Pinedale Elk Herd Unit (E108)
Brucellosis Management Action Plan
FINAL DRAFT (April 27th, 2006)

A. Introduction

The Pinedale Elk Herd (PEH) is located on the west slope of the Wind River Mountain Range in eastern Sublette and northern Sweetwater Counties, Wyoming and includes elk hunt areas 97 and 98 (Map 1). The area is bounded on the northwest by Pine Creek and Fremont Lake, the northeast by the Continental Divide, the southwest by the Green River, and the southeast by the Big Sandy River. It encompasses approximately 2,430 square miles (mi²), of which only 505 mi² are considered occupied elk habitat. Approximately 465 mi² is delineated as spring/summer/fall range, 18 mi² as Crucial Winter Yearlong, 16 mi² as Crucial Winter, and 6 mi² as Winter Year Long (Map 2). The remaining 1,925 mi² are mostly lower elevation areas in lower precipitation zones, once portions of native elk winter range. Three feedgrounds are located within the PEH: Fall Creek, Scab Creek, and Muddy Creek. These feedgrounds were established primarily to reduce depredation to privately owned stored hay, minimize risk of interspecific co-mingling of elk and livestock, and reduce winter mortality.

The U.S. Forest Service (USFS) manages the majority of lands within the occupied elk habitat in the PEH, with over half designated as Wilderness (Bridger Wilderness). Most private lands in this herd unit are concentrated at lower elevations associated with riparian and floodplain habitat of the Big Sandy, East Fork, Boulder Creek, and Pole Creek drainages. The Bureau of Land Management (BLM) manages the majority of unoccupied elk range within the PEH (Map 1)

This Brucellosis Management Action Plan (BMAP) was prepared to develop strategies for dealing with brucellosis issues in the PEH. Appendix 1 includes background management data and information relevant to understanding, formulating, and implementing this plan.

B. Brucellosis Management Options

The WGFD currently employs several methods to minimize intraspecific transmission of brucellosis among elk. Elk feeders are encouraged to feed hay on clean snow when possible to reduce inadvertent ingestion of contaminated feed and exudates. Elk are ballistically vaccinated with Strain 19 on 21 of 22 state feedgrounds and currently on the NER to reduce abortion events. Attempts have been made to reduce the duration of the feeding season on each feedground. However, damage and elk/livestock co-mingling concerns typically determine the duration of feeding on many feedgrounds.

Damage and livestock-elk co-mingling concerns contribute to increased risk of intraspecific transmission among elk. In most circumstances, elk are not tolerated consuming private crops and co-mingling 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 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 disease transmission. However, given current seroprevalence rates for elk feedgrounds and the recent brucellosis occurrences in cattle, these methods alone may not be sufficient to reduce incidence of the disease in elk to acceptable levels and prevent future interspecific transmissions. Alternative management options should be evaluated.

The intent of this document is to summarize existing data associated with elk and brucellosis management in the PEH; detail potential areas where a high risk of disease transmission exists; incorporate feedback from land management agencies and livestock producers, and develop a list of management actions that could, if implemented, reduce brucellosis prevalence in elk and the risk of interspecific transmission from elk to cattle; and indicate how each management option will be applied in the PEH. This plan is adaptive, and periodic revisions will occur to address new disease management tools or technologies and to update information.

To reduce prevalence of brucellosis in elk on feedgrounds, given current technologies and efficacy of vaccines, feeding durations would need to be decreased or ceased, if possible, during periods of high transmission risk. Reduced feeding durations will probably increase co-mingling if implemented abruptly, but reducing elk numbers through hunting prior to initiating the option could limit 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 or eliminating feeding entirely is considered to be a desirable option. 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.

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

1. Re-locating feedgrounds to lower elevation sites with increased geographic area for elk to disperse and increased distance from winter cattle operations.
2. Elimination of feedgrounds.
3. Reducing numbers of elk on the feedgrounds through increased harvest.

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

C. Discussion of Options

1. Feedground Relocation

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

Prior to feeding elk at the present site of the Muddy Creek feedground, the WGFD fed at three other sites. One of these sites was between Pocket Creek and the East Fork River, one at the Leckie place (SE of current site), and another near Buckskin crossing (Map 3). The Fall Creek feedground was originally started several miles west of the present location and was moved twice before the present site was selected. Scab Creek feedground was also located at two different sites before the present location was selected. Documentation of why these sites were moved is lacking.

Pros:
-may contribute to lower brucellosis prevalence
-elk would have increased area to disperse
-feeders could feed in larger area and on clean snow
-elk numbers could be maintained at or near current levels
-may decrease damage and co-mingling situations

Cons:
-difficulty may be experienced during initial habituation of elk to the new site
-problems may arise in spring when elk are migrating to higher elevations and elk may be attracted to private crops en route (these problems exist near some feedgrounds in their current locations)
-brucellosis prevalence may persist
-localized damage to vegetation
-may increase competition of elk with mule deer, antelope, and sage grouse
-would require funds for erection of new structures, fences, roads, etc.

The Muddy Creek feedground may have the potential for relocation given the above criteria. Fall and Scab Creek feedgrounds have no or limited potential. Significant cooperation and coordination with land management agencies and permittess will be required to implement this option for any of these three feedgrounds.

2. Feedground Elimination

This option, given current conditions and herd objectives, is currently not feasible for feedgrounds in the PEH. However, if current conditions and herd objectives change, through implementation of one or more of options 3, 4, 6, 7, and 8, this option may become more realistic. The WGFC has the authority to make this decision.

Pros:

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

Cons:

-would increase the risk of property damage and interspecific transmission of brucellosis to livestock if implemented abruptly with current numbers of elk and/or prior to elimination of brucellosis in elk
-would increase elk winter mortality
-would lower the number of elk that could be maintained in the PEH
-would reduce income to the WGFD due to reduced license sales
-would reduce hunter opportunity
-may increase potential for vehicle-elk collisions on Highway 191

3. Elk Reduction

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

Pros:

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

Cons:

-the response of seroprevalence of brucellosis in elk when populations are reduced is unknown, yet it is unlikely to reduce incidence to an acceptable level assuming the remaining elk are still fed
-the general public may be unwilling to accept large reductions in elk numbers
-will cause a loss of elk hunting opportunity
-may reduce license revenue in the long term (may be offset by reduced management costs)

All feedgrounds within the PEH would probably be affected equally by implementation of this option. The Scab Creek feedground may benefit the most due to the smaller area of the feedground.

4. Cattle Producer Change of Operation

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

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

5. Fencing

Elk proof fencing of feedgrounds may contain most elk within a given area, and fencing of winter cattle feedlines could prevent elk from co-mingling with cattle. This would require favorable decisions by the landowner (private and/or state/federal).

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

Cons:
-costs
-congregating all or most of the elk within the fence may be unfeasible
-large areas of fencing could impede migrations of other wildlife
-does not address seroprevalence of brucellosis in elk
-some producers may be unwilling to erect fencing
-would require federal agency cooperation and potential NEPA evaluation for federal lands

Interspecific disease transmission may decrease equally among all feedgrounds within the PEH with implementation of this option

6. Elk Test and Removal

This option could eliminate a percentage of the seropositive animals on a feedground. The number of aborted fetuses and associated fetal fluids contaminated with *Brucella* bacteria may be decreased. The WGFC has the authority to make this decision.

