemental feeding took place in the winter of 1980-81.)

E. Brucellosis Management Summary

1.Vaccination

Patrol Cabin and Alkali feedgrounds were first vaccinated in 1991; vaccination was initiated at Fish Creek in 1993. A total of 6,803 doses of vaccine have been administered on the three Gros Ventre feedgrounds since vaccination efforts have been established in the area.

Strain 19 vaccination on the Gros Ventre feedgrounds was modified somewhat in the winter of 2006. A total of 394 juveniles were vaccinated, out of 408 classified (97% coverage) throughout the entire Gros Ventre feedground system (Table 11). Vaccination efforts occurred on Patrol Cabin exclusively and were completed by early March. Over the last few years, elk have been grouping together on 1-2 feedgrounds, rather than remaining mostly evenly distributed among the three sites. These stochastic movements have made vaccination efforts complicated.

Vaccination on the Gros Ventre feedgrounds in 2007 was implemented over the first two weeks of March. Late arriving vaccine forced the vaccination program to begin later than optimal. Mild spring conditions along with the late-arriving vaccine resulted in low coverage at many feedgrounds; the Gros Ventre feedgrounds were no exception. Five hundred twenty-three calves were counted during classifications on the Gros Ventre feedgrounds, and approximately 350 doses of vaccine were administered (Table 11).

A total of 3,688 elk (3,076 calves and 612 cows) have been vaccinated on the NER to date. However, no elk vaccination occurred on the NER in 2007. WGFD personnel acclimated elk to the vaccine equipment over the course of a week in early March. This long acclimation period was necessary because of warm spring conditions, almost no snow cover, and low tolerance for the vaccination equipment on the part of the elk. By the time feeding terminated on the NER, a sufficient supply of vaccine had not yet arrived. Feeding on the NER, for 2007, was terminated on 21 March.

In the winter of 2006, however, excellent coverage with Strain 19 was accomplished on the NER (Table 11). Just one day was needed to acclimate elk to the firing of the paintball guns and biobullet rifles. Elk were vaccinated at the Poverty Flats, Nowlin, and the Shop feeding sites over a 25-day period. A total of 909 juveniles were vaccinated out of 920 classified (99% coverage), with an average of 20 elk vaccinated per day (range= 0-152).

Vaccine was first administered to elk on the NER during 1989-91 on an experimental basis. In 2002, an Environmental Assessment was written due to a settlement agreement entered into between the USFWS and the State of Wyoming in the case of Wyoming v. United States et al., in which the USFWS agreed to prepare a compatibility determination concerning Wyoming's proposed elk vaccination program for the NER. The USFWS determined Wyoming's proposed vaccination program to have "No Significant Impact", thus the decision was made to allow the WGFD to initiate the vaccination program during the 2003 winter feeding season. This decision did not, however, bind the agencies to a similar decision through the process of the BEMP-EIS that was completed by GTNP and the NER in 2007. The BEMP-EIS preferred alternative states that WGFD would be permitted to vaccinate elk for brucellosis on the NER as long as it is logistically feasible, but NER management actions would not be specifically designed to facilitate vaccination.

Table 11. Summary of vaccination for Jackson EHU feedgrounds, 2000-2007.

		Classification			Calves Vaccinated	
Year	Feedground	Calves	Females	Total Elk	Number	% of Classified*
2000	Alkali	3	27	40		
2000	Patrol Cabin	418	1565	2140	491[φ]	>100%
2000	Fish Creek	49	193	276		
2000	NER	950	3823	5463	0	N/A
2001	Alkali	0	0	0		
2001	Patrol Cabin	559	1974	2651	193[Ψ]	>100%
2001	Fish Creek	0	0	0	394[Ψ]	>100%
2001	NER	959	3984	6128	0	N/A
2002	Alkali	52	1082	1188	95	>100%
2002	Patrol Cabin	134	637	823	323	>100%
2002	Fish Creek	119	431	610		
2002	NER	818	4064	6366	0	N/A
2003	Alkali	190	1307	1663	259[$]	84%
2003	Patrol Cabin	118	581	716		
2003	Fish Creek	7	119	140		
2003	NER	793	4908	6992	238, 400[#]	11%
2004	Alkali	214	899	1214	405	81%
2004	Patrol Cabin	49	313	379		
2004	Fish Creek	236	905	1246		
2004	NER	717	3827	5876	808,1324[#]	47%
2005	Alkali	0	0	0	0[Ω]	
2005	Patrol Cabin	332	1266	1635	153	
2005	Fish Creek	339	864	1306	455	91%
2005	NER	576	3847	4969	507	88%
2006	Alkali					
2006	Patrol Cabin	408^	2524^	3217^	394[^]	97%
2006	Fish Creek					
2006	NER	920	4521	6730	909	99%
2007	Alkali	9	35	55		
2007	Patrol Cabin	514	2261	2845	350^	67%
2007	Fish Creek	0	0	21		
2007	NER	1194	4632	7279	0	0

* >100% coverage suggests some yearlings may have received S19 dose.

[φ] Following classifications all elk moved to Patrol Cabin and were vaccinated.

[Ψ] Following classifications ~ 700 elk left the Patrol Cabin; calves were then vaccinated at Fish Creek.

[$] Following classifications, elk left Fish Creek and calves were vaccinated at Alkali / Patrol Cabin.

[#] Both calves and adult females on the NER were vaccinated.

[Ω] Elk did not use Alkali feedground.

[^] Includes Fish Creek, Patrol Cabin, and Alkali feedgrounds.

2. Serology

Seroprevalence is determined by use of four tests as determined by APHIS (1998). The following four tests are used to determine if an animal is seropositive: 1) Card test, 2) Standard plate agglutination (SPT) test, 3) Complement-fixation (CF) test, and 4) Rivanol test. An animal is considered "seropositive" if 1) either two or more tests react at certain dilution rates, or 2) if the CF test alone shows a reaction at a dilution rate of 2+ 1:20 or higher. The criteria used to determine what is called a positive reactor (positive) for the four serology tests is as follows: 1) Card – positive or negative (no dilution), 2) SPT - 1:100 dilution or greater, 3) CF - 2+ 1:20 dilution or greater, 4) Rivanol - 1:25 dilution or greater.

Once serostatus is determined using the four standard tests, another test called cELISA (competitive enzyme-linked immunosorbent assay) is conducted on seropositive animals to differentiate between Strain 19 vaccine and field strain *Brucella abortus* (Van Houten et al. 2003). Killing the animal(s) and culturing Brucella from host tissues determines actual infection.

a. Feedground Serology

The WGFD initiated brucellosis surveillance of elk on the Greys River feedground and NER in 1971 to monitor the distribution and prevalence of the disease. Currently, BFH and other WGFD personnel trap, bleed, and test elk on 4 to 6 feedgrounds annually. Several thousand (4,531) yearling and adult female elk trapped on 21 different feedgrounds have been tested to date (post-winter 2006-07).

Dell Creek feedground is the only state-operated feedground where elk vaccination is not conducted. Distribution data of elk from this feedground suggest little interchange with surrounding feedgrounds, thus providing a suitable control to compare elk vaccination efficacy with other feedgrounds. Brucellosis surveillance was initiated on Dell Creek in 1989, and has since been conducted from 1998-2006. Serology data using cELISA indicate *Brucella* seroprevalence averages 29% (+/- 13.8) on Dell Creek, and has fluctuated from 8% in 2004 to 50% in 1999. More data are needed to more accurately assess efficacy of the Strain 19 vaccination program. BFH personnel of WGFD are currently developing a proposal for a 1 to 2 year study of abortion rates in vaccinated (Greys River) and unvaccinated (Dell Creek) elk by use of vaginal-implanted radio transmitters.

Surveillance on feedgrounds in the Jackson EHU typically occurs January through March. Based on cELISA and multiple years of data, seroprevalence levels range from 17% to 42% on state-operated feedgrounds in the Gros Ventre (Table 15). Likewise, seroprevalence on the NER is estimated to be 16% based on cELISA testing since 1997. Caution must be exercised when considering seroprevalence data; often the sample size obtained is below what is needed for even an 85% confidence level.

Table 14. Number of yearling, adult, total female, and % seroprevalence of elk tested on the Jackson EHU feedgrounds as determined by 4 standard tests and cELISA.

		# Tested			% Seroprevalence	
Feedground	**Year**	**Yearling**	**Adult**	**Total**	**4 Standard**	**cELISA**
Alkali	1990	8	108	116	26	*
-	1992	6	65	71	37	*
-	1999	1	47	48	25	13
-	2002	0	6	6	67	50[$]
-	**Sum**	**15**	**226**	**241**	**30**	**17**
Patrol Cabin	2002	0	13	13	38	39[$]
-	2003	0	6	6	50	50[$]
-	**Sum**	**0**	**19**	**19**	**42**	**42**
Fish Creek	1976	0	10	10	60	*
NER	1971	9	82	91	35	*
-	1972	11	37	48	46	*
-	1973	7	70	77	51	*
-	1974	11	106	117	47	*
-	1975	9	82	91	47	*
-	1976	4	102	106	34	*
-	1977	0	15	15	33	*
-	1978	5	179	184	46	*
-	1979	14	113	127	34	*
-	1980	4	72	76	18	*
-	1982	14	114	128	23	*
-	1985	3	10	13	23	*
-	1988	6	44	50	44	*
-	1990	6	30	36	28	*
-	1993	0	38	38	32	*
-	1995	7	10	17	41	*
-	1996	10	49	59	36	*
-	1997	5	25	30	20	13
-	1998	18	60	78	40	15
-	1999	6	33	39	23	13
-	2001	1	13	14	7	7[$]
-	2002	18	37	55	24	18
-	2003	7	16	23	17	17[$]
-	2004	1	4	5	20	20[$]
-	2005	2	8	10	50	50[$]
-	2006	2	24	26	19	19[$]
-	2007	0	17	17	12	12[$]
	Sum	**180**	**1,390**	**1,570**	**35**	**16**

* cELISA test not conducted

[$] statistically invalid n- listed seroprevalence is not an accurate reflection of the population

b. Hunter Surveillance and other Research Projects

In addition to trapping elk on feedgrounds, WGFD has conducted surveillance on hunter-killed elk in the fall and early winter, and non-feedground elk captured as part of research projects. The best sample sizes are from the most recent two years of hunting. In the fall of 2006, 151 useable blood samples from cow elk were obtained from primarily GTNP and NER hunters; 21 of those were seropositive for a seroprevalence of 14%. In the fall of 2005, 111 blood samples from hunter-killed cow elk were tested, with 20 positive (18%). Additional data are available from all ages and both sexes of elk (Table 12), however, knowing the serology of adult cows is most useful because they could potentially transmit the bacteria.

Table 12. Brucellosis status of hunter-killed elk (*all ages, both sexes*) from the Jackson EHU, 1998-2006. Samples potentially acquired September-January.

Year	# Tested	# Positive	% Positive
1998	4	0	0
1999	9	0	0
2000	10	0	0
2001	7	0	0
2002	2	1	50
2003	0	-	-
2004	0	-	-
2005	170	25	14.7
2006	176	27	15.3
Total	**378**	**53**	**14.0**

Because elk wintering in the Buffalo Valley typically spend the winters away from feedgrounds, seroprevalence data from hunter-killed elk in HAs 70 and 81 are separated from the rest of the Jackson EHU. Since 1987, three samples from hunter-killed elk have tested positive, for a total seroprevalence of 3.4% (Table 13). Hunting seasons in the Buffalo Valley have tended to run much later than many HAs, in order to remove additional elk that would otherwise create damage/commingling situations on private land. Thus, samples could have been taken as late as January in several years.

Table 13. Brucellosis status of hunter-killed elk (all ages, both sexes) from the Buffalo Valley (HAs 70 and 81), 1987-2005. Samples potentially acquired October-January.

Year	# Positive	# Sampled	% Positive
1987	0	10	0
1988	0	4	0
1998	1	19	5.3
1999	0	3	0
2000	0	6	0
2001	0	12	0
2004	1	9	11.1
2005	0	12	0
Total	**3**	**87**	**3.4**

WGFD also is currently cooperating with researchers from Iowa State University on a study of elk parturition site selection. As part of that project, 73 different cow elk, wintering in the Buffalo Valley, were captured and tested for brucellosis in February of 2006 and January of 2007. Nine of those animals tested positive for brucellosis, for seroprevalence of 12%.

3. Prevention of Elk/Cattle Commingling

Annually, WGFD personnel employ a variety of damage control techniques to maintain spatial and temporal separation of elk and cattle. The WGFD has a long-standing practice of providing game-proof stackyard fencing to private producers to prevent elk from depredating privately owned stored hay crops and to discourage elk from frequenting cattle feeding areas. By preventing elk from establishing feeding patterns in cattle wintering areas, the potential for interspecific brucellosis transmission may be diminished.

a. Stackyards

Since 1992, elk-proof fencing materials for 177 haystacks (as of August 2006) have been provided by WGFD personnel to cattle producers in Lincoln, Sublette, and Teton counties in western Wyoming. Since 2000, WGFD personnel have distributed materials for at least five permanent stackyards in the Jackson EHU. Currently, all known stackyards in the Jackson EHU are fenced that are associated with test-eligible cattle with the potential for commingling.

b. Hazing/Hunting

In some instances, elk are hazed from cattle feeding sites. These animals are removed from areas of conflict via snowmobiles or aircraft to WGFD feedgrounds or winter range areas. In other cases, when the aforementioned management actions fail to achieve desired results, special depredation hunting seasons or kill permits are employed to remove problem animals (Appendix 2, Section B-1).

c. Elk Parturition Overlap with Public Grazing Allotments

Although the Wyoming Livestock Board (WLB 2006) recently defined the "period of exposure" for cattle as 1 January to 1 May, *Brucella*-induced abortion events in captive and feedground elk have been documented from late February to June (Thorne et al. 1991, Roffe et al. 2004, WGFD unpublished data). Additionally, public grazing allotments where cattle and feedground elk are present during the latter stages (i.e., May and June; Roffe et al. 2004) of the transmission period may provide conditions for interspecific transmission. Ongoing research on elk parturition selection patterns (section E-2, *above*) should further refine WGFD parturition maps, thus guiding management actions taken to prevent elk and cattle overlap during periods of high transmission risk. Preliminary data (from year 1 of a multi-year project) show that some elk have been calving as late as July. Thus, while turning cattle out on public land after the period of high transmission risk is beneficial, there is no specific date that can be designated as absolutely safe.

Since 1999, BFH personnel have monitored areas where designated elk parturition ranges overlap with public grazing allotments that "turn on" prior to June 15th (Figure 32). During the elk calving period from late May to mid June, an elevated risk of brucellosis transmission to cattle on overlapping ranges exists. Twelve public land grazing allotments in 3 counties have been identified as potential risk areas. Eleven of 12 risk areas showed no elk/cattle interaction from 1999-2006. Within the Jackson EHU, there are four allotments (Burro Hill, Pacific Creek-GTNP and BTNF, Upper Gros Ventre, Big Cow Creek) that overlap spatially with designated elk parturition ranges. Two of these grazing allotments have turn-out dates of June 15th or later. On the remaining allotments, WGFD personnel have observed elk in the vicinity of cattle during monitoring activities. Coordination and education efforts with land managers and grazing operators have been initiated to resolve elk/cattle interaction.