Pros:
-may reduce brucellosis prevalence in elk
-may reduce elk numbers to more efficiently pursue options 1,2,6,7, and 8.

-may increase tolerance of elk on private lands if brucellosis prevalence is decreased

Cons:
-would require erection of large traps on feedgrounds capable of working many animals with large holding pens
-will be very expensive and require substantial fiscal and personnel resources
-must be implemented on all feedgrounds for numerous years to minimize possibility of future increases in brucellosis prevalence.
-the general public may not support such an operation due to decreased elk numbers
-does not address other potential diseases on feedgrounds
-all seropositive animals may not be infected
-if the option is implemented for numerous years, the large amounts of money and effort spent could be negated by only one *Brucella* infected fetus aborted on a feedground, which has the potential to infect hundreds of naive animals, resulting in increased seroprevalence and subsequent *Brucella* induced abortions
-would require federal agency cooperation and potential NEPA evaluation for federal lands

The rates of both intra- and interspecific brucellosis transmission may decrease on all feedgrounds within the PEH given implementation of this option.

7. Habitat Enhancement

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

Pros:
-could reduce feeding duration and brucellosis prevalence
-would benefit many species of wildlife and, in some instances, cattle

Cons:
-may have limited effectiveness in reducing dependency on supplemental feed by the availability of forage in years of high snow accumulation
-elk may not be tolerated on treatment areas when in close proximity to livestock
-requires changes in post-treatment wildlife and livestock management within the treatment area to ensure treatment effectiveness
-would require approval of federal agencies for federal land, private landowners for deeded land, and the State Land Board for state land projects
-may increase likelihood of invasive specie(s) establishment
-will be very expensive and require substantial fiscal and personnel resources

This option may be best used in conjunction with options 1,2,3, and 8 to achieve maximum success. The risk of intra- and interspecific disease transmission may decrease on all feedgrounds within the PEH with implementation of this option.

8. Acquisition/Conservation Easements

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

Pros:

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

Cons:

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

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

9. Continuation of Strain 19 Elk Vaccination Program

The WGFD initiated this program in 1985 on Grey's River feedground, and has vaccinated around 66,000 elk to date on 22 state operated feedgrounds and the National Elk Refuge. Elk cows and calves are vaccinated the first two years, then calves only thereafter assuming adequate coverage is maintained. Dell Creek feedground serves as a control population (i.e. no vaccination) to assess effectiveness of the vaccination program in reducing brucellosis seroprevalence in elk (see Appendix 1, Section D).
Controlled studies with captive elk indicated Strain 19 elk vaccinates were around 30% less likely to abort than unvaccinated control animals after being challenged with *B. abortus* strain 2308 (69% abortion rate in non-vaccinated elk and 40% in vaccinates) (Thorne et al., 1981). Brucellosis seroprevalence data from Dell Creek and Grey's River feedground elk indicate no significant difference. 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, and the potential that the infectious dose may overwhelm antibody protection. The decision authority lies with the WGFC.

Pros:

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

Cons:

-will be very expensive and require substantial fiscal and personnel resources
-has not shown to reduce seroprevalence in elk on feedgrounds

-elk must be concentrated on feedgrounds to ensure delivery is feasible

This option is currently employed on all feedgrounds in the PEH. Disease transmission risk will likely not decrease significantly if this option is continued, based on the program's evaluation to date between Grey's River and Dell Creek feedgrounds.

D. Coordination Meetings

Personnel from the WGFD and the BLM met on August 2, 2004 at the BLM office in Pinedale to discuss alternative management options to elk feedgrounds and brucellosis management. Topics included: reduction of cattle AUM's on some allotments in native elk winter range, potential response of the BLM if Muddy Creek feedground were moved south and west, and future oil and gas development in native elk winter ranges within the PEH unit. BLM officials suggested communication with the potentially affected permittees must be conducted, and their agreement and cooperation would be necessary before any actions would be authorized by the BLM. The WGFD was advised to plan any potential management action, work with potentially affected permittees and develop their agreement, and then submit the plan to the BLM.

Several personal communications were held between WGFD personnel and USFS personnel in the Pinedale Ranger District of the BTNF. As management options concerning native elk winter range and the development/acquisition/enhancement thereof does not primarily involve USFS lands, these communications were limited in scope to conducting habitat treatments in areas of elk transitional ranges and limited areas of potential elk winter range. USFS personnel indicated willingness to pursue habitat treatments in the Muddy Ridge area that may, if implemented, result in reduced dependency of elk on supplemental feed on the Muddy Creek feedground. USFS and private lands near Scab Creek feedground were also discussed as potential treatment areas. These discussions are ongoing and WGFD BFH and Habitat biologists are actively delineating areas for treatment.

A meeting was held November 19th, 2004 to discuss brucellosis management options with the producers in the PEH. Fourteen interested producers, representatives from the BLM, USFS, WGFD, and AHPIS, and the State Veterinarian and the Sublette County Agriculture Extension Agent attended. Each option was discussed and a general consensus on acceptable management actions pertaining to seven of the options were developed. Development of specific management actions for each livestock operation was left for APHIS, the State Veterinarian, and producers to develop in the Individual Herd Plans.

E. Proposed Management Actions

1. Feedground Relocation

The WGFD will work with producers and land management agencies to determine opportunities for moving the Muddy Creek Feedground and pursue this option as opportunities are identified.

2. Feedground Elimination

The WGFD will not pursue this option in the immediate future given existing elk brucellosis seroprevalence rates and public expectations for current elk numbers. The highest probability for successfully implementing this option is with the Muddy Creek Feedground. Implementation will require allocation of AUMs on public lands or purchase of private AUMS for elk on elk winter range south of the Muddy Creek Feedground. It will also require a reduction in brucellosis prevalence and willingness by three or four landowners adjacent to or south of the Muddy Creek Feedground to change winter feeding programs or to fence winter-feeding areas to prevent short stopping of elk. WGFD employees will pursue all opportunities that will facilitate this option.

3. Elk Reduction

The WGFD manages for current, Commission established, elk herd unit population objectives. Elk herd unit reviews occur every 5 years. Elk herd unit management, including population objectives for the PEH, will be reviewed and discussed at a public meeting during the winter of 2005/2006. Following meetings and public input, the WGFD will present recommended herd unit population objectives to the WGFC for their consideration and action. The WGFD will design harvest strategies to ensure elk populations are maintained at established herd unit objectives.

4. Cattle Producer Change of Operation

The WGFD will encourage cattle producers to implement any changes to their operations that decrease the risk of interspecific disease transmission.

5. Fencing

The WGFD will contract to construct approximately 1.6 miles of elk proof fencing near the Muddy Creek elk feedground to reduce elk movements onto private property and the risk of interspecific disease transmission events. See Map 4 for a detailed overview of the fence, which will be completed by fall, 2006.