4. Biological Control - Scavenging

Several WGFD personnel working with feedgrounds have suggested that retaining viable populations of scavengers on and adjacent to feedgrounds may increase the scavenging rate of aborted fetuses. Ultimately, this "biological control" likely reduces the risk of intra-specific transmission of brucellosis. In March 2005, 6 pseudo-aborted fetuses and respective placentas (hereafter termed fetal unit) were placed on Franz feedground to determine how quickly fetal units were removed from the feedground. During this study, fetal units were removed from 3.33hr to 24hr ($\bar{x}$ = 14.9hr) after placement on the feedground; coyotes and eagles were considered the primary scavengers. In March and April 2006, 29 fetal units were distributed among and placed on Franz, Soda Lake, Muddy Creek, and Alpine feedgrounds, and 4 fetal units were place in Buffalo Valley (non-feedground), northeast of Jackson. Mean scavenging rate on the feedgrounds was 18.99hr vs. 33.37hr in Buffalo Valley, suggesting that scavengers are actively selecting feedgrounds as feeding sites and likely reducing risk of intra-specific transmission of brucellosis. Coyotes and eagles were again identified as primary scavengers with the addition of foxes. Based on the results of these two studies, scavengers are likely a viable form of biological control for brucellosis. Control of scavengers on and adjacent to feedgrounds should be prevented.

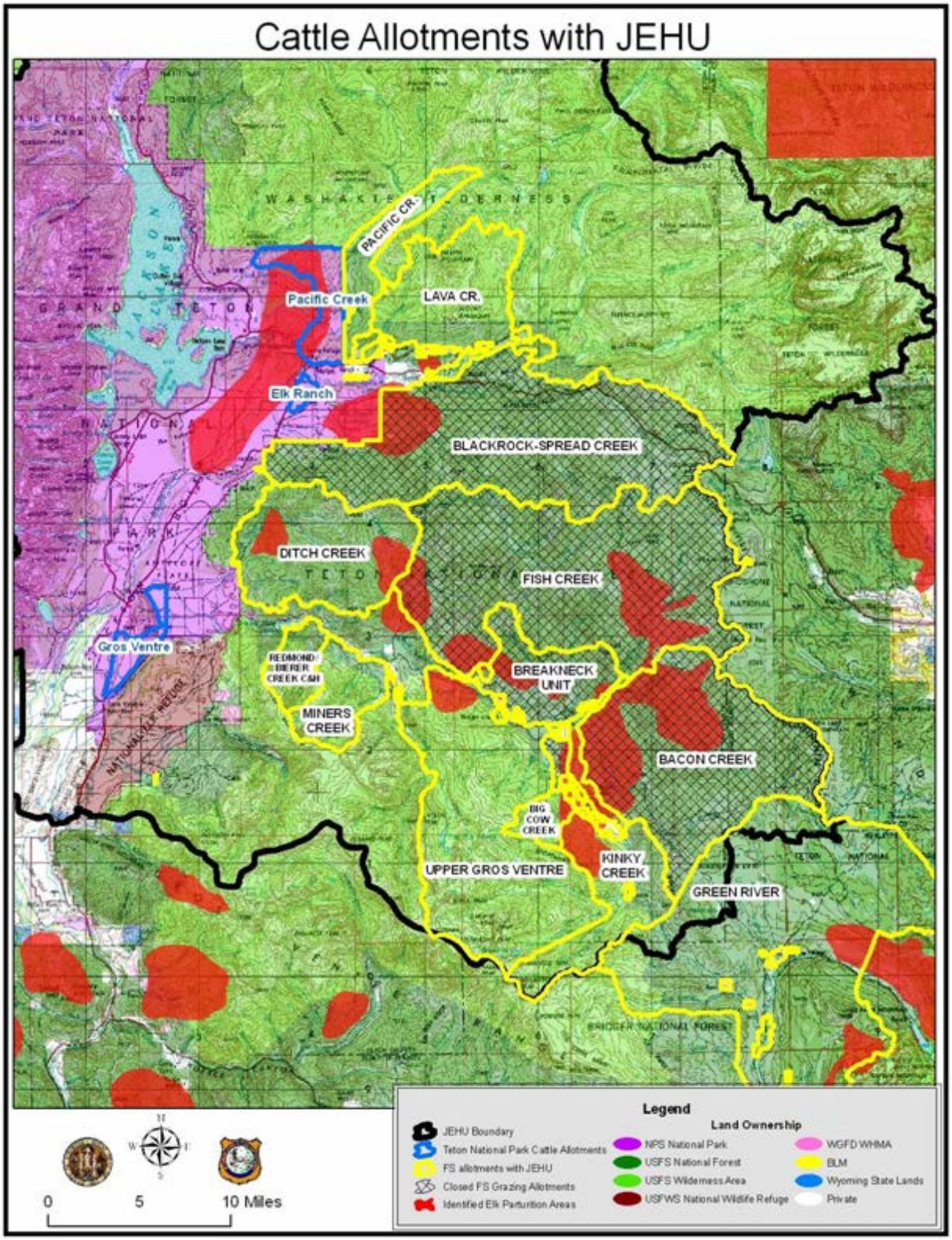

Figure 32. Elk parturition areas as currently designated by WGFD and public-land grazing allotments in the Jackson EHU.

F. Literature Cited

Animal & Plant Health Inspection Service. 1998. Brucellosis in *Cervidae*: Uniform Methods and Rules, Effective September 30, 1998. APHIS 91-45-12.

Roffe, T.J., L.C. Jones, K. Coffin, M.L. Drew, S.J. Sweeny, S.D. Hagius, P.H. Elzer, and D. Davis. 2004. Efficacy of single calfhood vaccination of elk with *Brucella abortus* strain 19. Journal of Wildlife Management 68:830-836.

Thorne, .E.T., J.K. Morton, and F.M. Blunt. 1991. Brucellosis vaccination of free-ranging elk (*Cervus elaphus*) on western Wyoming feedgrounds. Pages 107-112 *in* R.D. Brown, editor. The biology of deer. Springer-Verlag, New York, New York, USA.

United States Fish and Wildlife Service, and National Park Service. 2007. Final bison and elk management plan and environmental impact statement for the National Elk Refuge/ Grand Teton National Park/ John D. Rockefeller, Jr., Memorial Parkway. http://www.fws.gov/bisonandelkplan. Accessed 2007 April 6.

Van Houten, C.K., E.L. Belden, T.J. Kreeger, E.S. Williams, W.H. Edwards, E.T. Thorne, W.E. Cook, and K.W. Mills. 2003. Validation of a Brucella abortus competitive enzyme-linked immunosorbent assay for use in Rocky Mountain elk (*Cervus elaphus nelsoni*). Journal of Wildlife Diseases 39: 316-322.

Wyoming Game and Fish Department. 2006. Annual Big Game Herd Unit Job Completion Report (2005) for the Jackson Elk Herd Unit (E106), Jackson/Pinedale Region. Cheyenne, Wyoming, USA.

———. 2004. Annual Feedground Report, 2003-2004. Cheyenne, Wyoming, USA.

Wyoming Livestock Board. 2006. Brucellosis exposure policy. Memorandum 06-BRC-0007.

Jackson EHU BMAP
Appendix 4
Habitat Management

A. Feedground Habitat Assessment

In 2006, WGFD personnel in the Jackson-Pinedale Region undertook an assessment of the feedground program's effects on habitat. Director Cleveland requested a qualitative assessment of habitat conditions on and adjacent to elk feedgrounds in western Wyoming. Each of the next three sections are excerpted from that project. The first two sections (*Factors Affecting Vegetative Change on Feedgrounds, General Assessment of Vegetative Change Associated with Feedgrounds)* apply to the entire supplemental elk-feeding program. The third section *(Gros Ventre Feedground Habitat Assessment)* was written specifically for the state-operated feedgrounds of the Jackson EHU.

1. Factors Affecting Vegetative Change on Feedgrounds (excerpt, WGFD 2006)

WGFD feeds between 14,000 and 17,000 elk at 22 different locations each winter. Concentrating large numbers of elk on relatively small areas for 70 to 180 days each winter causes vegetative changes to those areas receiving heavy use. The effect that feedground elk have on vegetation (e.g., browse use, species richness/diversity) is dependent on several factors (listed below).

a. Vegetation type present prior to the establishment of the feedground

Feedgrounds established on land under cultivation (e.g., hay meadows) have little, if any, vegetation changes occurring on the feedground proper, although changes typically occur to adjacent areas. Feeding sites in areas dominated by woody plant species show the greatest change.

b. Snow depths

Snow depths at some feedgrounds affect vegetation change. Deep snow can restrict elk movements, limiting the size of the area used/inhabited by elk during the winter. Vegetation that is accessible to elk during winter feeding can receive heavy utilization. However, deep snow may protect low growth forms of native shrubs and herbaceous plant species on and near feeding sites.

c. Density of elk on the feedground

Feedgrounds concentrate populations of elk (250 to ≥ 1000 animals) on feeding areas varying from 15 acres (Muddy Creek) to 145 acres (South Park) during a substantial portion (90 days to 160 days) of the winter. High numbers and/or densities of elk typically impact vegetation change on the feedground proper more than areas surrounding the feedground.

d. Productivity of the site

This is related to vegetation present at the site. Again, feedgrounds established on land under cultivation (e.g., hay meadows) have little, if any, vegetation changes occurring on the feedground proper, although changes typically occur to adjacent areas.

Feeding and loafing areas on shallow soils and/or dry south slopes are more susceptible to loss of native shrubs and invasion of weeds than are those on more productive sites.

e. Length of the feeding season

Promoting elk to free range by delaying feeding in the early winter and/or terminating feeding early in the spring increases the use on areas near the feedgrounds. Implementation of broad-scale habitat enhancement projects adjacent to feedgrounds can reduce this impact.

f. Total years a site has been used as a feedground

Vegetation change occurs with each successive year that a site is used. The vegetation that is present (e.g., grasses, forbs) may not be affected by the additional use, or may be over-utilized (e.g., shrubs), resulting in plant death. Palatable tree species such as aspen and cottonwood often survive if established in larger (≥ 10ft) growth forms. Young sprouts (i.e., suckers) of these species often receive heavy utilization and either do not survive or form stunted, "hedged" growth forms.

2. General Assessment of Vegetative Change Associated with Feedgrounds (excerpt, WGFD 2006)

Feedground elk foraging/behavior patterns and subsequent vegetative changes can be grouped into general categories (listed below).

a. Feeding area

This is the area where hay is spread and varies from 15 acres at Muddy Creek to 145 acres at South Park. A total of 1,258 acres are used for this purpose, or an average of 57 acres per feedground. Commonly, most native herbaceous and woody species are replaced by introduced perennial grass species. Plant species diversity may be limited to a single grass species. Some feedgrounds, particularly those with deep snow conditions and/or large feeding areas, may retain many native species.

Grass production in these areas is generally much greater than was present before the establishment of the feedground and provides large quantities of forage. Some of these sites (South Park, Camp Creek, Greys River) are productive enough that the WGFD has harvested hay in previous years. Production of 2,000 to 6,000 lbs of forage per acre (1-3 ton per acre) is common on areas where elk have been fed and the vegetation converted into a grass type. The large amount of grass production commonly serves as an attractant to cattle grazing.

b. Waste areas

These are areas where large amounts of manure collect and/or vehicle travel has disturbed the area to the point that no vegetation or only weedy species are present. The depth of manure can increase to the point that precludes plant life or provides conditions only for specially adapted plants (normally weeds). Also, areas can be disturbed (tractor activity during normal feeding operations) to the point that native species are killed and replaced by invading plants (annual weeds). Waste areas are not present on all feedgrounds. When present, these areas tend to be less than one acre, although feedgrounds with small feeding areas (Muddy, Scab Creek) supporting large numbers of elk have larger waste areas. Waste areas can be found on the feeding area and/or loafing areas.

c. Loafing areas

Elk tend to select a site where they "loaf" or spend "idle" time when not eating hay. Elk spend much of their time on these areas and vegetation use can be substantial. These areas vary in size (estimated 1 to 40 acres), location (may or may not be on the feedground proper), and appear to be related to snow depths and the location of cover (if present). When loafing areas are off the feeding area, they are immediately adjacent to the feeding area. Shrubs may be killed or severely hedged. Bark on trees may be eaten or rubbed off, which may kill some trees. Areas receiving this type of use are also seen on some native ranges caused by elk not associated with feedgrounds.

Conifers are invading aspen stands at some locations. Reproduction of woody species in these areas is nearly non-existent, unless it is a low growth form that is protected by snow. The amount of herbaceous plant production present depends largely on the productivity of the site. Most areas having deep soils produce large quantities of herbaceous forage, commonly grasses.

d. Transitional areas

Transitional areas are commonly within ½ mile of the feedground. These areas provide native forage to elk as they migrate into the area before feeding is initiated in the early winter and as they search for native forage as the snow leaves in the spring. There may be a reduction in the frequency and production of some plant species that are native to the area (*e.g.*, shrubs, suckers), and an increase in the frequency and production of some other native plant species (e.g., native and non-native herbaceous species).

Determining the size of these areas and the effects of feedground elk are often complicated because of use by other wild ungulates. These areas tend to be highly irregular in shape, complicating boundary delineations and acreage calculations. The areas most affected are those along migration routes. Areas adjacent to feedgrounds, but not in migration paths, commonly show some vegetation change associated with feedground elk.

Delaying feeding in the early winter and/or terminating feeding early in spring may increase forage utilization on transitional areas. Most heavy to severe browse utilization by feedground elk is believed to occur within ¼ to ½ mile of feedgrounds.

3. Gros Ventre Feedground Habitat Assessment (excerpt, WGFD 2006)

The three feedgrounds in the Gros Ventre (Fish Creek, Patrol Cabin, Alkali) were visited in June of 2006 by Steve Kilpatrick, Terrestrial Habitat Biologist. General observations and data collected as part of other projects (e.g., pre- and post-burn fire effects monitoring) were used to assess habitat conditions on and adjacent to each of the feedgrounds. The following is excerpted from WGFD (2006).

The information provided is my assessment of habitat conditions associated with feedgrounds which I am familiar with and have collected pertinent information. The assessment is based on my observations, publications and data collection. It is important to note that herbivory levels can be attributed to a combination of factors; unnatural concentrations of wintering elk due to the presence of feedgrounds, naturally wintering out elk, and herbivory by other ungulate browsers (e.g., moose (*Alces alces*)). Contributions from these factors vary considerably among specific locations and feedgrounds. Most of the feedgrounds are located on and/or adjacent to riparian or riverine systems, which has raised questions with resource managers with respect to

water quality effects. To my knowledge, little to no monitoring has been done to address this concern.

Fish Creek Feedground (USFS property)

The actual feeding site is located on a grassy bench slightly elevated above and adjacent to the Gros Ventre River. There are few shrubs present within the feeding area. Trampling and/or utilization appear to not be significant to the extensive sagebrush (*Artemesia tridentata var. vaseyana)* communities located adjacent to the feeding area. Sagebrush utilization has been monitored on the south facing slopes of Cottonwood Creek, approximately 1.5 miles north, with use being undetectable. Cottonwood (*Populus angustifolia*) and willow (*Salix* spp.) communities within the vicinity of the feedground show moderate to severe utilization levels. Cottonwood regeneration within the Cottonwood and Fish Creek drainages is generally hedged severely with suppressed growth forms.

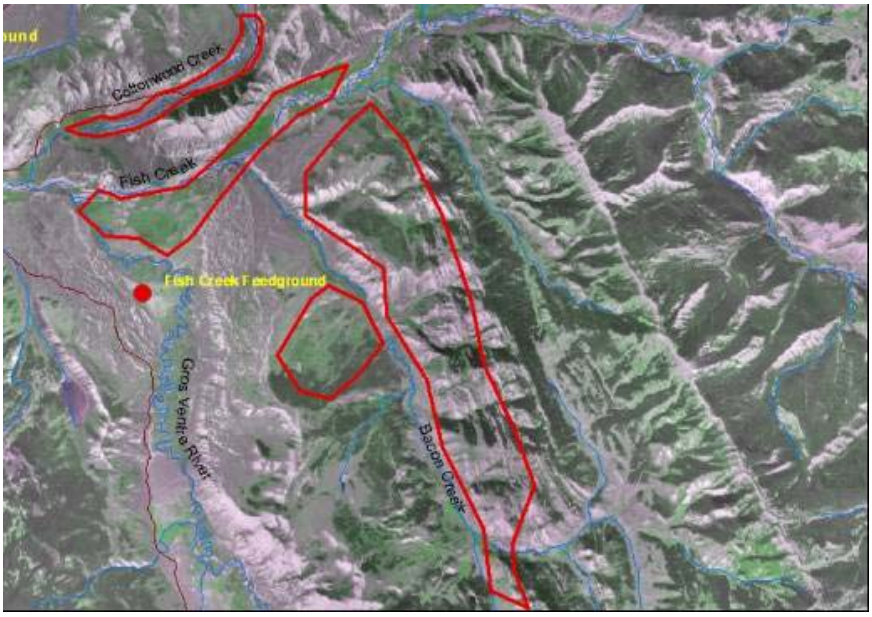

Figure 33. Areas of heavy herbivory on aspen, willow, cottonwood, and mountain shrubs adjacent to the Fish Creek feedground.

Successful cottonwood regeneration in the lower reaches of these drainages should not be expected with current use levels (A. Winward and D.L. Bartos, USFS, personal communications). Willow herbivory varies from moderate near the confluence of Cottonwood Creek and the Gros Ventre to heavier near the confluence of Bacon Creek and Fish Creek where utilization was 38 % during the 2004-2005 winter.

Numerous habitat enhancement projects, primarily prescribed burns, have been conducted within the Gros Ventre drainage. The goal of most projects was to enhance aspen regeneration and recycle sagebrush communities. Habitat enhancements within the adjacent Bacon Creek drainage have exhibited varying degrees of success with respect to aspen. Utilization levels differ significantly by aspect, while distance from feedground does not seem to be as important within the Gros Ventre drainage (Kilpatrick et al. 2000; Kilpatrick et al. 2003). Due to differential snow accumulations affecting browse availability, northeast (NE) and south-southwest (SSW) aspects were compared 8-10 years post-burn in the Gros Ventre drainage.

Mean stem densities were not different between these aspects ($P > 0.05$). However, mean stem height on NE aspects (1.4 m) was greater ($P < 0.05$) than SSW aspects (0.80 m)(Kilpatrick et al. 2000).

Patrol Cabin Feedground (WGFD property)

The actual feeding site is located mostly on a grassy area adjacent to the Gros Ventre River (Figure 34). On some years feeding has occurred northeast of the Gros Ventre road within a mountain/basin big sagebrush (*Artemesia tridentata* var. *vaseyana* and *Ar. tridentata tridentata*) community type. Herbivory on the adjacent willow communities along the Gros Ventre River is severe, resulting in some mortality. The sagebrush community on the northeast side of the road has been degraded mostly because of trampling associated with feedlines.

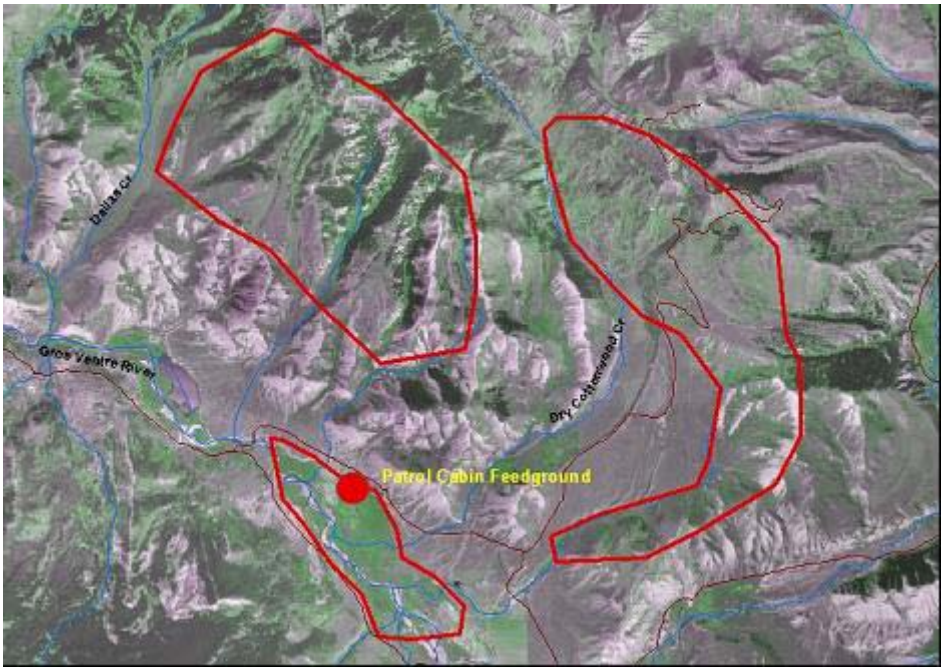

Figure 34. Areas of heavy herbivory on aspen, willows, and mountain shrubs adjacent to Patrol Cabin feedground.

Figure 35. Pre- and post-treatment aspen conditions at Breakneck Ridge, Gros Ventre drainage. Top: 1974; bottom: 2004.

Aspen communities associated with this feedground in the Breakneck Ridge area have been the focus of several habitat enhancement efforts since prescribed burns were implemented in 1974 (Figure 35). Bartos et al. (1994) and Bartos and Mueggler (1981) evaluated the effects of prescribed fire on decadent aspen stands within the Breakneck Ridge area. The primary purpose of the prescribed burns was to produce more aspen suckers than the local elk population could consume and thus perpetuate aspen stands. The size of the prescribed burn was 1,100 acres. Initial suckering response, approximately 49,420 stems/ac, was adequate to regenerate

deteriorating aspen stands. Densities 6-yr post-treatment (10,625 to 25,451 stems/ac) were approximately the same as pre-treatment. Bartos et al. (1994) reported sucker densities 12-yr post treatment ranging from 3,706 to 5,930 stems/ac, which was 29 to 38% less than pre-burn densities. The control also had a 39% decrease in production. Monitoring was repeated again in 2002, and densities ranged from 0 – 1,214 (mean = 332) stems/ac. The decreases in aspen density have been attributed to excessive elk herbivory due to aspect and the close proximity of the Patrol Cabin and Fish Creek feedgrounds. These aspen stands are not expected to perpetuate themselves in the long-term.

Aspen monitoring in an adjacent drainage, Dry Cottonwood Creek, indicated 80% of the regenerating suckers had one or more of the leaders browsed each year from 1998-1999 (WGFD 1999).

Alkali Feedground (USFS property)

Feeding occurs mostly within a grass meadow adjacent to sagebrush grassland, aspen and mixed aspen-conifer stands (Figure 36). Herbivory is heavy to severe on aspen stands adjacent to the feedground. The aspen stands close to the feedground are not expected to sustain themselves for the long-term due to excessive herbivory. The impacts to sagebrush are mostly due to trampling and are localized within the feeding area proper. Musk thistle (*Carduus nutans)* is present and treated frequently by WGFD and/or the Jackson Hole Weed Management Association (JHWMA). Introduced agronomic grasses (i.e., orchard grass – *Dactylis glomerata*, and common timothy – *Phleum pratense*) have become established in the meadow and have outcompeted native graminoid species.

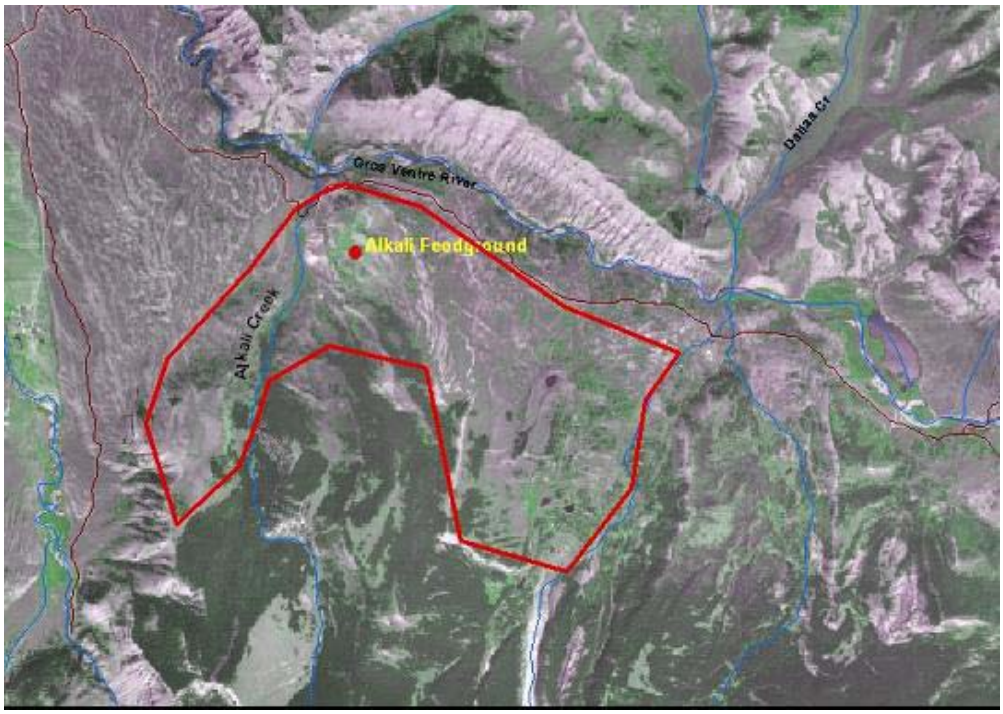

Figure 36. Areas of heavy herbivory on aspen and mountain shrubs adjacent to Alkali feedground.

B. Monitoring & Habitat Enhancement

1. Overview of Habitat Enhancement Projects

Wildlife habitats in western Wyoming have been modified through fire suppression, urban expansion, oil and gas development, and other anthropogenic practices during the past century (WGFD 2001). Historically, disturbances (primarily wildfire) maintained health and diversity of vegetation communities. Many communities, such as aspen and sagebrush, are dependant upon fire for regeneration (Wright and Bailey 1982). Fire frequency has been suggested to occur on 32 to 70-year intervals for sagebrush (Houston 1973), and 80 to 100-yr intervals for aspen (Schier 1974).

Habitat enhancement projects can be employed to mimic natural disturbances, create a mosaic of multi-aged plant communities, and restore habitat to a more properly functioning condition across the landscape (Stroud 1990). WGFD personnel cooperate with other agencies to implement habitat enhancement projects that restore or create vegetative diversity, increase forage (herbaceous and browse) production, and improve range conditions for myriad species. These projects involve identification of treatment areas, approval of land management agencies and/or livestock permittees, acquisition of funding, habitat inventory, implementation, and pre- and post-treatment monitoring.

2. Jackson Interagency Habitat Initiative (excerpt from WGFD 2004)

The Jackson Interagency Habitat Initiative was formed in the fall of 2001 by several wildlife biologists from the BTNF, NER, WGFD, and GTNP. These resource professionals were concerned about the loss of habitat effectiveness on native ungulate winter and transitional ranges within the Upper Snake River Basin (USRB) and the challenges the agencies faced in implementing on-the-ground habitat enhancement projects to address current management issues in a coordinated manner. The JIHI group reports its progress and takes recommendations at the annual Advisory Group meeting of the Jackson Cooperative Elk Studies Group.

The goal of JIHI is to maximize effectiveness of native winter and transitional range for ungulates and a diversity of species indigenous to this region through identification of habitat enhancement opportunities. These habitat components are emphasized because they are limited in extent yet crucial to the maintenance of the elk herd. Advancing plant succession continues to erode the availability of winter-spring habitats to species that use early and mid-successional vegetation communities. Furthermore, the current practice of feeding elk (and bison) on lands administered by the BTNF, NER, and WGFD concentrates large numbers of animals in small areas with the unintended consequence of elevated risks of disease transmission, prevalence, and maintenance in the population. The specific objectives of JIHI are to:

1) Create a common GIS database of:
    a. Winter ungulate distributions
    b. Potential additional winter range
    c. Plant communities and/or habitat types
    d. Location, size and distribution of habitat enhancement treatments and wildfires
    e. Wild and domestic feeding operations
    f. Summer and winter travel plans
    g. Noxious weed distribution

2) Identify and map areas of opportunity for winter and transitional range treatments.
3) Identify competing land uses that limit habitat effectiveness.
4) Prioritize areas of opportunity.
5) Identify protocols for pre- and post-treatment monitoring of habitat enhancement projects.
6) Develop a protocol for continuing coordination among agencies for progress evaluation.

To progress from the USRB to site-specific vegetation treatments, the JIHI group developed a common GIS database in 2002 and 2003. The integrated data layers were used to identify broad, watershed-scale areas where habitat enhancement opportunities existed and site-specific planning could commence. The watershed areas identified included the Gros Ventre, Spread Creek, and Buffalo Valley drainages. These watershed areas were categorized as the Buffalo Valley/Spread Creek, Upper Gros Ventre (east of Slate Creek), and Lower Gros Ventre focus areas for project planning. Thus the hierarchical progression was from the USRB (approximately the Jackson EHU as defined by WGFD), to watersheds, to ungulate winter and transitional ranges (focus areas), to project areas, to site-specific treatments within project areas.

Because of the large numbers of elk, the large winter-feeding programs, and existing and potential disease issues, JIHI has placed considerable emphasis on enhancement of winter and transitional ranges for elk. Elk from YNP, Teton Wilderness, and the Mt. Leidy Highlands winter in the Buffalo Valley and Spread Creek watersheds. Elk from those areas and from the Gros Ventre Mountains winter in the Upper and Lower Gros Ventre. Recent studies of radio-collared animals also indicate that as many as 30% of the elk that winter in the Gros Ventre may spend the summer in the Wind River and Green River watersheds. Thus, vegetation treatments in the USRB stand to benefit elk dispersed across some 16 Hunt Areas. Habitat enhancement spread throughout watersheds of the USRB will encourage a wide distribution of elk and other ungulates in winter, reducing disease risks and fostering forest health. Habitat enhancements and vegetation restoration will also have positive effects on other species tied to similar habitats (e.g., sagebrush dependent bird species) and those reliant on healthy ungulate populations for prey (e.g., wolverine, gray wolves, and grizzly bears).

3. The Association between Habitat and Brucellosis

Management of wildlife habitats and manipulations of animal distributions are key components in breaking the cycle of disease transmission (Aune et al. 2002). The primary goal of the "Habitat" facet of the BFH program is to enhance transitional and winter elk habitat to minimize the transmission and prevalence of brucellosis in elk associated with feedgrounds (Clause et al. 2002). Although the Wyoming Livestock Board (2006) recently defined the "period of exposure" for cattle as 1 January to 1 May, *Brucella*-induced abortion events in captive and feedground elk have been documented from late-February to June (Thorne et al. 1991, Roffe et al. 2004, WGFD unpublished data). The concentration of elk on feedgrounds during most of this period likely increases the risk of intraspecific brucellosis transmission and/or prevalence (Thorne et al. 1979), either through density-dependent (Figures 37 and 38; WGFD unpublished data) and/or frequency-dependent effects (i.e., increased length of feeding season, Figure 39; Cross et al. 2007).

Manipulating decadent vegetation in areas near feedgrounds can increase the production and palatability of grasses while promoting new forb and shrub growth (WGFD unpublished

data). In some locations, habitat treatments may be less effective for brucellosis management due to heavy snow conditions (even during relatively mild winters), damage/commingling risks, or post-treatment management regimes of the habitat enhancement area (e.g., livestock grazing). When desirable forages are available, the dependence of elk on artificial feed will decrease, as demonstrated annually during spring green-up (WGFD unpublished data). Shorter feeding durations and lower elk concentrations on feedgrounds, especially during the high transmission risk period, may decrease the probability of intraspecific brucellosis transmission events. Any reduction in length of feeding season, regardless of cause, will also reduce cost of feedground operation.