6. Elk Test and Removal

The WGFD will implement the recommendations of Wyoming Governor Fruedenthal's Brucellosis Coordination Team and carry out a 5 year pilot test and slaughter project on the three feedgrounds in the Pinedale elk herd unit in an effort to reduce brucellosis prevalence in the Pinedale elk herd. The current herd unit population objective is 1900. The elk population will not be reduced more than 10% below objective during the pilot project. Following the five-year pilot project the WGFD will evaluate the technique and determine if this management option warrants further consideration. The pilot test and slaughter program was commenced on the Muddy Creek feedground during winter 2006, and will proceed as follows if at all possible:

Fiscal Year 2007 (July 1, 2006 - June 30, 2007)
- Test and slaughter on Muddy Creek feedground
- Construct and erect new portable elk trap on Fall Creek feedground

FY08
- Test and slaughter on Muddy and Fall Creek feedgrounds
- Construct and erect new portable trap on Scab Creek feedground

FY09 and FY10
- Test and slaughter on Muddy, Fall, and Scab Creek feedgrounds

7. Habitat Enhancement

The WGFD will continue to coordinate with private landowners, federal land managers and livestock permittees to develop and implement habitat improvements that may reduce elk dependency on supplemental feed.

Several areas have been identified in the PEH unit near feedgrounds. Muddy Ridge, east and south of the current Muddy Creek feedground, includes several large south facing slopes currently heavily encroached by sagebrush and conifers. WGFD employees plan to work with USFS personnel and livestock permittees to develop a prescribed burn project to increase grass and forb production. Several south facing slopes are also in the vicinity of Scab Creek feedground located on private, BLM and USFS owned lands. The landowner and permittee have indicated interest in pursuing habitat treatments, and the WGFD will work with the federal land management agencies to develop projects.

A final endeavor currently being considered is developing a forage reserve allotment on USFS lands east and south of the Muddy Creek feedground. The allotment is currently unoccupied by livestock, but receives trespass use due to inadequate livestock fencing. A proposal was submitted by the WGFD to the Governor's Wildlife Trust Fund to provide monies for improving the livestock fence system and develop this allotment as a forage reserve to provide alternate pasture for willing producers whose current allotment(s) are being rested for habitat treatments.

8. Acquisition/Conservation Easements

The WGFD will continue to identify and pursue all opportunities that will facilitate our efforts to move or eliminate the Muddy Creek Feedground or reduce feeding duration on Muddy Creek, Fall Creek or Scab Creek Feedgrounds. Project proposals have and will continue to be submitted to the Wildlife and Natural Resources Trust, as well as other funding sources, to facilitate implementation of this option.

9. Vaccination of Elk Calves

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

F. Best Management Practices

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

Feedground Management

1. 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, unless data prove it is not effective
6. Prevent elk/cattle commingling

G. Additional Actions

Brucellosis Surveillance

The WGFD currently traps and tests elk for exposure to brucellosis on 4 to 6 feedgrounds annually. This practice should continue on as many feedgrounds as possible annually to assess efficacy of the Strain 19 vaccination program and monitor prevalence of the disease. Additionally, hunter-harvested elk brucellosis surveillance will occur annually in an effort to survey the entire state over a 4-year period. Feedground surveillance efforts may be reduced during the Pinedale elk herd unit test and removal pilot project.

Information and Education

BFH and other WGFD personnel regularly inform and educate various public factions about wildlife diseases, including brucellosis. Educational outreach has included group presentations, news releases, interpretive signs at feedgrounds and crucial winter ranges, and various brochures and publications. The importance of quality wildlife habitat and the substantial role fire plays in natural ecosystems are also stressed during public forums. BFH and other WGFD field staff make numerous private landowner contacts regarding habitat improvement projects, wildlife-friendly management techniques, or ways to prevent commingling of elk and livestock. Additional efforts are focused on area school groups and events such as the WGFD's annual Hunting and Fishing EXPO to inform children and their parents on brucellosis management.

These efforts should be continued to inform the public of the WGFD's role in brucellosis management and relay consequences of the disease to the State's economy. Additionally, should any of the aforementioned options be officially adopted, I&E efforts should focus on why the option(s) was (were) pursued and what benefits may be realized. The public should be made aware of any proactive management embarked upon by the WGFD, and their interests in the actions should be heard.

Progress Reporting

Efforts associated with each management option within this plan will be summarized and a detailed report will be submitted on an annual basis.

Research

Sound management of brucellosis in elk on feedgrounds and the risk of transmission from elk to cattle necessitate accurate and reliable data to facilitate decisions. Most research concerning brucellosis, feedground elk, and feedground management has focused on elk vaccination. Many aspects of feedground elk ecology, brucellosis transmission and pathology, and feedground management have not been investigated. Potential research topics that could assist in management decisions are listed below.

1. Relationship of seropositive vs. culture positive, and strain of *Brucella*, in feedground elk.
2. Characteristics of scavenging of aborted fetuses 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. Relationship of coyote densities and scavenging rates on feedgrounds.
7. Abortion and viable birth rates, and temporal and spatial distribution of abortions and births, in seropositive feedground elk.
8. Relationship of brucellosis seroprevalence and feeding duration.
9. Collect snow-water equivalency measurements in areas of habitat enhancement projects, both past and future, and correlate with elk use and distribution.

Appendix 1.

A. Historical Elk Herd Management

Prior to the establishment of feedgrounds along the west slope of the Wind River Mountains, elk migrated from the higher elevations to winter at lower elevations in lower precipitation zones to the south. The last known large-scale migrations of elk occurred around 1910. The first known record of supplemental elk feeding within the PEH occurred during the winter of 1948-1949, when elk were reportedly fed throughout western Wyoming. Approximately 2,000 head were fed in the Green River-Pinedale area. The WGFD began supervising supplemental elk feeding in the PEH in 1958-1959, when 236 elk were fed on Muddy Creek feedground. Feeding was initiated at Fall Creek and Scab Creek feedgrounds in 1960-1961 and 1967-1968, respectively.

Elk herd management regimes in the PEH have been designed to maintain elk numbers established by the WGFD Commission. Current Commission feedground quotas are as follows: Fall Creek, 700; Scab Creek, 500; and Muddy Creek, 600. These quotas were last changed in 1987, when the objective for Scab Creek was increased from 233 to the current quota, and Fall and Muddy Creek remained static. The current post-hunt population objective for the PEH is 1,900 elk wintering on and off feedgrounds.

B. Current Elk Herd Management

Population Estimate

Past attempts to create a functional population simulation model for this herd unit have not been successful. Annual attempts to construct a population simulation model for this herd unit were made until 1998. These attempts produced models that poorly represented actual herd dynamics. Hence, reported harvest, sex/age classification data obtained from post-season surveys, and trend counts have been used to estimate population size.

2002-2003 Trend Count and Herd Composition Survey

The 2002 and 2003 trend counts were the lowest recorded over the past 10 years (Table 1). The mild winter of 2002-03 and a significantly reduced flight budget contributed to a low overall count. 2003 classification counts yielded less than 100 elk on native winter range. Total elk numbers were down approximately 150 animals from 2002 at Fall Creek feedground, up 200 animals at Scab Creek feedground, and down 100 animals at Muddy feedground. Trend counts from 1994-2001 show an average of 2,142 elk for the entire herd unit, which is slightly higher than the desired population objective of 1,900 (+/- 10%).

Table 1. Herd Trend Counts in the Pinedale Elk Herd Unit, 1994-2003.