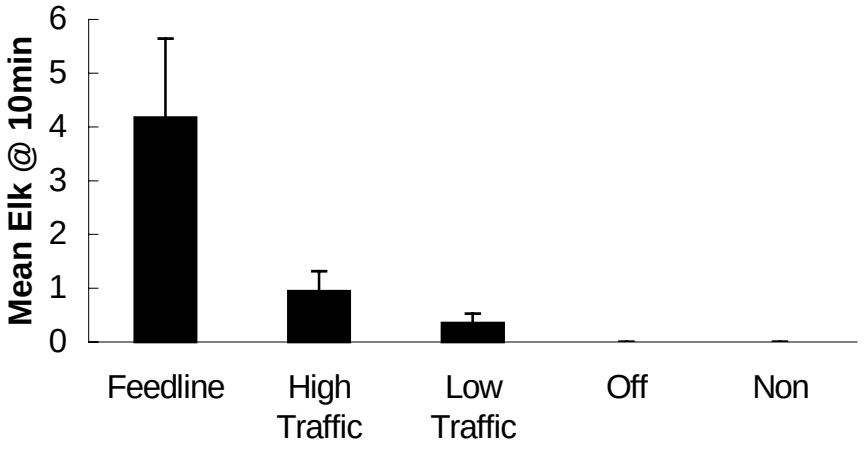

Figure 37. Mean number of elk counted every 10 min during 4-hr sampling period within 5m of pseudo-aborted elk fetuses and membranes (i.e., fetal unit). Fetal units were placed on Buffalo Valley (non-feedground) and within 3m of areas defined as feedline, high traffic, low traffic, and off the feedground on Grey's River, Franz, Soda Lake, and Muddy Creek feedgrounds.

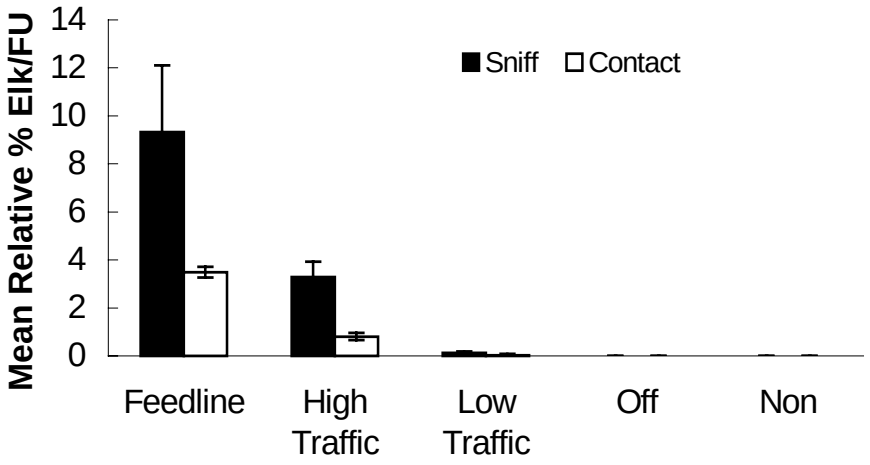

Figure 38. Mean relative % of elk on (Greys River, Franz, Soda Lake, Muddy Creek) and off (Buffalo Valley) feedgrounds observed sniffing and contacting pseudo-aborted fetal units (i.e., fetus and membranes).

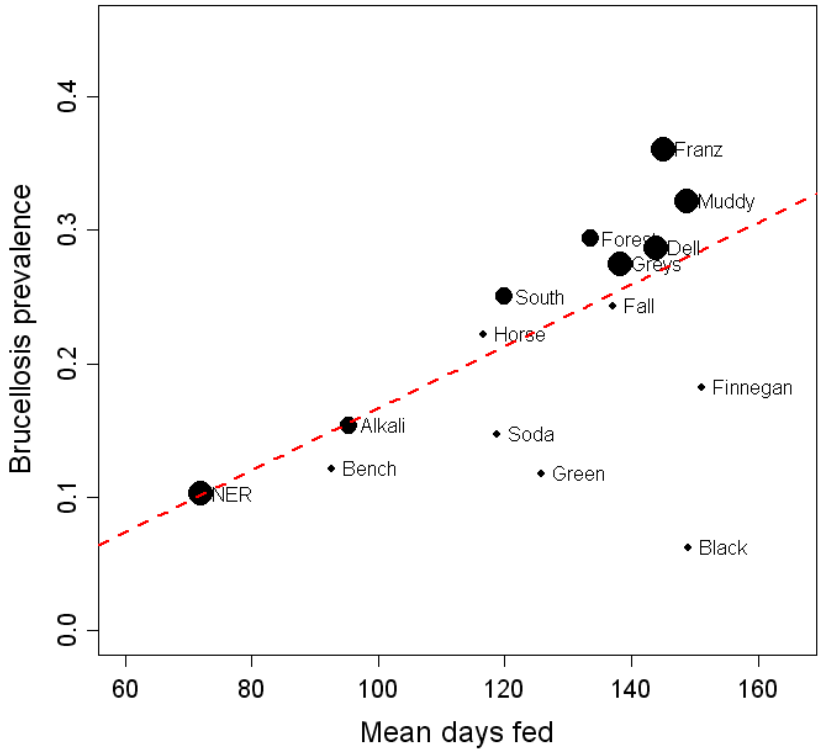

Figure 39. Seroprevalence of brucellosis in elk increases with the length of feeding season ($P < 0.0004$). Sites were weighted according to the reciprocal of their estimated variance, reflected by the size of each point in the plot. Brucellosis status was determined using four standard serological tests and confirmed using a cELISA test, which differentiates between vaccinated and naturally infected animals. Data included all feedgrounds with over 30 tests (2,064 total tests) and feeding season lengths were based upon all data from 1955 to 2006.

4. Habitat Enhancement Methods

Prescribed (human-controlled) fire works to mimic the natural occurrence of fire on the landscape and enhances habitat. Fire encourages growth of early successional plant communities preferred by elk and other wildlife. It is also typically the most cost efficient treatment type per acre. To provide adequate fine-fuels for fire growth and spread, all areas to be treated with prescribed fire require one season of rest from livestock grazing prior to treatment. To encourage reestablishment and growth of herbaceous vegetation species and prevent colonization of weeds and less desirable species, areas treated with prescribed fire require two seasons of rest (often one season of rest, one season of deferment) from livestock grazing post treatment. In addition heavy browsing by ungulates can potentially overwhelm vegetative response to the treatment. Thus it also is critical to treat large areas in order to distribute browsing ungulates that will naturally be drawn to the enhanced area.

Mechanical treatments involve the use of some form of machine to manipulate vegetation. These devices usually involve some type of modified farm equipment such as a disc, half-round drum, ripper, or mower. Thinning and harvesting using chainsaws or a forward harvester (vehicle used to cut and move trees) may also be used. Mechanical habitat treatments promote herbaceous production, species diversity, stand rejuvenation, and elimination of select species. Often, these treatments (particularly via chainsaws) are used prior to conducting prescribed burns to 1) provide adequate fuel for fire spread, and 2) provide greater control over fire behavior (e.g., near edge of areas to be burned or structures). These treatments usually do not require pre-treatment rest from grazing. Post-treatment grazing management is based on site-by-site objectives. Treated aspen may need to be rested or fenced to prevent over browsing by domestic stock; sagebrush treated with mechanical methods usually does not require rest.

Rest and/or deferment from livestock grazing is another type of habitat treatment (Stroud 1990). Because of the need for public and private grazing allotments to maintain viability of livestock operations and the relative uncertainty and distrust of conservation easements necessary to purchase AUMs, this treatment type has received little attention in western Wyoming (and the western US). However, this treatment type may provide a greater abundance of native forage for elk than in treated areas in exchange for payment to a willing permittee or landowner.

The effectiveness of aspen enhancement, through fire or mechanical means, is dependent on several factors. Kilpatrick and Abendroth (2000) emphasize aspen treatment site selection. They suggest that site aspect, distance from concentrations of wintering ungulates and elk feedgrounds, supplemental elk feeding regime, aspen community type, stand vigor, and soil type are just some of the factors impacting effectiveness of aspen treatments. Bartos et al. (1994) concluded that an aspen burn near elk feedgrounds in the Gros Ventre might have hastened the demise of the decadent aspen clones. On the other hand, other prescribed burns in the same area that lacked intense herbivory were successful (Bartos et al. 1991). It can be concluded that herbivory levels following treatment of aspen will have a major impact on the long-term effectiveness.

5. Grazing Management

The number of AUMs has decreased substantially on public land grazing allotments in the Jackson EHU. Multiple allotments have been closed or modified in recent years (below), which has and will continue to contribute to the effectiveness of habitat enhancement efforts. Some areas have been designated as forage reserves. Forage reserves provide benefits to myriad wildlife and vegetation species, but acquisition requires willing seller(s) and, typically, substantial monetary funding.

a. Elk Restricted Areas

The Gros Ventre River drainage has been recognized as important elk winter habitat for nearly a century. Attempts have been made at protection since the early part of the 20th century. In his annual report for 1907 the State Game Warden of Wyoming recommended that six townships of public land on the Upper Gros Ventre be set aside as a winter range for elk. This proposal originally included a strip of land six miles wide extending easterly from range line 114-115 nearly to the head of the Green River Divide. In the report of the State Game Warden

for 1906 a map was published showing this area. A recommendation was made that Congress be asked to donate the land to the State. On February 16, 1909, the Legislature of Wyoming passed a resolution urging Congress to grant the State of Wyoming 6 townships of land. The area outlined in the resolution differed slightly from the first proposal, but included 6 townships. The passage of this resolution met opposition from two segments; the settlers who either had acquired title to some of the land or who were interested in grazing cattle in the proposed area, and from residents in Jackson Hole who, seeing the possibility that a Government reserve might be established desired to sell land in Jackson Hole proper, or who were interested in selling hay for elk to the Government rather than in having the Government raise it. As a result of a meeting held the following year in Jackson, strong protests were made and the idea was abandoned.

After a number of visits and inspections by personnel of the Forest Service, Biological Survey, and Wyoming Game and Fish Department previous to 1918 a report was made by District Forester Kneipp to The Forester in Washington D.C. on October 31, 1918 that three areas (Figure 29) be designated as Restricted Elk Areas around Jackson Hole. These areas were:

Elk Restricted Area No.1: As a territory tributary to the Gros Ventre River outlined on a map (This map has not been located to determine exactly the original area). That this "area shall be administered by the Forest Service primarily with the purpose of making available to the elk the maximum amount of feed during winter months, grazing and all other forms of utilization to be subordinated to this primary purpose." Regulated cattle use was described.

Elk Restricted Area No.2: "All domestic stock should be excluded from that part of the Forest bounded on the west by the Forest boundary, on the east by the summit of the ridge which terminates in that in known as Sheep Mountain, on the north by the Gros Ventre River, and on the south by Game Creek." Preble, of the Biological Survey, and Johnson of the Forest Service had previously recommended that this area should also extend north of the Gros Ventre drainage and include part of the Ditch Creek drainage. However, Kneipp did not recommend this.

Elk Restricted Area No.3: A gross acreage of 60,160 acres, of which 47,360 acres lie east of the Snake River and 12,800 acres west of the Snake River running south from Game Creek and up the Hoback River. It was recommended that no change or reduction be made in the number of stock authorized to graze here during the spring and summer months, that if conflict does occur between cattle and elk it is in the late fall.

A letter from Kneipp to Forest Supervisor, Jackson, in August of 1919 directly referred to the three restricted areas and that there had been no grazing on Area No. 2. The references were direct enough to indicate that the limitation in grazing and setting aside the areas had been accomplished during the interim period. The grazing map for 1918 did not show the three areas as set aside, but the next map from 1922 did show the three areas as set aside. These areas are being managed to date as restricted game winter range.

Most pertinent to the Jackson EHU were Areas 1 and 2 (Figure 41). With the exception of trailing, the 137,985-acre area in the Gros Ventre was declared closed to livestock grazing (Boyce 1989). The Forest Supervisor's order was not legally binding and subsequent Supervisors opted to not adhere to its original intent. By the 1960s and 1970s, trespass cattle within the closure were frequent and deemed unmanageable. In 1973, a livestock grazing management plan was proposed for a portion of the closure to control livestock use. The grazing plan was eventually agreed upon

by the WGFD and the USFS and formalized by the Fish Creek Cattle and Horse Allotment Grazing Management Plan and associated Environmental Analysis Report. To clarify the parties concerns and expectations, a formal MOU was signed by the BTNF and WGFD in December 1979. The MOU emphasized limited livestock use of the Haystack and Breakneck Units of the Fish Creek Allotment by stating livestock use "... shall only be made to the extent that no detrimental effect is made to the elk winter range habitat requirements, and that the integrity of the basic intent of the 1919 range designation of elk winter range be maintained. If irresolvable conflicts between big game and domestic livestock develop, removal of domestic livestock from these critical big game ranges will be required by the Bridger-Teton National Forest". In addition, it was agreed to establish long-term monitoring studies to cooperatively evaluate the effects and levels of livestock and elk use. Five trend transects were established shortly after the MOU. When last read in 1985, they indicated improved range conditions (Boyce 1989).

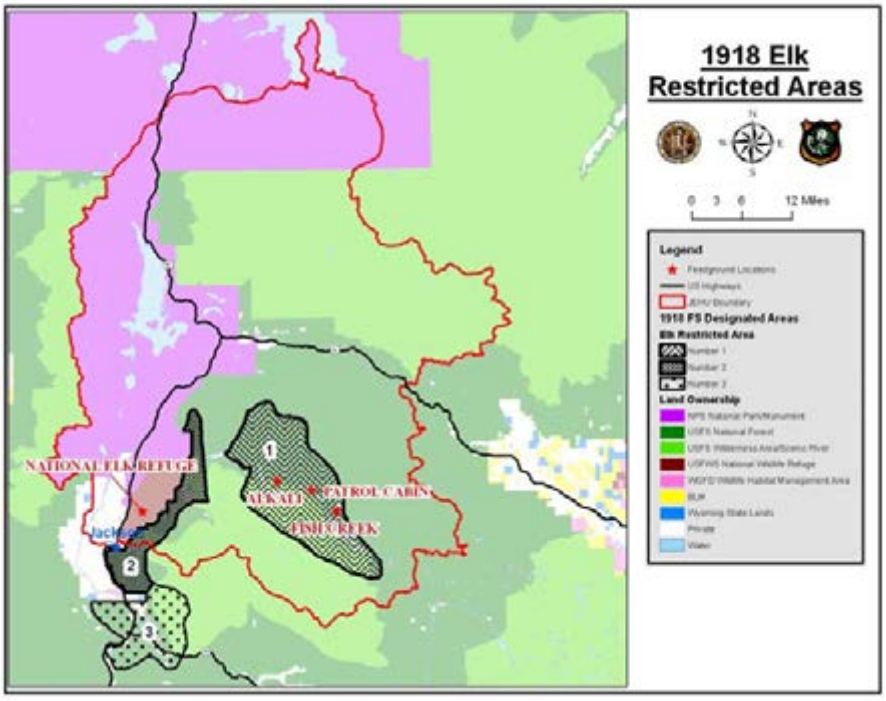

Figure 40. Restricted elk areas on USFS land, as designated by the USFS in 1918-1919.

b. Blackrock/Spread Creek allotment closures, 2003

In August of 2003, BTNF Supervisor Kniffy Hammilton and the Walton Ranch, with economic incentive, agreed to remove livestock grazing from the Blackrock/Spread Creek Allotment (Figures 32 and 41). Of the 87,500 acres within the allotment, 75,000 acres (*Grizzly Bear Management Situation 1 and 2*) were placed in closure status. The remaining 12,500 acres was temporarily placed in vacancy status, pending a suitability assessment to be conducted during the ongoing Forest Plan revision. This allotment had experienced more grizzly bear/cattle conflicts than any other allotment within the GYE. WGFD documented 108 conflicts within the allotment in recent years and spent approximately $158,000 in management costs. Moreover, the potential for additional conflicts with other species such as bison, wolves, and elk was imminent.