Location	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Fall Creek F.G	813	723	911	611	806	533	690	696	182	547
Scab Creek F.G	515	501	630	585	588	631	627	585	651	710
Muddy Creek F.G.	697	771	523	594	566	676	580	620	550	486
N.W.R.	218	326	123	430	159	297	86	25	315	75
Herd Unit Total	**2243**	**2321**	**2188**	**2220**	**2119**	**2137**	**1983**	**1926**	**1698**	**1818**

Herd composition surveys documented bull:100 cow:calf ratios of 25:100:27 for 2003. Bull:100 cow ratios remained identical while calves:100 cows increased slightly from 2002 to 2003 (Table 2). The long-term average (1994-2001) for this herd unit reflects a total bull:100 cow ratio of 30:100 and a calf:100 cow ratio of 32:100. Calf production from 1994-2001 exhibited a pattern of highs and lows that changed to a stable rate in 2002 and 2003. This alternating pattern with calves is also apparent with yearling bulls, but to a much lesser extent. Years following high calf production show slightly higher yearling bull:100 cow ratios (Table 2).

Table 2. Herd composition summary for the Pinedale Herd Unit, 1994-2003.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Ad. Bulls:100 Cows	13	16	23	16	21	20	20	20	17	17
Yrlng Bulls:100 Cows	10	13	11	12	10	13	12	13	9	8
Total Bulls:100 Cows	22	29	34	28	31	33	32	33	25	25
Calves:100 Cows	34	23	38	27	38	27	35	30	24	27

Harvest

The proposed 2003 harvest objective of 540 elk was not reached during the 2003 hunting season, which may be attributed to a very warm and dry autumn. A total of 499 elk were harvested during the 2003 hunting season, which was similar to the 517 elk harvested in 2002. The 2003 harvest comprised 175 mature bulls, 23 yearling bulls, 231 cows, and 70 calves. This represents 92 elk less than the previous 5 year average harvest of 591 for this herd unit. Although harvests for 2002 and 2003 were lower than projected, they were sufficient to stabilize and/or slightly reduce this population. The 2000 harvest survey indicated a total harvest of 790 elk (347 cows), the highest recorded in the past 10 years. The high 2000 harvest contributed to the gradual decline in population trends over the past three years.

Hunter Success

During the 2003 hunting season, it took an average of 21 days to harvest an elk with 32% hunter success. During the previous five years, hunter success and effort has varied with a low of 21% success and 33 days/animal in 1999 to a high of 46% success and 13 days/animal during 2000.

WGFD personnel typically field check a relatively small proportion (~10%) of the total harvest from hunt areas 97 and 98. Fifty-three, 42, and 50 elk were field checked during 2001, 2002, and 2003, respectively. Field checks have traditionally been difficult to obtain from these hunt areas. Much of the area is backcountry and encountering hunters at various trailheads is unpredictable. Check stations have been attempted at several locations with little success. Other herd units have taken priority for gathering harvest and age data, so little emphasis has been placed on collecting harvest data in the PEH. In addition, this population had been exceeding management objectives with respect to population size and bull:100 cow ratios, so there was little cause for intensive data collection. With declining trends in population estimates, increased data collection may be necessary in future years.

Additionally, no teeth were collected for cementum annuli aging. This population is healthy and current hunting regulations have not adversely affected any segment of the herd. Thus, detailed analysis of age structure data is not necessary at this point in time.

Table 3. Harvest Trends in the Pinedale Herd Unit, 1994-2003.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Adult Males	327	162	320	208	299	182	255	217	237	175
Yearling Males	29	39	47	46	35	40	61	41	30	23
Total Males	356	201	367	254	334	222	316	258	267	198
Females	241	148	283	253	323	121	347	260	215	231
Juveniles	35	16	28	37	38	47	127	44	35	70
Total Harvest	632	365	678	544	695	390	790	562	517	499

Ear Tag Returns

In effort to increase understanding of elk movements in and out of the PEH, a trapping and tagging program has been conducted periodically in conjunction with brucellosis surveillance activities since 1990 in this herd unit. Animals were trapped and tagged at Muddy Feedground during 1990, 1991, 1996, and 1997. Elk were also trapped and tagged at Fall Creek Feedground during the 1994 and 1995 winters. Tag returns from 2002 and 2003 totaled nine, all of which were killed within the PEH (Table 4). An evaluation of all tag returns (n=131) from elk tagged within the PEH (1990-2003) indicates that only 8% (n=10) of the tagged elk were killed outside the herd unit. Of 10 elk harvested outside the unit, one was harvested from Hunt Area 24 (E638), 2 from Hunt Area 96 (E107), and 7 from Hunt Areas 28 and 99 (E637). Overall, tag return data indicate little interchange with surrounding elk herd units. Tagging data also indicate the majority of elk are killed within the area they were trapped and tagged, as indicated from the 2002 and 2003 returns.

Table 4. Tag returns from the Pinedale Elk Herd Unit, 2000-2003.

Tag #	Date Tagged	Tag Location (HA)	Sex	Age	Kill Date	Kill Location (HA)
G5395	1/20/1997	Muddy Creek FG (98)	F	Juv.	11/18/2002	NE Fork (98)
G5289	1/19/1995	Fall Creek FG (97)	F	Adult	9/25/2002	Fall Creek (97)
G5178	1/17/1995	Fall Creek FG (97)	F	Adult	11/11/2002	Burnt Lake (97)
G5376	1/20/1997	Muddy Creek FG (98)	F	Juv.	9/24/2002	Boulder Lake (98)
G5300	1/19/1995	Fall Creek FG (97)	F	Juv.	11/12/2003	Halfmoon Mt. (97)
A0886	1/27/1997	Muddy Creek FG (98)	F	Juv.	found tag	Irish Canyon (98)
G5216	1/18/1995	Fall Creek FG (97)	F	Adult	11/16/2003	Fall Creek (97)
G5621	1/29/1996	Muddy Creek FG (98)	F	Yrlg.	found tag	Jim Creek (98)
A0859	1/21/1997	Muddy Creek FG (98)	F	Juv.	10/23/2003	Silver Creek (98)

Chimney Butte Hunter Management Area

The Chimney Butte Hunter Management Area (CBHMA) was implemented in 2001-02 following a request from landowners. The CBMHA is located in Hunt Area 98 between the Silver Creek and East Fork Drainages. During the past three seasons the CBHMA granted access to 100 hunters with antlerless elk licenses valid from mid-November through January 31. The Silver Creek Ranch has been closed during the

month of December. This special hunt was designed to move elk off private ranches, thereby reducing elk damage problems. Lands enrolled in the CBHMA are listed in Table 5. Landowners allow various types of access (foot, horse, or vehicle) to permitted hunters to target problem elk causing damage to stored crops. Approximately 200 head of elk are usually present early in the hunt.

During 2003, 100 access permits were available at the Pinedale Game & Fish Office on a first come basis on November 8th from 8:00 am to noon, and during office hours after that date. Only hunters with an unused area 98 type 1,2, or 6 license could receive a CBHMA permit. Eighty-seven permits were issued during the 2003-04 season. All 100 permits were allocated to hunters in 2001-02.