Grazing had actually not occurred on the allotment in any of the previous four years because of wildlife/livestock conflicts. In addition to closing the allotment because of concerns with wildlife/livestock conflicts, the area also receives heavy elk use throughout the year. Elk parturition range occurs in the Spread Creek drainage in the northeast corner of the westernmost portion of the allotment near the GTNP boundary (Figure 32). The lower portion of the Spread Creek drainage is also considered crucial elk winter range (Figure 2). Elk migrate in large numbers through this area in late fall/early winter and again in the spring as they move between summer ranges in YNP and the Teton Wilderness and winter range on the NER. Commingling of livestock and elk would be possible if livestock grazed there.

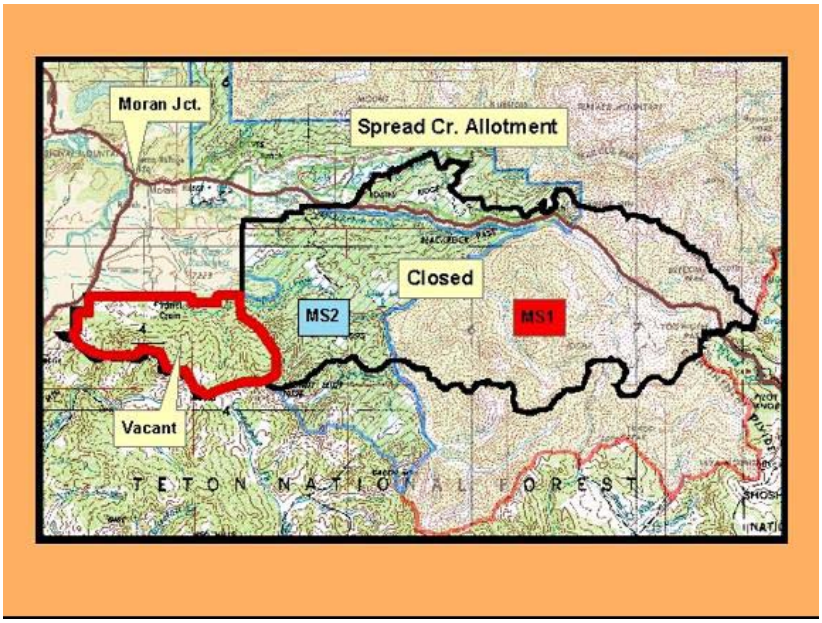

Figure 41. Blackrock/ Spread Creek allotment. Portions of the allotment within Grizzly Bear Management Situation 1 and 2 were closed. The portion outside of MS 1 and 2 was placed in vacant status.

c. Bacon Creek and Fish Creek allotment closures, 2007

In early 2007, the BTNF Forest Supervisor declared the entire Bacon Creek and Fish Creek allotments closed to grazing by domestic livestock or designated as a forage reserve (Figure 42). The modifications were the result of an agreement with the National Wildlife Federation and the grazing permittee. Portions of the allotments were closed, and the remainder is to be established in a forage reserve.

The closure includes the portions that are within the Primary Conservation Area (PCA) for grizzly bears, as well as portions outside of critical winter range that are within ten miles of the PCA. The remainder was designated as a forage reserve with two emphasis areas. A "winter range forage reserve" was designated from the areas identified as critical winter range for elk. On that portion, infrequent livestock grazing may be utilized in addition to other management tools to improve forage quality and quantity for wintering wildlife. Livestock grazing may occur only to the extent it demonstrably benefits the winter range. A Forage Reserve Management Plan (FRMP) will be developed through a NEPA process, and measurable criteria will be defined for those benefits.

A second management priority is conservation of large carnivores. Grazing would only be permitted to the extent it did not result in conflict with grizzly bears and wolves. Control actions on these predators would not be initiated in reaction to conflicts with livestock. Instead,

livestock would be moved and managed within the forage reserve, until all options are exhausted. At that point livestock would need to be removed from the forage reserve.

The portion of the allotments outside the PCA, outside of the ten-mile zone and outside of elk winter range, were designated as a forage reserve and called the "conflict forage reserve". Since this area lies outside of important winter range, the management emphasis will be on reducing conflicts between livestock and predators. This forage reserve area also could be used on an infrequent basis for grazing by domestic livestock if conflicts with bears or wolves are occurring on an adjacent allotment or if a forest fire or wildlife habitat improvement project has significantly reduced forage on an adjacent allotment.

The winter forage reserve portion of this allotment adjustment includes much of the area identified by the State Game Warden and the Wyoming legislature as important winter range in 1907 as well as the Restricted Elk Area No. 1 designated by the Forest Service in 1918-1919 (*see Figure 40, above*).

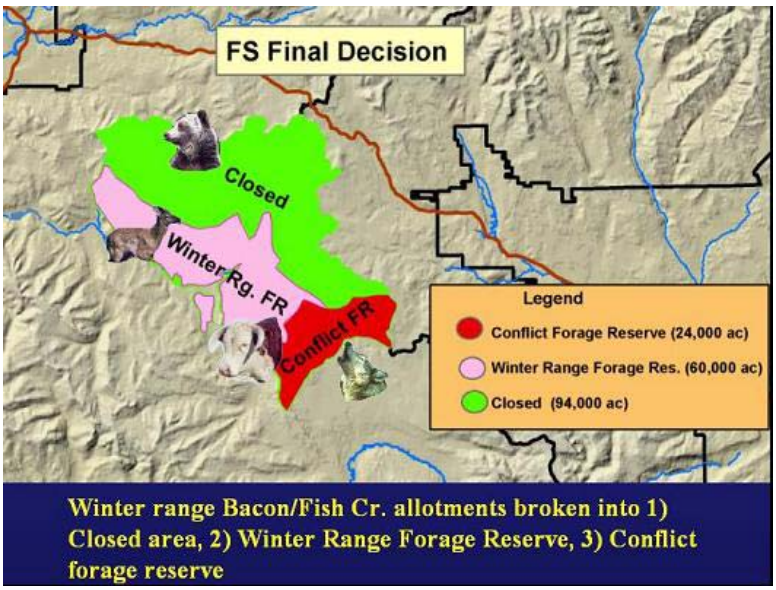

Figure 42. Bacon/Fish Creek allotment closure and forage reserves.

C. Habitat Enhancement Projects and Monitoring

1. Implemented Projects

Numerous range improvements and studies have been conducted since the 1960s. Prescribed fire has been utilized since the early 1970s to enhance forage and browse conditions. At least 50 habitat enhancement projects (totaling > 31,000 acres treated) have occurred within the Jackson EHU on elk winter and transitional ranges since 1974 (Table 17, Figure 43). In addition, over 300,000 acres of wildfires have occurred on public lands within the Jackson EHU since 1988 (Figure 43; section D, below). Most habitat enhancement projects in the Jackson EHU have occurred on USFS lands. Descriptions of just some of the habitat enhancement and monitoring projects pertinent to the Jackson EHU are included here.

Table 17. Habitat treatments, landowner, year(s) treated, and area of enhancement project in the Jackson EHU (excluding NER). Habitat is listed in order of size of area burned of that type.

Treatment Type	Treatment Name*	Landowner	Year	Habitat	Acres
Mechanical:	Breakneck	BTNF	1988	Sagebrush	210
Range Pitting	Bacon Creek	BTNF	1989	Sagebrush	189
Prescribed Fire	Eynon Ridge	GTNP	2006	Aspen/Conifer	806
-	Diamond L	BTNF	2005	Aspen	1,300
-	Jackson Lake Lodge	GTNP	2002	Willows	1,575
-	Wolff Ridge	GTNP	2002	Aspen/Sagebrush	1,570
-	Timbered Island	GTNP	2002	Conifer	235
-	Elbo Ranch	GTNP	2002	Sagebrush	281
-	Kelly	GTNP	2002	Sagebrush	81
-	Teton Science School	GTNP	2001	Sagebrush	113
-	Cow Lake	GTNP	1999	Aspen/Sagebrush	3,165
-	Blackrock Willows	BTNF	1999	Willows	423
-	Gros Ventre South	GTNP	1999	Sagebrush	920
-	Lower Spread Creek	GTNP	1998	Sagebrush/Aspen	545
-	Antelope Flats South	GTNP	1998	Sagebrush	1,203
-	Blacktail South	GTNP	1998	Sagebrush	1,103
-	Blacktail C	GTNP	1998	Sagebrush	278
-	Gray Hills/Lightning Creek	BTNF	1998	Sagebrush	70
-	Lower Spread Creek	GTNP/BTNF	1997	Sagebrush/Aspen	6,113
-	Uhl Draw A	GTNP/BTNF	1997	Sagebrush/Aspen	555
-	Uhl Draw B	GTNP/BTNF	1996	Sagebrush/Aspen	1,040
-	Lost Creek	GTNP	1996	Sagebrush	465
-	S. Rosie's Ridge	BTNF	1995	Willows	24
-	Blackrock	BTNF	1994	Willows	40
-	Randolph	BTNF	1991	Aspen/Sagebrush	395
-	Blackrock	BTNF	1991	Willows	14
-	Curtis Canyon	BTNF	1991	Sagebrush	189
-	Breakneck	BTNF	1991	Aspen	263
-	Cottonwood	BTNF	1991	Sagebrush	395
-	NE Rosie's Ridge	BTNF	1990	Willows	15
-	Dry Hollow	BTNF	1990	Sagebrush	195
-	Gros Ventre Big Game	BTNF	1990	Aspen	1,627
-	Gros Ventre Big Game	BTNF	1989	Sagebrush	634
-	Russold Hill	BTNF	1988	Sagebrush/Aspen	211
-	Heart Six	BTNF	1986	Aspen	31
-	Trailer Court	BTNF	1985	Willows	68
-	Haystack	BTNF	1985	Sagebrush	
-	Gros Ventre Sagebrush	BTNF	1983	Sagebrush	808
-	Blackrock	BTNF	1982	Willows	24
-	Haystack	BTNF	1981	Sagebrush/Aspen	
-	Dry Dallas	BTNF	1981	Sagebrush	
-	Fir Creek	BTNF	1980	Aspen	92
-	Dry Dallas	BTNF	1980	Sagebrush	
-	Dry Dallas	BTNF	1979	Sagebrush	
-	Haws	BTNF	1978	Willows	58
-	Dry Dallas	BTNF	1978	Sagebrush	
-	Haystack	BTNF	1977	Sagebrush/Aspen	786
-	Uhl Draw	BTNF	1976	Aspen	348
-	East Blackrock	BTNF	1976	Willows	13
-	Burro Hill	BTNF	1974	Aspen	478
-	Breakneck	BTNF	1974	Aspen	750
				Total Acres Treated:	**≥ 31,457**

a. Mechanical

Purely mechanical habitat treatments have seen limited use in the Jackson EHU, as emphasis has been on prescribed fire (Table 17). Some range pitting has occurred, however, in the Gros Ventre drainage in attempts to enhance graminoid production, thereby reducing elk dependence on feedgrounds. WGFD personnel gained FS approval to utilize a mechanical range pitter to enhance forage conditions for elk winter/ transitional range on two sites in the Gros Ventre drainage in 1988 and 1989. Range pitting on the Whiskey Mountain Wildlife Habitat Management Area, near Dubois, had resulted in a several fold increase in graminoid production on bighorn sheep and elk winter ranges. Managers wished to experiment with this mechanical tool by expanding its use on similar sites.

The range pitter is a modified tandem disc usually used for tilling farmland. The disc was modified by complete removal of every other disc blade and removing 1/3 to 1/2 of each remaining blade with a cutting torch. With these modifications, the implement no longer left a continuous furrow but produced "pits" on the soil surface. Such pitting typically resulted in reduced density and competition of mat-forming forbs (i.e., *Phlox hoodi*, *Antenneria rosa*), and sagebrush while simultaneously preparing a seed bed for graminoid establishment.

The two areas pitted in the Gros Ventre drainage included the relatively flat terrain associated with Breakneck Creek and the bench northeast of the confluence of Bacon and Fish Creeks (Figure 43). Approximately 210 and 189 acres were treated at Breakneck and Bacon Creek, respectively. The Breakneck site was range pitted during the summer of 1988. A small metal-tracked dozer was used to pull the pitter and the implement was adjusted for moderate disturbance (i.e. creating pits 3-5 inches deep and removal of minimal sagebrush). Rubber rabbitbrush seed (*Chrysothamnus nauseosus albicalus*) was subsequently broadcast from a pickup mounted seeder. This shrub is highly sought after by wintering elk in the Gros Ventre drainage and is capable of withstanding extensive browsing pressure annually.

The Bacon Creek site was range pitted in 1989. The objectives were the same as those for the Breakneck site. However, a rubber-tired tractor was used to pull the pitter instead of the dozer and the implement was adjusted for maximum disturbance to the soil and existing vegetation. Some small areas were also double pitted. Pits were 5-8 inches deep and more sagebrush was removed than on the Breakneck site. Rubber rabbitbrush was seeded post pitting, using a helicopter. The side door was taken off a six-passenger helicopter and the seed was hand broadcasted during low-level flight (WGFD 1990).

Results were monitored at both sites. There was no significant difference in productivity between control and treatment plots at the Breakneck site five years post treatment. At the Bacon Creek site, however, production increased significantly. There was a 207% and 292% increase in productivity with single and double pitting, respectively, four years after treatment.

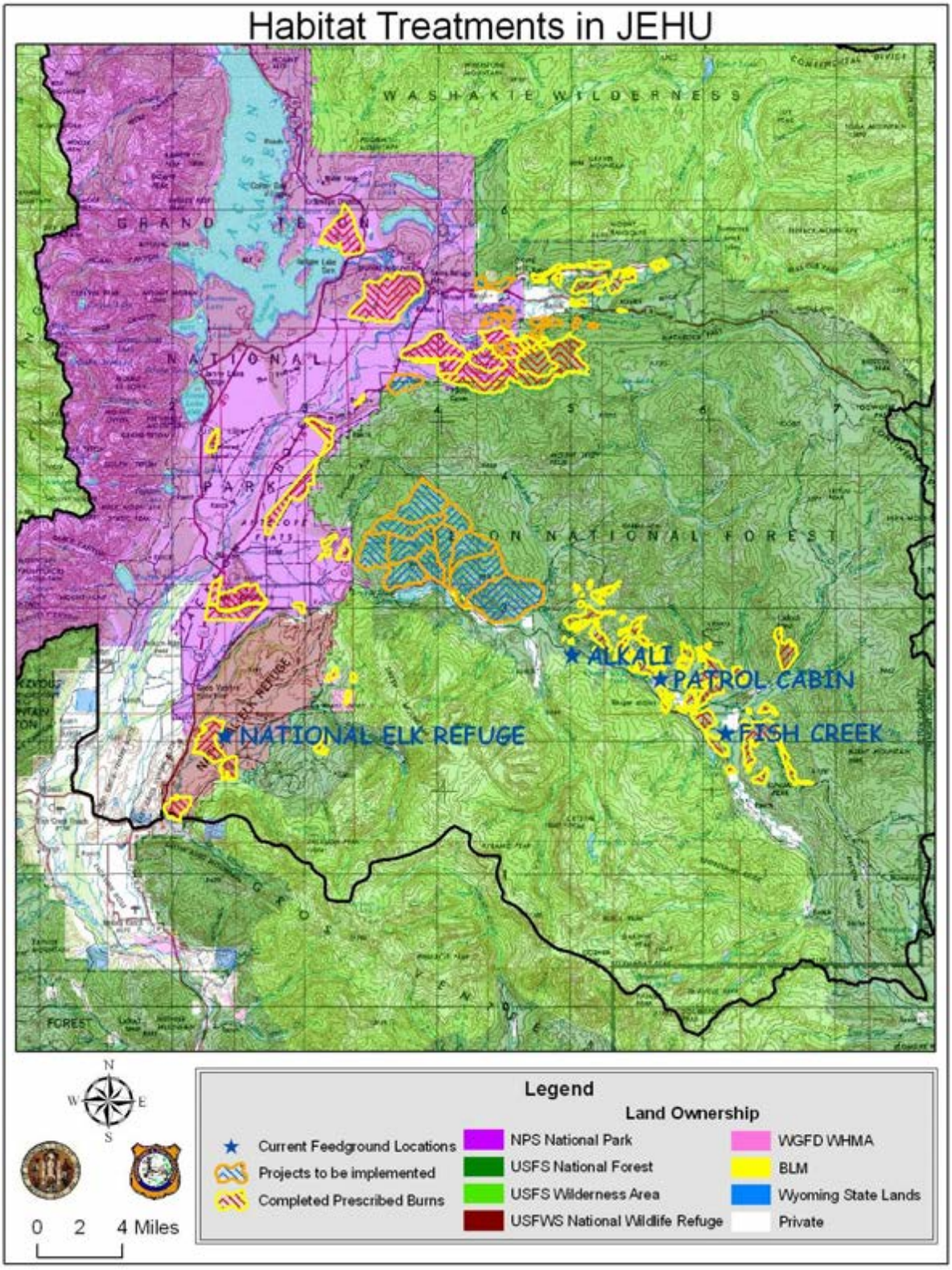

Figure 43. Locations of implemented and proposed habitat enhancement projects in the Jackson EHU.

b. Prescribed Fire

Wolff Ridge

The GTNP Fire Management Committee originally approved the 1,700-acre Wolff Ridge Prescribed burn for implementation in October 1997. Numerous issues delayed and modified the project including: grazing on the unit, establishment of wolf denning and rendezvous sites adjacent to the project boundary, Sage Grouse and sagebrush management, concerns about effects on the Elk Reduction Program, effects of ungulate browsing on aspen suckers, and a prescribed burn moratorium. The plan was reworked to address those issues and resubmitted for approval in September of 2002 with significant changes in project boundaries, and refinement of specific objectives. The primary project objectives included aspen regeneration, reducing conifer in aspen stands, increasing native forbs and grasses, and decreasing fuel loading.