Table 5. Landowners and acreage enrolled in the CBHMA

Mark Jones	(Jones)	920
East Fork Cattle Company	(Bousman)	3160
Richie Ranches	(Richie)	1550
Smythe Property	(Smythe)	600
Silver Creek Ranch	(Baker)	300
Hittle/Michnevich	(Hittle & Michnevich)	1900
Flying Fish Hook Ranch	(Opler)	80
Jensen Ranches	(Doc Jensen)	1960
TOTAL PRIVATE		10,470
BLM		3,680
TOTAL		**14,150 acres**

The CBHMA has been somewhat effective in harvesting elk and moving them away from hay damage areas. It has also been relatively easy to monitor and enforce, with few violations detected. High hunter activity has been documented during Thanksgiving, Christmas, and periods of cold weather. Landowners have been allowing hunters not enrolled in the CBHMA to hunt on their land and have been extremely easy to work with.

Several hunters were concerned with the closing of a BLM road south of Silver Creek. Closing key access roads to vehicles has allowed elk to stay within the area longer during the day allowing hunters to get within rifle range of elk herds. This hunt has achieved 10 times the elk harvest than the traditional late hunt for this area. Generally, most hunters are satisfied. Prior to this hunt, vehicles accessed much of the area in the early morning, driving elk into more inaccessible areas.

Harvest within the CBHMA was approximately 50 elk during 2001 and has decreased gradually during 2002 and 2003 primarily due to lower hunter participation. Elk have generally been present within the area throughout the hunt, with a small group of bulls typically remaining during the latter end. Cow and calf groups, responsible for the majority of hay damage, typically move out of the CBHMA or into inaccessible areas with increasing hunting pressure. Harvest success in the CBHMA is often dependent upon harsh winter conditions (deep snow and cold temperatures) to move elk into lower, more accessible areas.

During the winter of 2003-04, following the CBHMA season, department personnel met with landowners enrolled in this area to obtain feedback on the hunt. Although

landowners feel the CBHMA season has been effective, it was recommended that the 2004 season close on December 31 instead of January 31. Most landowners believed little hunting occurred during January. The CBHMA will also be expanded on the south end to include the south side of the East Fork drainage at the request of landowners. This expansion should eliminate the potential for elk to stage just south of the Jensen Ranch and encourage elk to move further south towards the Muddy Feedground.

C. Current Feedground Management

The three feedgrounds in the PEH are similar in most respects (e.g. starting and ending dates, potential damage situations). They are located between summer and traditional winter ranges and facilitate keeping elk away from livestock and private property. Most feedground management is primarily based on reducing elk-human conflicts and maintaining WGFC established elk population objectives. There were 1,843 elk fed in this herd unit during the 2003-04 winter, and 8 reported mortalities.

Wolves were present in this herd unit on Fall Creek and Scab Creek feedgrounds in the 2003-04 winter. Wolves predated one elk on each of these feedgrounds. There were no feedground management problems associated with wolf activity.

Elk in the PEH were fed an average of 8.34 lb/elk/day, or 0.56 ton/elk, for the feeding season. The cost of feeding elk was $70.78/animal, which is about $8 more than the ongoing Region average. Damage/co-mingling was not a problem in this herd unit in winter 2003-04. Damage at some traditional sites may have been averted through the implementation of the CBHMA.

Fall Creek

Feeding began November 25, 2003 and continued until March 22, 2004 for a 119-day feeding season (Figure 1). This is one of the shortest feeding seasons since 1975-76 and is 16 days less than the long-term average.

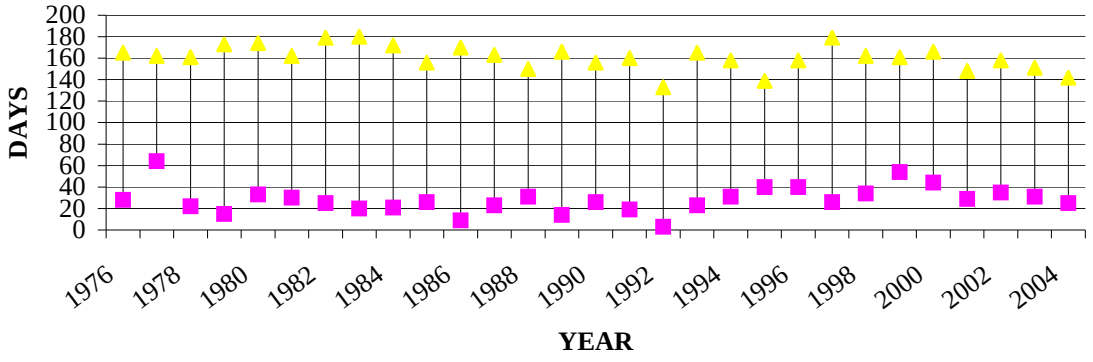

Figure 1. Days fed for the Fall Creek feedground, 1976-2004 (0 on y axis is Nov. 1st).

There were 618 elk on feed in 2003-04, which is 30 elk below the long-term average (Table 6) and 82 elk below the Commission quota of 700. Two elk died on the feedground, one predated by a wolf, and one resulting from an unknown injury. Each elk was fed an average 8.17 lb/day or 0.49 ton for the winter. It cost $61.60/elk at the Fall Creek feedground in 2003-04.

Table 6. Summary data for the Fall Creek feedground, 1975-1976 to 2003-2004.

YEAR	ELK #	TONS	DAYS	DEAD	COST/ELK	TON/ELK
1975-76	660	490	140	0	40	0.74
1976-77	605	253	98	0	28	0.42
1977-78	720	449	140	9	44	0.62
1978-79	580	318	158	6	36	0.55
1980-81	460	207	132	2	35	0.45
1981-82	465	315	156	4	55	0.68
1982-83	563	352	161	3	53	0.63
1983-84	570	372	153	4	56	0.65
1984-85	470	205	139	4	44	0.44
1985-86	527	349	163	10	58	0.66
1986-87	500	265	141	1	51	0.53
1987-88	675	299	122	1	41	0.44
1988-89	680	364	153	7	48	0.54
1989-90	710	277	132	4	49	0.39
1990-91	735	346	142	2	50	0.47
1991-92	700	360	132	11	55	0.51
1992-93	914	419	145	6	52	0.46
1993-94	742	327	128	2	53	0.44
1994-95	813	325	100	2	43	0.4
1995-96	754	368	120	3	62	0.49
1996-97	936	559	154	4	81	0.6
1997-98	635	261	129	4	60	0.41
1998-99	806	230	107	3	35	0.28
1999-20	533	280	123	1	53	0.53
2000-01	691	282	120	2	49	0.41
2001-02	696	337	124	3	76	0.48
2002-03	482(182)	147	121	0	46	0.3
2003-04	618	300	119	2	62	0.49
AVERAGE	648	324	135	4	50	0.51

Scab Creek

Feeding began November 17, 2003 and ended April 6, 2004 for a 142-day feeding season (Figure 2). The 2003 feeding season was 13 days shorter than the long-term average (Table 7) and represented the earliest stopping date since 1975-76.