Figure 44. Wolff Ridge, looking from east to west. No-burn areas are highlighted in red.

Due to concerns of over-browsing by ungulates, GTNP installed and maintained an electric fence in this project area during the winter months until spring 2005. Non-permanent 1/100th acre circular plots were used inside and outside of the fence to count live aspen sprouts by height classes and browse status. GTNP staff did not have the available time necessary to continue maintenance of the fence. Data collected indicated no statistical difference between browse levels inside and outside the fence (Figure 45).

After 2005 the fence was not used, thus stems/acre data was collected across the project area as one data set (Figure 46). Data collection will continue in the summer of 2007.

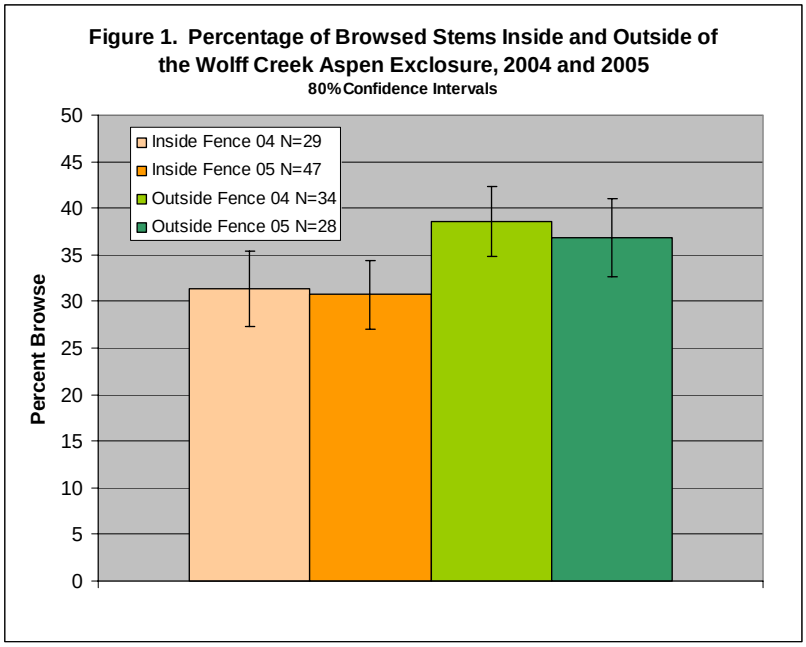

Figure 45. Percentage of browsed stems inside and outside the Wolff Creek aspen exclosure, 2004 and 2005. (80% confidence intervals).

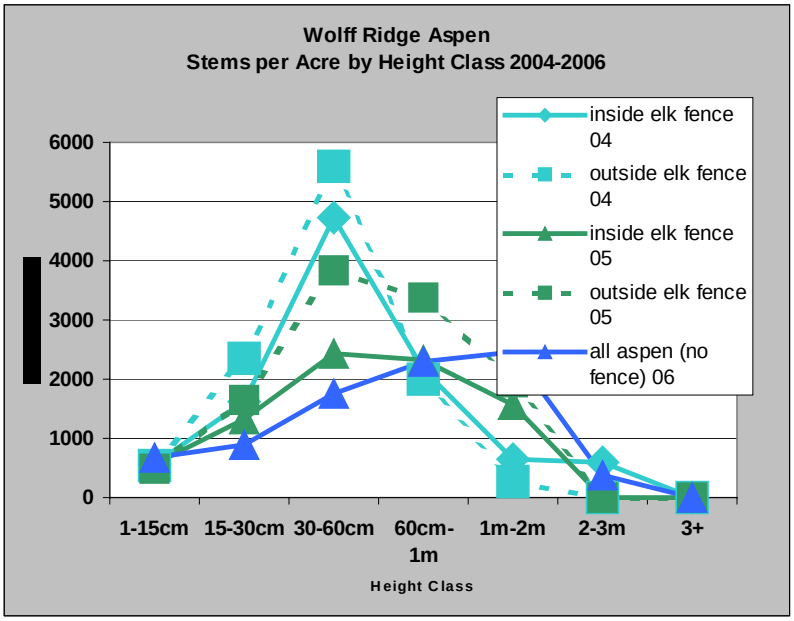

Figure 46. Stems per acre, by height class, 2004-2005 on the Wolff Ridge prescribed burn.

Diamond L Prescribed Burn

The Diamond L prescribed burn was completed in the fall of 2005. This 1,300-acre burn was the first project from the JIHI group to be implemented. This burn primarily included objectives for aspen, but also included sagebrush and conifer. This burn was located north of Spread Creek on BTNF land, in an area that has a long history of habitat enhancements (Figure 42). This area is utilized by a segment of the Jackson EHU that primarily uses winter and parturition ranges away from feedgrounds.

The burn was implemented late in the fall season, and may have burned a little "cooler" than optimal in places. More time is needed to determine if objectives were met. Aspen monitoring will occur in the summer of 2007 to measure initial post-burn suckering.

Eynon Ridge Prescribed Burn

The Eynon Ridge prescribed burn was completed in the fall of 2006. This 800-acre burn was completed as the second part of the Buffalo Valley JIHI effort, after Diamond L. This burn is located in GTNP directly west of the Diamond L prescribed burn, completed one year earlier on BTNF land. The objectives were very similar for both units; however, implementation methods varied which provided fire managers a good opportunity to learn more about how to get the best regeneration of aspen.

Eynon Ridge had aspen stands throughout with a heavy conifer component. The year before burning the unit, many conifers were cut down and left to cure out as a form of pre-treating the area. This served as a means to build up heat and fire behavior, which carried better into the conifer stands.

Post-burn monitoring will be conducted in the summer of 2007.

Lost Creek Prescribed Burn

The Lost Creek prescribed burn was completed in the fall of 2005. The 123-acre fuels reduction project was located on federal and adjacent private land containing some high-value homes. The burn was a coordination of federal, state, county, and private agencies. The dominant vegetation is sagebrush steppe and the burn area contains identified areas of important sage grouse habitat.

Burn objectives for Lost Creek called for a "mosaic of burned and unburned areas" within the sagebrush community, as well as a conversion of a portion of the sagebrush community to native forb and grass communities. Such a mosaic mimics natural ecological disturbance and allows for the delineation of "no burn" areas in important wildlife winter and transitional ranges.

Two specific monitoring objectives address the reduction of live sagebrush density and cover and an increase in native grass cover. The first objective, pertaining to sagebrush, was monitored in yr01 post-burn (Figure 47), while the second objective, pertaining to native grass cover, will be measured in yr02 post-burn.

The shrub intercept method showed a 33% decrease in live sagebrush cover, while the shrub circles showed an 87% decrease in live sagebrush density. Both methods show a significant decrease. Monitoring objective #1 was met according to the shrub circle method and just under objective according to the shrub intercept method.

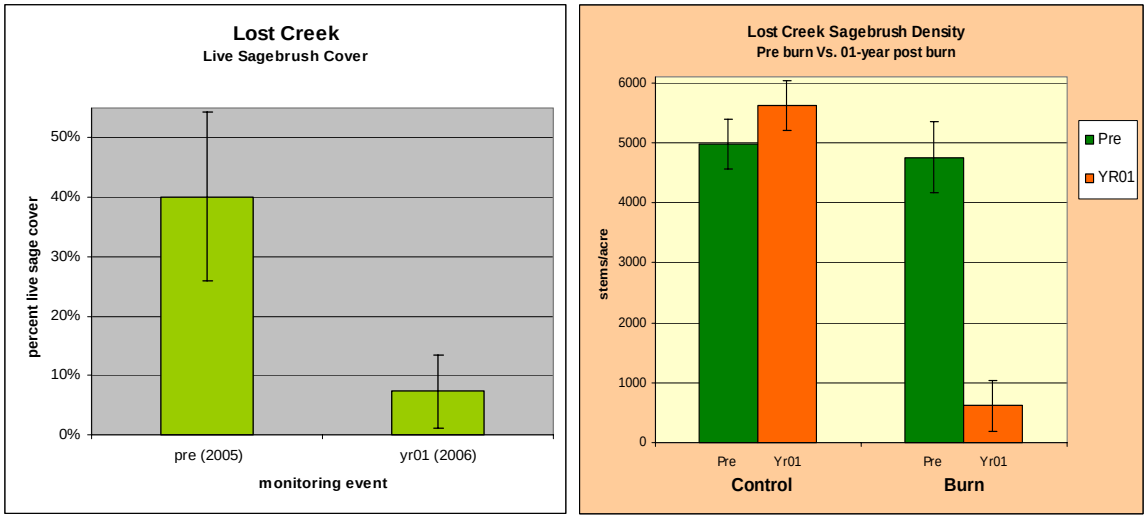

Figure 47. Sagebrush cover and density on the Lost Creek prescribed burn.

Another interesting result found at Lost Creek, one-year post burn, is that burning appeared to have minimal effect on species richness. The burned plots changed very little from pre-burn to one-year post burn in terms of number of species present within the sagebrush community, especially when compared with the control plots.

Monitoring of the Lost Creek prescribed burn will continue in 2007 with a reread of all plots two-years post burn. In addition to those measurements made one-year post burn, measurements of the abundance and cover of forbs and grasses within the sagebrush community will be conducted with FMH-style BARTR plots and controls.

Lower Spread Creek/Uhl Draw

A collaborative prescribed burn among the BTNF, GTNP, and WGFD was implemented in May 1997. The burn targeted aspen, willow, and sagebrush communities within an approximately 4,000 acre area southeast of Moran Junction (Figure 43).

Annual monitoring was conducted from 1997-2004 to determine willow and aspen response as well as browsing levels. The monitoring design included three fence treatments (i.e., exclosures); 1) no fencing received both livestock and wildlife browsing, 2) summer fencing to preclude just livestock use, and 3) year-long fencing to preclude both livestock and wildlife. The exclosures were 256 ft^2 and approximately 7 ft in height.

The area is within elk, moose, and bison winter and transitional ranges. Cattle were allowed to utilize the area during the 1997 and 1998 grazing seasons only. By 2004, willow heights had achieved: 79 inches in the sites fenced year-long, 24 inches in the sites fenced only in the summer, and 18 inches in sites which received both livestock and wild ungulate use (Figure 48). Aspen sucker heights for the treatments were 42, 23, and 19 inches, respectively. Aspen sucker densities six yr post burn were 7,627, 6,102, and 2,881 stems/acre, respectively.

The data indicate that mean willow height continued to increase in the year-round exclosure for four growing seasons and then stabilized at potential natural height. This is the expected response due to year-round exclusion of wild and domestic ungulates. Willow response in the summer-only fenced area was an increase in height for the first two growing seasons and then decrease in height until they stabilized at a height similar to the control or unfenced area.

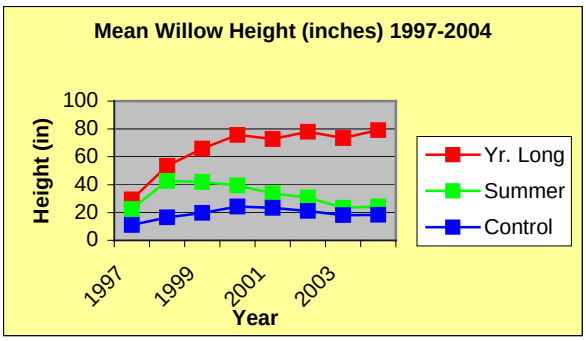

Figure 48. Post-burn mean willow stem heights for three fencing treatments in the Lower Spread Creek area.

The sites were visited during summer-fall months and no wildlife herbivory was observed. Livestock had not used the area since the summer of 1998. Thus, one would conclude that wintering wild ungulates were responsible for the reduced willow heights. Visits to the site during late winter indicated most plants were generally browsed to the existing snow depth. Willow stems in the control or unfenced area were heavily browsed during the 1997 and 1998 summers by cattle. After the removal of cattle, stems increased in height until they were similar to stems in the summer-fenced treatment. Willow stem height currently appears to be suppressed by winter wildlife herbivory for both treatments. Aspen stem heights follow a similar pattern for the three treatments.

Aspen monitoring in the Gros Ventre

Previous aspen investigators working within the Gros Ventre drainage have expressed concern that regenerating aspen with existing levels of herbivory would be difficult. Aspen monitoring in an adjacent drainage, Dry Cottonwood Creek, indicated typically 75% of the regenerating suckers have one or more of the leaders browsed each year. Approximately 90% of the browsing occurs during the fall/winter season and 10% during the spring (WGFD 2000).

Krebill (1972) concluded that if current browsing and parent tree mortality continued most of the aspen type in the Gros Ventre would ultimately be eliminated from these winter ranges. Bartos et al. (1994), after monitoring sucker response 12 years post burn in the Breakneck Ridge area, questioned the continued use of fire to regenerate aspen stands that are subject to heavy ungulate use. Such management action could speed the elimination of aspen stands.

Bartos et al. (1994) and Bartos and Mueggler (1981) evaluated the effects of prescribed fire on decadent aspen stands within the Gros Ventre drainage. The primary purpose of the prescribed burns was to produce more aspen suckers than the local wintering elk population could consume. Initial suckering response, approximately 20,000 stems/ha, was adequate to regenerate deteriorating aspen stands. Densities 6 years post treatment (4,300-10,300 stems/ha) were about the same as pretreatment. Bartos et al. (1994) reported sucker densities 12 years post treatment ranging from 1,500 to 2,400 stems/ha, which was 29 to 38% less than pre-burn densities. The control also had a 39% decrease in production which was attributed to elk use.

It has been hypothesized, however, that some burned aspen stands are capable of successful regeneration despite heavy elk use (Despain et al 1986; Gruell and Loope 1974; Houston 1982). Evidence of successful prescribed fire induced aspen regeneration amid large wild ungulate populations on other sites in the Gros Ventre drainage and elsewhere in northwest Wyoming has encouraged managers to continue treating aspen.

Managers continue to monitor the effects of fire induced aspen regeneration and ungulate herbivory to determine site opportunities for successful regeneration. Kilpatrick and Abendroth (2000) established aspen belt transects in association with prescribed burns within the Bacon Creek

drainage. They were monitored annually from 1996-1999 and sporadically since that time. General objectives were to recycle sagebrush communities and regenerate decadent aspen stands. Successful clone establishment objectives were: 1) mean stem densities > 12,355 stems/ha, 2) mean stem heights > 3m.

Mean stem height increased from 0.79m in 1996 to 1.1m in 1999 (Figure 49). Mean stem densities 8-10 years post-treatment were 19,300 stems/ha (+/- 4,632 stems/ha). Overall stem density did not change (P< 0.05) from 1996-1999 (Figure 50). Due to differential snow accumulations affecting browse availability, northeast (NE) and south-southwest (SSW) aspects were compared. Mean stem densities were not different between these aspects (P < 0.05)(Figure 51). However, mean stem height on NE aspects (1.40m) was greater (P < 0.05) than SSW aspects (0.80m)(Figure 52). Their ability to detect a difference in regenerating aspen height between aspects was probably due to differential browsing levels of ungulates.

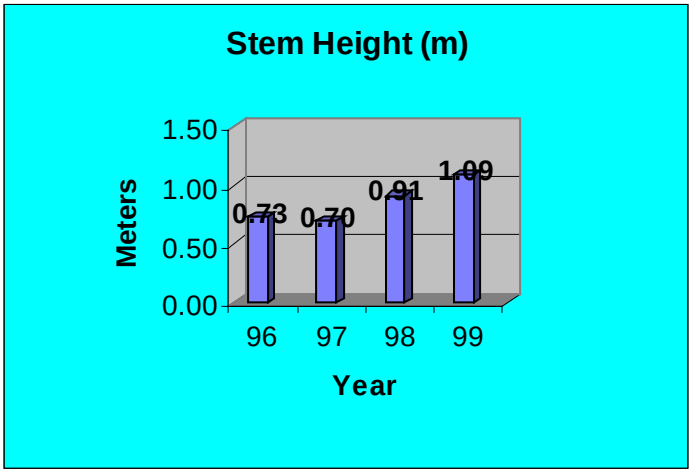

Figure 49. Aspen sucker heights following 8-10 growing seasons following prescribed burning. (From Kilpatrick and Abendroth 2000).

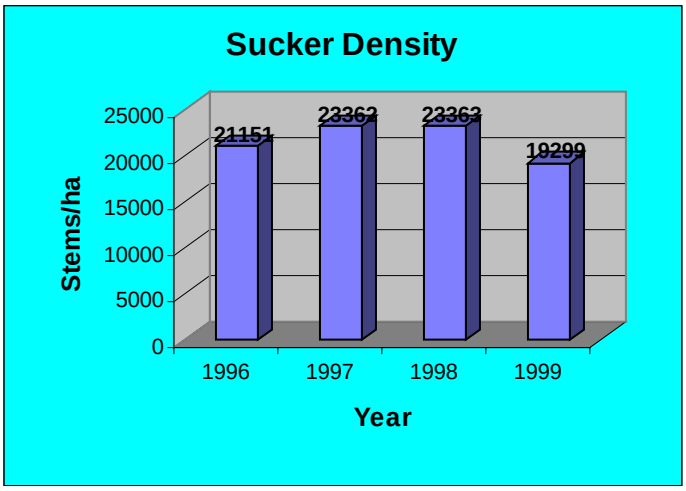

Figure 50. Aspen sucker density 8-10 growing seasons following prescribed burning. There was not a significant difference between years (P < 0.05). (From Kilpatrick and Abendroth 2000).

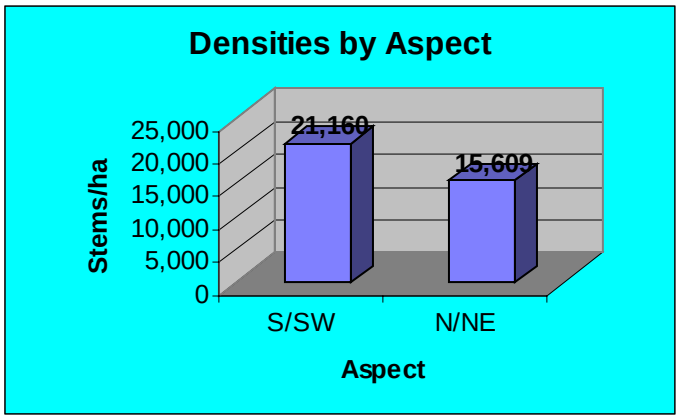

Figure 51. Aspen sucker density 8-10 growing seasons following prescribed burning. There was not a significant difference between aspects ($P < 0.05$). (From Kilpatrick and Abendroth 2000).

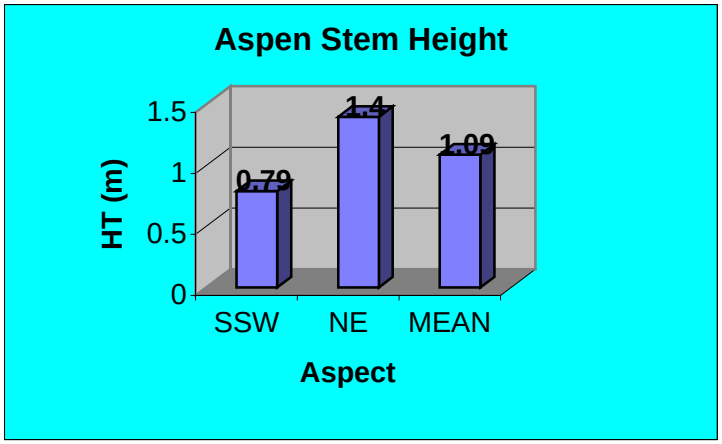

Figure 52. Comparison of aspen sucker heights between aspects (SSW= south/southwest; NE=northeast). Height differentials between aspects were significantly different ($P < 0.05$). (From Kilpatrick and Abendroth 2000).

Selecting potential aspen treatment sites based on aspect appears to be one of many factors managers can control and should be considered in areas of high wintering ungulate populations. Monitoring results in the Bacon Creek tributary indicate northerly aspects have a better chance of escaping suppressive levels of herbivory. Sucker growth rates, heights, and densities indicate successful clone establishment 8-ll years post treatment. Clones on southerly aspects appear to still have vigor, are maintaining adequate densities, and slowly gaining height. Southerly aspects will require continued monitoring before drawing conclusions on success/failure.

Detailed knowledge of wintering ungulate distribution and concentrations is also critical to successful aspen regeneration and is something managers can obtain. While in close proximity to each other and adjacent supplemental elk feedgrounds, herbivory levels differ considerably between the Breakneck Ridge area and Bacon Creek. Historic observations of winter elk use indicate much larger numbers using the Breakneck area for wintering, migration, and loafing. Combining the knowledge gained from Bartos et al. (1994) with what we now know about elk distribution, managers would emphasize the Breakneck Ridge site for potential

aspen regeneration. More detailed information on numbers of animals, timing of use, and duration of use will be helpful in selecting potential treatment sites.

The time of initiation of supplemental elk feeding can be managed, and may affect aspen herbivory levels. Herbivory appears to be reduced during years when abrupt accumulations of snow trigger earlier supplemental feeding in the Gros Ventre. The potential exists for early initiation of feeding to attract elk away from treatments until stems are more browse resistant.

Locating treatments a certain distance from elk feedgrounds may or may not help to protect suckers from browse pressure. Localized wintering elk and/or moose populations can easily suppress aspen regeneration. Again, determining seasonal use patterns for wild ungulates is critical. Fire induced aspen regeneration within summer and transitional ranges appears to be very successful in northwest Wyoming.

Fire induced aspen regeneration has also been successful in human impacted areas. Areas receiving higher levels of human use usually preclude wintering wildlife use, thus reducing the probability of suppressing herbivory levels. While winter browse for ungulates is not realized, all other values associated with aspen communities will still be realized.

Prescribed Burn Projects & Monitoring (late 1980s-late 1990s)

In 1989, WGFD and BTNF cooperatively initiated a program for the improvement of winter and transitional ranges for wild ungulates in the Jackson Ranger District. Vegetative communities within the Curtis Canyon, Gros Ventre River drainage and Buffalo Valley were targeted for treatment.

The cooperative vegetation treatment and monitoring program was generally designed to address the effects of historic fire suppression and advanced vegetation succession across the landscape. Specific goals were to:

1. Provide a greater diversity of habitats by setting back natural succession to early and mid-seral vegetative plant communities, thus increasing the quality and quantity of forage produced on crucial big game winter range.
2. Reestablish early spring and late fall transition range for big game.
3. Reduce competition among big game species on crucial winter range by improving the quality and quantity of forage produced.
4. Regenerate decadent aspen stands, and stands being encroached by conifers, thus maintaining an important habitat component.
5. Maintain habitat and vegetative diversity and other resource values including visual quality objectives and soil and water quality and quantity.
6. Reduce elk dependency on supplemental feeding by improving the quality and quantity of forage produced on crucial big game winter range.

In addition to enhancement projects, an extensive monitoring program was initiated for many of these areas. Permanent nested-frequency monitoring sites were established in the Curtis Canyon, Dry Hollow, Bacon Creek, Dry Cottonwood, Dry Dallas, Haystack Fork, Russold Hill, and Squaw Creek. Control and treatment sites were established at each location.

Nearly all the treatments were successful in setting succession back to early seral stages and increasing habitat diversity. Prescribed-burn treatments generally increased herbaceous forage production, increased species diversity, increased aspen and mountain shrub regeneration, and decreased sagebrush density and canopy cover. Additionally, wintering wild ungulates were

documented utilizing treated areas with an apparent preference over untreated areas. The Jackson Ranger District produced a report in 1993 summarizing initial monitoring: *Crucial Winter Range and Transitional Range Vegetation Treatment Projects, Monitoring and Evaluation* (BTNF 1993).

2. Proposed Projects

a. Lower Gros Ventre

JIHI recently initiated a habitat inventory in the lower reaches of the Gros Ventre drainage. The area thus far inventoried is generally bounded on the south by the Gros Ventre River, on the east by Slate Creek, on the north by the North Fork of Ditch Creek, and on the east by the GTNP boundary (Figure 43). David Alexander was hired in 2005 by pooled funds from the JIHI agencies to complete an inventory of the area and provide a GIS based habitat-type map. That phase of the inventory was completed in summer 2005. Agency personnel are proposing a fall 2007 burn within two of the 11 burn units (Units J and K: 5,600 acres). The larger project area covers 17,000 acres of burn units, which will be implemented over several years.

Vegetation within the project area includes a mix of Douglas fir, subalpine fir, lodgepole pine, Engelmann spruce, limber pine, aspen, sagebrush, and small willow/riparian communities. Treatment and monitoring objectives include conifer mortality, aspen regeneration and browse, maintenance of limber pine, reduction of sagebrush density, and increase of bighorn sheep and elk forage and nutritional quality. Conifer-encroached aspen, limber pine, and sagebrush stands designated as important bighorn sheep and elk winter habitats are high priority within the project area.

Pre-burn monitoring for burn units J and K was initiated in 2006. Aspen density measurements were done in a conifer-encroached aspen stand. Shrub density measurements were completed in both treatment and control sagebrush stands. Photopoints were installed to monitor additional aspen stands. Additional photopoints will be installed during the 2007 field season to monitor limber pine stands.

b. Upper Gros Ventre

River (Joy) Osborn was hired in 2006 through the State of Wyoming Internship Program to continue the JIHI habitat/community typing along both sides of the Gros Ventre River from Slate Creek to Dry Cottonwood Creek. Many different vegetation types are present in the project area. There are four general habitat/community type groupings: aspen, aspen/conifer mix, aspen/sage/forb mix, and mixed conifer (Figure 53). Aspen/conifer mix and mixed conifer make up most of the polygons with aspen/sage/forb mix being common. Only eight polygons were identified that are true aspen community types, a few of which are in poor ecological condition. Aspen stands of varying stages of succession and conifer encroachment can be found throughout the project area. The project area is considered an important winter range and migration corridor for bighorn sheep as well as elk.

Future goals include maintaining existing aspen stands, and regenerating and expanding aspen on the landscape in order to increase forage production and nutritional quality of native forbs and grasses. Aspen has been emphasized due to its importance as critical big game habitat.

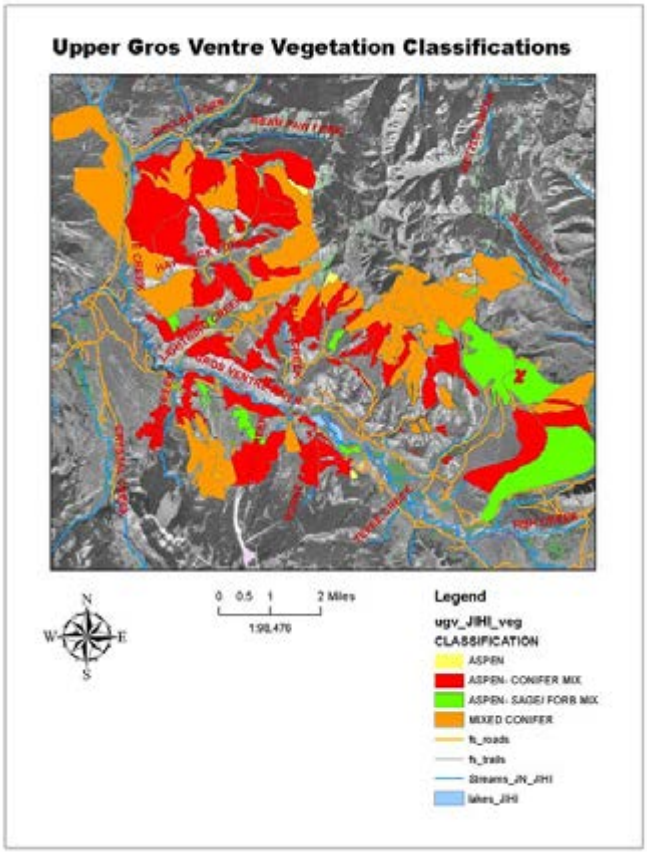

Figure 53. Location and delineation of major vegetation classifications between Slate Creek and Cottonwood Creek within the Gros Ventre drainage, 2006.

c. South West Quad

This will be a timber project followed by a prescribed burn, just north of Spread Creek within the JIHI project area. It was the second highest priority area in Buffalo Valley outlined by JIHI. There is extensive conifer encroached aspen in the area that could use treatment to increase aspen regeneration. The area is important transitional range for elk, and is used as winter range in some years as well. The project is still in the planning phase and may not be implemented for a year or two.

d. Lava Creek

The currently proposed Lava Creek prescribed burn project is a 130-acre portion of the Buffalo Valley Defensible Space Fuels Reduction Project. Implementation of this project adjacent to private land is intended to reduce the potential for high intensity wildland fire by reducing fuel loads, breaking up the continuity of sagebrush fuels via a burn mosaic, and rejuvenating aspen stands.

The plant communities include aspen, mixed aspen/conifer, sagebrush, and mountain shrubs. Sagebrush slopes along the south edge of the unit along the highway present the greatest hazard fuels risk to the adjacent private land because they are downslope and upwind, and include some old and dense stands. The mountain shrubs and aspen on the east end are more

mesic, however they are directly upwind and adjacent to the only road that accesses the subdivision. This project is ready for implementation in 2007.

e. Randolph Mountain Hazardous Fuels

This is a prescribed burn on the BTNF located north of the Buffalo Valley road. It has primarily fuel reduction objectives, but is located in an area that is widely used by elk and moose. WGFD is currently trying to put objectives into this project that will encompass wildlife needs such as aspen regeneration. This is an area that JIHI identified to investigate in several years. However, the Forest was ready to implement the project prior to JIHI analyzing it. This project will include a variety of treatment methods including mechanical and prescribed fire. The NEPA process is not completed yet, and implementation may be a year or two away.