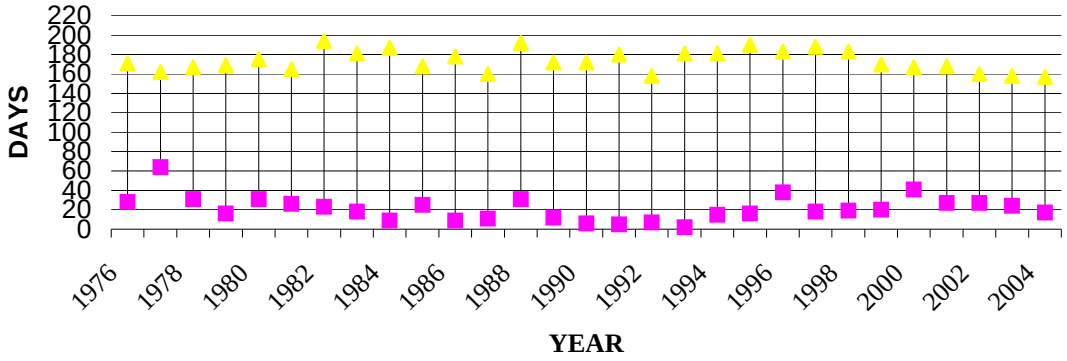

Figure 2. Days fed for the Scab Creek feedground, 1976-2004 (0 on y axis is Nov. 1st).

Elk numbers at Scab Creek have increased gradually since 1998 (Table 7), and in 2003, more elk were fed at Scab Creek than any other year since 1975-76. The 2003-04 attendance figures were 216 elk over the long-term average and 210 elk over the Commission quota of 500. There were 4 elk that died on the feedground. One elk was predated by a wolf and the others died from unknown causes.

Table 7. Summary data for the Scab Creek feedground, 1975-1976 to 2003-2004.

YEAR	ELK #	TONS	DAYS	DEAD	COST/ELK	TON/ELK
1975-76	377	202	143	0	38	0.54
1976-77	200	71	98	0	28	0.36
1977-78	315	197	137	0	51	0.63
1978-79	198	136	157	0	56	0.69
1979-80	215	109	153	2	35	0.51
1980-81	150	76	135	0	52	0.51
1981-82	340	196	176	0	57	0.58
1982-83	416	271	174	2	61	0.65
1983-84	485	246	180	1	51	0.51
1984-85	510	252	160	1	47	0.49
1985-86	615	361	171	1	56	0.59
1986-87	587	286	156	1	49	0.49
1987-88	673	364	163	0	54	0.54
1988-89	670	364	153	3	54	0.54
1989-90	529	290	172	5	73	0.55
1990-91	555	335	176	5	74	0.6
1991-92	504	288	154	5	63	0.57
1992-93	550	392	180	3	87	0.71
1993-94	578	347	166	4	71	0.6
1994-95	515	274	174	4	72	0.6
1995-96	503	356	147	0	82	0.71
1996-97	631	503	171	4	108	0.8
1997-98	601	384	164	2	95	0.64
1999-20	631	299	117	1	56	0.47

Table 7. (Continued)

YEAR	ELK #	TONS	DAYS	DEAD	COST/ELK	TON/ELK
2000-01	627	351	142	1	68	0.55
2001-02	620	363	134	9	93	0.59
2002-03	651	385	135	2	85	0.59
2003-04	710	416	142	4	80	0.59
AVERAGE	494	286	155	2	64	0.58

Elk were fed 8.25 lbs/day and totaled 0.59 ton/elk for the entire winter (Table 7). The cost per elk fed was $79.74, which was the highest for this herd unit and about $17 more than the Region average.

Muddy Creek

Feeding began November 30, 2003 and ended April 6, 2004 (Figure 3). This was a 129-day feeding season and was 19 days less than the long-term average (Table 8). There were 486 elk fed at this site, which was 64 elk less than the previous year, 114 elk less than the long-term average, and 95 elk below the Commission quota of 600 elk (Table 8). Two elk died on this feedground in 2003; one was crippled and one cause of death was undetermined.

Elk were fed an average 8.61 lb/day, or 0.56 ton/elk/winter. It cost $73.00/elk for this feedground, which was similar to cost from the previous two winters (Table 8).

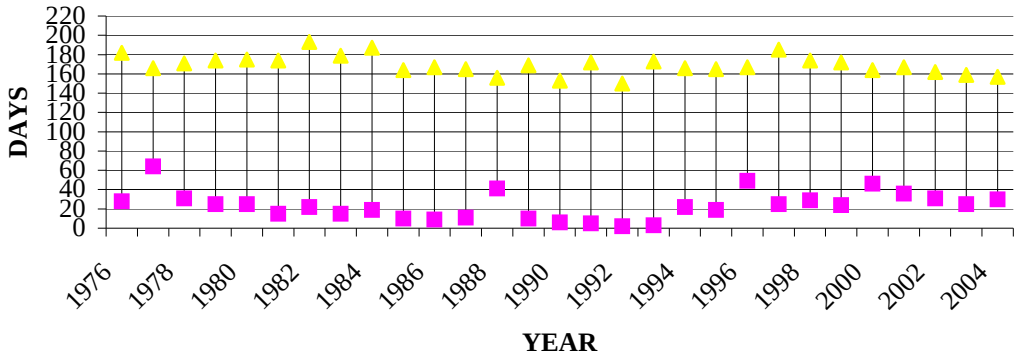

Figure 3. Days fed for the Muddy Creek feedground, 1976-2004 (0 on y axis is Nov. 1st).

Table 8. Summary data for the Muddy Creek feedground, 1975-1976 to 2003-2004.

YEAR	ELK #	TONS	DAYS	DEAD	COST/ELK	TON/ELK
1975-76	803	622	153	1	42	0.77
1976-77	770	285	102	2	24	0.37
1977-78	470	305	141	1	47	0.65
1978-79	580	378	159	4	43	0.65
1979-80	473	309	151	5	46	0.65

Table 8. (Continued)

YEAR	ELK #	TONS	DAYS	DEAD	COST/ELK	TON/ELK
1981-82	486	415	171	0	70	0.85
1982-83	610	335	165	6	48	0.55
1983-84	620	402	175	0	55	0.65
1984-85	430	260	156	3	56	0.6
1985-86	483	321	160	7	61	0.66
1986-87	431	230	155	0	52	0.53
1987-88	560	288	117	1	47	0.51
1988-89	564	366	162	2	67	0.65
1989-90	537	247	148	4	59	0.46
1990-91	648	449	168	2	82	0.69
1991-92	590	363	150	3	63	0.62
1992-93	780	490	171	2	72	0.63
1993-94	730	265	145	0	47	0.36
1994-95	750	375	154	11	58	0.5
1995-96	786	322	120	2	48	0.41
1996-97	523	390	161	7	101	0.75
1997-98	594	313	147	0	67	0.53
1998-99	566	359	153	1	76	0.63
1999-20	676	290	119	4	50	0.43
2000-01	580	334	126	3	57	0.58
2001-02	635	327	132	3	73	0.51
2002-03	550	279	135	5	72	0.51
2003-04	486	270	129	2	73	0.56
AVERAGE	600	341	148	3	58	0.58

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 co-mingling 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 greatly from the Jackson/Pinedale Region's existing 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 may be implemented and others may not. Some are in direct contrast with others and 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 goals may be given preference, this goal should be considered when making all decisions regarding the operation of feedgrounds. The degree to which this goal can be applied depends on the situation. Reducing the length of the feeding season is desirable when trying to reduce the spread of disease and feeding costs. The earlier that feeding can be terminated in spring, the greater the potential of reducing brucellosis exposure among elk.
2. Does the feedground assist in the efforts of the Department to prevent damage to private property? This is a primary function of feedgrounds. Without holding elk at these feedgrounds, elk can cause considerable damage to private property and increase the risk of transmitting brucellosis to domestic livestock.
3. What can be done to keep feedground operating costs as low as possible? The amount of hay fed (influenced primarily by the number of elk and length of the feeding season) represents most of the cost for 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 possible? This usually involves keeping the feedgrounds as large as possible and feeding on fresh snow as much as possible.
5. Attempt to feed at a rate that keeps the elk in good body condition where potential damage problems are not a concern. 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 in early winter, then feed enough to keep pregnant cows in good nutritional condition during late winter. It is these two age groups (calves on the feedground and those to be born in the spring) that are most susceptible to inadequate nutrition.
6. Attempt to feed at rate that will satisfy the elk's appetite when 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 damage on private lands and commingling with livestock).

Feedground Operation Plans

Fall Creek

Most of this feedground is located on BLM and USFS property. Some feeding occurs on adjacent WGFD administered land. The established quota is 700 elk.

Primary Management Issues

1. Damage prevention is the primary goal for the operation of this feedground. Once migrating elk have moved beyond the feedground, they can be very difficult to haze back.

Secondary Management Issues

1. Feed lines should be as distant from Fall Creek as possible.

2. Living quarters are provided at this feedground for the elk feeder. Because this feeder lives in isolation, there should be some method of monitoring the safety of the feeder.

Management Suggestions/Criteria

1. Free ranging elk will generally forage on the Half Moon Unit until forage becomes limited. Feeding should begin at this time or they will move to the Fayette Ranch where they may co-mingle with livestock or damage stored crops. It is very difficult to haze elk back to the feedground once they move this far.
2. Feeding can be terminated when sufficient forage on native ranges is available to distribute elk away from agricultural conflict and hay consumption diminishes. The feeder can reduce the amount offered in an effort to encourage them to free-range.

Scab Creek

The Scab Creek Feedground is located on BLM property. This area is relatively small and rocky and is one of the less desirable feeding sites of all feedgrounds. Free water is not available at the site and water for horses must be hauled or snow melted. Feeding commonly initiates earlier than adjacent feedgrounds to ensure the elk are held in the area. Livestock operations exist below the feedground and elk that move past the feedground before feeding begins can cause damage and may be difficult to haze back. The established quota is 500 elk.

Primary Management Concerns

1. Because of the ease with which damage can occur and the difficulty in moving elk in this area, most of the feedground management is based on holding elk on the feedground before they migrate to lower elevations.

Secondary Management Concerns

1. Potential damage problems can exist in the spring if elk move to lower elevations and onto private property.
2. The number of elk on this feedground has exceeded the Commission quota for the past 20 years. Attempts have been made to reduce this population.

Management Suggestions/Criteria

1. Feeding is normally initiated as soon as elk begin arriving at this site in the fall. This is because there is normally little native forage available for the elk and significant damage problems can result if the elk move on to adjacent private property.
2. Efforts should be made to encourage the elk to free-range in the spring. On many feedgrounds, elk will voluntarily leave in the spring regardless of how they are fed. Feeding can be reduced in spring as snow recedes, and monitoring of elk distribution/behavior should be used as indices to range readiness and feeding termination.

Muddy Creek

This is the southern most feedground on the western slope of the Wind River Range and is located on USFS property. This is a less than desirable feeding site, situated in the bottom of the Muddy Creek drainage and relatively small in area. Several livestock operations are located within a few miles of the feedground, and damage concerns drive most of the feedground management decisions. There is an elk fence west of the feedground running north to south near the BTNF boundary on private and state lands, which was designed to reduce damage to private property. However, elk can easily move around the end of the fence. The established quota is 600 elk.

Primary Management Issues

1. Elk must not be allowed to free-range when risking damage/co-mingling problems.

Secondary Management Issues

1. Access to and from the feedground is allowed via an easement with adjacent landowners. Courtesy and respect should be shown when using the easement to maintain positive working relationships with the landowners.

Management Suggestions/Criteria

1. Feeding should be initiated when elk arrive at the feedground and demonstrate movement from the area, or if snow and forage conditions indicate that available forage is marginal. Hay meadows exist north of the elk fence and feeding should begin early enough to prevent elk from moving onto these fields.
2. Feeding rates can be reduced in spring when the elk begin leaving the feedground. This can be done to encourage elk to leave.

D. Brucellosis Management Summary

The Wyoming Game & Fish Department (WGFD) developed an integrated program in an attempt to manage brucellosis in free-ranging elk associated with feedgrounds in the late 1980s. This approach, called the Brucellosis-Feedground-Habitat (BFH) Program, combines 5 ongoing management activities: feedground elk vaccination, feedground management, habitat enhancement, elk/cattle separation, and brucellosis education. Goals established in 1989 were: maintain spatial and/or temporal separation of elk and cattle during brucellosis transmission risk periods, reduce prevalence of brucellosis in elk through vaccination and habitat improvements, and to work with all affected interests in trying to eliminate brucellosis in the GYA. BFH and other WGFD personnel conduct the following activities.

Vaccination

Elk were first vaccinated in the PEH on Fall Creek feedground in 1994. Scab and Muddy Creek feedgrounds initiated vaccination in 1995. Numbers vaccinated and

percent coverage of number classified per feedground from 2000 to 2006 are listed in Table 9.

Table 9. 1998 – 2006 vaccination summary for Fall, Scab, and Muddy Creek feedground elk.

PEH Feedground Vaccination Summary

		Classification			Calves Vaccinated	
Year	Feedground	Calves	Females	Total elk	Number	% of classified
2000	Fall Creek	77	314	533	149	> 100
2000	Scab Creek	120	407	631	118	98
2000	Muddy Creek	111	449	676	123	> 100
2001	Fall Creek	156	391	690	176	> 100
2001	Scab Creek	141	380	627	158	> 100
2001	Muddy Creek	108	375	580	115	> 100
2002	Fall Creek	139	415	696	157	> 100
2002	Scab Creek	108	364	585	117	> 100
2002	Muddy Creek	108	406	620	115	> 100
2003	Fall Creek	30	115	182	148	> 100
2003	Scab Creek	113	444	651	130	> 100
2003	Muddy Creek	82	371	550	85	> 100
2004	Fall Creek	104	357	547	133	> 100
2004	Scab Creek	131	467	710	145	> 100
2004	Muddy Creek	70	325	486	75	> 100
2005	Fall Creek	111	270	438	111	100
2005	Scab Creek	168	520	825	198	>100
2005*	Muddy Creek	84	242	396	43	51
2006	Fall Creek	79	328	506	85	>100
2006	Scab Creek	135	551	810	150	>100
2006**	Muddy Creek	103	263	431	NA	NA

* elk left feedground early, preventing 100% coverage

** pilot test and slaughter project initiated, no vaccination to prevent false titers

Serology

The WGFD initiated brucellosis surveillance of elk on the Greys River feedground and National Elk Refuge 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. Three thousand seven hundred and five yearling and adult female

elk trapped on 19 different feedgrounds have been tested to date. Elk on Fall Creek feedground were tested in 1994 and 1995. Muddy Creek feedground elk were trapped and tested on 1990, 91, 96, 97, and 2004-2006 (Table 10). A permanent trap does not exist on the Scab Creek feedground, and these elk have never been tested.