D. Additional Habitat Monitoring Data

1. Wildfires

Wildfires have spread across more than 300,000 acres of the Jackson EHU since 1988 (Table 19, Figure 54). Several small wildfires have occurred as well. Between 1946 and 1998, at least 22 wildfires occurred on the NER alone, but only totaled about 345 acres (Smith et al. 2004).

Table 19. Significant wildfires in the Jackson EHU since 1988, with land ownership, year, and acreage burned. Habitat is listed in order of size of area burned of that type.

Wildfire Name*	Landowner	*Year*	*Habitat*	*Acres*
Purdy Fire*	BTNF	2006	Sagebrush/Aspen/Conifer	22,569
Moss Ridge Fire*	BTNF	2003	Conifer/Sagebrush	2,972
Blacktail Fire	GTNP	2003	Sagebrush	2,652
Enos Fire	BTNF	2000	Conifer/Sagebrush	7,406
Row Fire	GTNP	1994	Sagebrush	3,404
Dry Cottonwood Fire	BTNF	1991	Sagebrush/Aspen	8,672
Hunter Fire	BTNF	1988	Sagebrush	4,634
Mink Fire	BTNF	1988	Conifer/Aspen/Sagebrush	144,689
Huck Fire	BTNF	1988	Conifer/Aspen/Sagebrush	119,433

* Designated as Fire-Use Wildfire for Resource Benefit

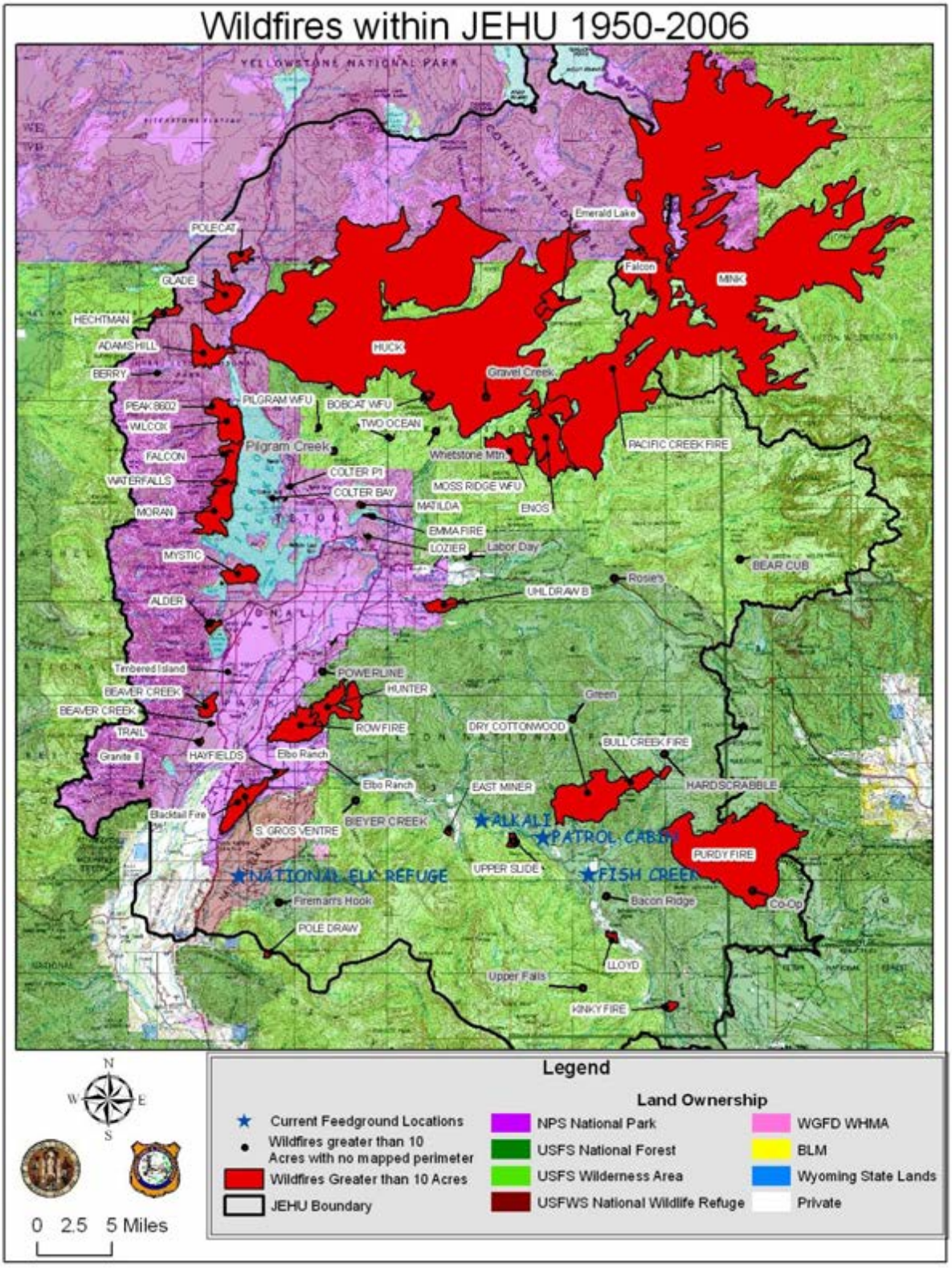

Figure 54. Wildfires occurring in the Jackson EHU since 1950.

2. Winter Range Production Clippings

Herbaceous forage production was measured in ten out of the last eleven years on four winter range transects associated with feedgrounds in the Jackson and Fall Creek EHUs. Transects are located on south facing slopes of historical winter ranges and in close proximity (≤ 1 mile) of feedgrounds. Each transect is 100 m long; vegetation is clipped at 20 points inside a 1.96 ft^2 frame. Sampling is done in late September to October. Samples are air dried for a minimum of two weeks, then weighed. Transect photos are taken each year as well for a visual comparison.

Table 20. Herbaceous production measured in the fall of 2005. Production is calculated from the mean dry mass of vegetation clipped at 20 points along each transect.

Site	Production (lbs/acre)	Standard Deviation	95% Conf. Intervals
Patrol Cabin	358	223	276-440
Fish Creek	234	163	144-324
Horse Creek	2328	686	1560-3096
Camp Creek	780	305	596-974

Forage production in 2005 was greater than production in 2004 on all sites except Patrol Cabin (Table 20, Figure 55). Production (measured in lbs/acre) in 2004 was 510, 195, 1,665, and 458 lbs/ac at Patrol Cabin, Fish Creek, Horse Creek, and Camp Creek, respectively. However, the mean production in 2005 was still lower than the previous 9 year mean at Fish Creek and Patrol Cabin.

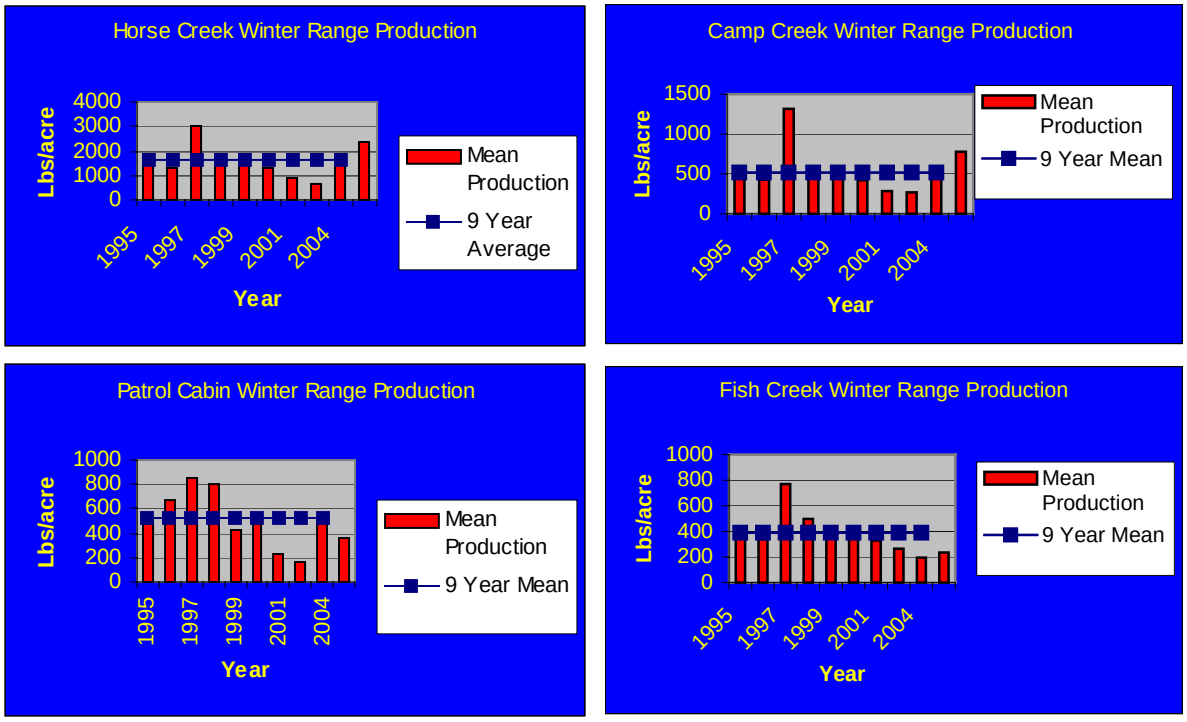

Figure 55. Mean herbaceous production, 1995-2005, with the long-term mean at four winter range production clipping transects.

3. Willow Monitoring

In fall 2005, four sets of long-term riparian monitoring transects were established in order to quantify species composition, age class, plant height, and evaluate offtake (i.e., browse intensity). Two of these transects are located in the Buffalo Valley (one in GTNP and one in the "Moose Pasture" near Blackrock Ranger Station) and the other two are located in the Gros Ventre (one by Goosewing Ranch and one by Elk Track Ranch). Transects ideally are monitored annually in the spring for all data and in the fall for all data excluding offtake; photo monitoring is also done on each visit (Figure 56). We have been able to detect over the last three years a clear preference for Booth willow (*Salix boothii*) over Geyers willow (*Salix geyeriana*) for browse by ungulates, primarily moose and elk. Many other willow species are present, but at lower densities.

Figure 56. Photo-monitoring point at Elk Track Ranch, one of the four riparian monitoring transects.

E. Literature Cited

Aune, K., K. Alt, and T. Lemke. 2002. Managing wildlife habitat to control brucellosis in the Montana portion of the GYA. Pages 109-119 in T.J. Kreeger, editor. Brucellosis in elk and bison in the Greater Yellowstone Area. Wyoming Game and Fish Department, Greater Yellowstone Interagency Brucellosis Committee, Cheyenne, Wyoming, USA.

Bartos, D.L., J.K. Brown, and G.D. Booth. 1994. Twelve years biomass response in aspen communities following fire. Journal of Range Management 47:79-83.

———, and W.F. Mueggler. 1981. Early succession in aspen communities following fire in western Wyoming. Journal of Range Management 34:315-318.

———, W.F. Mueggler, and R.B. Campbell. 1991. Regeneration of aspen by suckering on burned sites in western Wyoming. Research Paper INT-448. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT.

Clause, D., S. Kilpatrick, R. Dean, and B. Smith. 2002. Brucellosis-Feedground-Habitat Program: An integrated management approach to brucellosis in elk in Wyoming. Pages 80-96 *in* T.J. Kreeger, editor. Brucellosis in elk and bison in the Greater Yellowstone area. Wyoming Game and Fish Department, Greater Yellowstone Interagency Brucellosis Committee, Cheyenne, USA.

Despain, D., D. Houston, M. Meagher and P. Schollery. 1986. Wildlife in transition: Man and nature on Yellowstone's northern range. Roberts Rinehart Inc., Boulder, CO, USA.

Gruell, C.E., and L.L. Loope. 1974. Relationship among aspen, fire, and ungulate browsing in Jackson Hole, Wyoming. U.S. Forest Service Intermountain Region, Ogden, UT.

Houston, D.B. 1973. Wildfires in northern Yellowstone National Park. Ecology 54:1111-1117.

———. 1982. The northern Yellowstone elk: Ecology and management. Macmillan Publishing, New York, NY, USA.

Kilpatrick, S.A., and D.C. Abendroth. 2000. Aspen response to prescribed fire and ungulate herbivory. Pages 387-393 *in* Sustaining aspen in western landscapes, Symposium Proceedings. Grand Junction, CO, USA.

———, D. Clause, and D. Scott. 2003. Aspen response to prescribed fire, mechanical treatment and ungulate herbivory. Pages 93-102 i*n* USDA Forest Service Proceedings: Fire, fuel treatments, and ecological restoration, RMRS-P-29. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fort Collins, CO.

Krebill, R.G. 1972. Mortality of aspen on the Gros Ventre elk winter range . USDA Forest Service Research Paper INT-129. Intermountain Forest and Range Experiment Station, Ogden, UT.

Preble, E.A. 1911. Report on Conditions of elk in Jackson Hole, Wyoming, in 1911. USDA Biological Bulletin 40.

Roffe, T.J., L.C. Jones, K. Coffin, M.L. Drew, S.J. Sweeny, S.D. Hagius, P.H. Elzer, and D. Davis. 2004. Efficacy of single calfhood vaccination of elk with *Brucella abortus* strain 19. Journal of Wildlife Management 68:830-836.

Schier, G.A. 1974. Deterioration of aspen clones in the middle Rocky Mountains. Research Paper INT-170. USDA, Ogden, UT, USA.

Sheldon, C. 1927. The Conservation of the Elk of Jackson Hole, Wyoming. A Report to Hon. Dwight F. Davis, the Secretary of War, Chairman of the President's Committee on Outdoor Recreation and Hon. Frank C. Emerson, Governor of Wyoming. National Conference on Outdoor Recreation, Washington, D.C., USA.

Smith, B.L., E.K. Cole, and D. S. Dobkin. 2004. Imperfect pasture: A century of change at the National Elk Refuge in Jackson Hole, Wyoming. Grand Teton Natural History Association, Moose, Wyoming, USA.

Stroud, D. 1990. Habitat modification techniques (mechanical, biological, herbicide & special). Habitat Extension Bulletin No. 34. Wyoming Game and Fish Department, Cheyenne, WY, USA.

Thorne, E.T., J.K. Morton, and W.C. Ray. 1979. Brucellosis, its effect and impact on elk in western Wyoming. Pages 212-200 *in* M. S. Boyce and L. O. Hayden-Wing, editors. North American elk: Ecology, behavior, and management. University of Wyoming, Laramie, USA.

———, ———, and ———. 1991. Brucellosis vaccination of free-ranging elk (*Cervus elaphus*) on western Wyoming feedgrounds. Pages 107-112 *in* R.D. Brown, editor. The biology of deer. Springer-Verlag, New York, NY, USA.
Wyoming Game and Fish Department. 1990. Brucellosis/feedground/habitat management plan for the Jackson elk herd unit. Cheyenne, WY, USA.
———. 1999. 1998 Jackson/Pinedale Region Annual Big Game Herd Unit Report. Cheyenne, WY, USA.
———. 2000. 1999 Jackson/Pinedale Region Annual Big Game Herd Unit Report. Cheyenne, WY, USA.
———. 2001. Strategic Habitat Plan. Cheyenne, WY, USA.
———. 2004. 2003 Jackson/Pinedale Region annual big game herd unit job completion report. Cheyenne, WY, USA.
———. 2006. Effects of feedground elk on vegetation. Cheyenne, WY, USA.
Wright, H.A., and A.W. Bailey. 1982. Fire ecology: United States and southern Canada. John Wiley & Sons, New York, NY, USA.