Four tests are used to evaluate elk sera; the standard plate agglutination test (SPT), the buffered *Brucella* antigen rapid card test (BBA), the rivanol precipitation-plate agglutination test (RIV), and the complement fixation test (CF). Seroprevalence is determined using procedures published in Brucellosis in Cervidae: Uniform Methods and Rules, Effective September 30, 1998, published by United States Department of Agriculture – Animal and Plant Health Inspection Service (APHIS 91-45-12). Sera that produce a reaction on two or more tests, or if the CF test alone shows a reaction at a dilution rate of 2+ 1:20 or higher, are considered positive. Once serostatus is determined using these criteria, the cELISA (competitive enzyme-linked immunosorbent assay) is conducted on positive sera to differentiate between Strain 19 vaccine and field strain *Brucella abortus* titers. Seroprevalence indicates the animal has been exposed to *Brucella* and has formed an antibody response, but does not determine presence (or infection) of *Brucella* within the animal.

Table 10. Number of yearling, adult, and total female, and % seroprevalence of elk tested on Fall and Muddy Creek feedgrounds as determined by 4 standard tests and cELISA.

FG	YEAR	# Tested			% Seroprevalence	
		Yearling	Adult	Total	4 Standard	cELISA
Fall Cr.	1994	2	12	14	43%	29%
	1995	4	22	26	42%	15%
	SUM	6	34	40	43%	20%
Muddy Cr.	1990	2	14	16	25%	*
	1991	5	5	10	10%	*
	1996	17	35	52	56%	37%
	1997	7	31	38	50%	24%
	2004	3	12	15	27%	27%
	2005	5	25	30	27%	27%
	2006	10	148	158	37%	37%
	SUM	49	270	319	39%	33%

* cELISA test not conducted

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 (Table 11) indicate Brucella seroprevalence averages 32.4% (+/- 13.9) on Dell Creek, and has fluctuated from 8% in 2004 to 50% in 1999. Seroprevalence on Fall Creek averages 20.0% (+/- 9.9), and the mean rate of Muddy Creek elk is 33% (+/- 9.8).

Table 11. Yearly and mean seroprevalence (%) as determined by 4 standard and cELISA tests on Dell, Fall, and Muddy Creek feedgrounds

Year	Dell Cr.*	Fall Cr.	Muddy Cr.
1993			
1994		29	
1995		15	
1996			37
1997			24
1998	26		
1999	50		
2000	45		
2001	26		
2002	35		
2003	37		
2004	8		27
2005	18		27
2006	13		37
TOTAL	**28.0**	**20.0**	**33.0**

*Dell Cr. is a control and has never been vaccinated

Elk/Cattle Disease Transmission Reduction

Annually, BFH and other 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. Since 1992, elk-proof fencing materials for 192 haystacks have been provided by BFH personnel to cattle producers in Lincoln, Sublette, and Teton counties in western Wyoming. Approximately 54 of these have been delivered to producers within the PEH.

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. 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.

Since 1999, BFH personnel have monitored areas where elk parturition and cattle turn out dates overlap (Map 5). During the elk calving period from late May to mid June, a potential 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 1999-2005. Coordination and education efforts with land managers and grazing operators will be initiated to resolve elk/cattle interaction if and when conflict areas are identified.

E. Habitat Management Summary

A primary goal of the "Habitat" approach of the BFH program is to enhance transitional and winter elk habitat to potentially minimize the transmission and prevalence of brucellosis in elk associated with feedgrounds. Manipulating decadent vegetation can increase the production and palatability of grasses. If habitat improvements are completed near feedgrounds or between summer range and feedgrounds, the enhanced forage produced will decrease the dependence of elk on artificial feed, snow conditions permitting. Reduced feeding durations and lower elk concentrations on feedgrounds, especially during the high transmission risk period, may decrease the probability of intraspecific brucellosis transmission events. Habitat enhancement projects also create vegetative diversity, enhance aspen communities, and improve range conditions for myriad species.

Habitat enhancement projects can be employed to mimic natural disturbances and restore habitat to a more properly functioning condition. BFH biologists work with WGFD Habitat biologists and other agencies to implement habitat enhancement projects that improve elk transitional and winter ranges as well as habitat for many other wildlife species. These projects involve identification of treatment areas, habitat inventory, implementation, and post-treatment monitoring.

Numerous habitat improvement techniques can be utilized to increase habitat quantity and quality for elk and other wildlife. These methods involve manipulating vegetation to create a mosaic of multi-aged plant communities across the landscape. The most commonly used habitat enhancement techniques include prescribed fire, mechanical treatments, and herbicide application.

Several habitat enhancement projects have occurred within the PEH on elk winter and transitional ranges. Most of these are associated with an elk feedground (Map 6). Cooperators on the project included the BTNF, WGFD, BLM, RMEF, and private landowners. Table 12 lists habitat projects conducted within the PEH since 1990.

Table 12. Habitat projects conducted within the PEH

Prescribed Fire – 8,300 total acres treated at five locations.
Fayette Ranch/Halfmoon: 5000 acres of sage/bitterbrush. Private, WGFD, and USFS lands.
Boulder Ridge: 600 acres of sage/bitterbrush. USFS land.
Burnt Lake: 400 acres of sage/bitterbrush and aspen. USFS land.
South Boulder: 1200 acres of sage/bitterbrush and aspen. BLM and USFS lands.
Cottonwood Allotment: 1100 acres of sage/bitterbrush. BLM land.

Herbicide (Spike) – 620 total acres treated at two locations.
West Boulder: 600 acres of sage/bitterbrush. WGFD land.
Burnt Lake: 20 acres of sagebrush. USFS land.

Mechanical (Cutting) – 30 total acres treated at one location.
Burnt Lake: 30 acres of aspen. USFS land.

Total = 8,950 acres treated at 8 locations

In addition, approximately 43,000 acres of wildfires have occurred within the PEH since the late 1980's, primarily in elk summer range (Map 7).

BFH Project Biologists and Habitat Biologists conduct vegetation monitoring to evaluate success of treatments in meeting objectives, and gain knowledge useful in planning future projects. Permanent plots are established to collect various plant attributes to assess habitat quality and monitor vegetation response post-treatment. Ideally, data from a plot located in a treated area (i.e., prescribed fire, etc.) are compared with data from an untreated ("control") area to detect vegetative changes. If a control plot is not established, data collected from the treated site during different years provide comparative information. Data collected from plots include one or several of the following: cover, shrub/tree density, shrub/tree age structure, forage production, species diversity, and photographs. In additon to monitoring vegetation response, elk use patterns in relation to treatments is also monitored.

Prescribed Fire

Fayette Ranch/Halfmoon Mountain Prescribed Fire

In 1996, a prescribed burn was conducted to improve existing habitat conditions by reducing shrub cover and increasing herbaceous production on 2000 acres of the Fayette Ranch (private land). The prescribed fire escaped and burned additional acreage of the Halfmoon Wildlife Habitat Management Area (WGFD land) and USFS land, totaling approximately 5,000 acres.

Vegetation plots were established prior to treatment on the Fayette Ranch and one year post-treatment on Halfmoon Mountain to monitor effects of the fire. Control plots were not established. A large percentage of the shrub component was removed and shrub density has remained low post treatment (Table 13). Total herbaceous production decreased 36% from 1999 to 2001 (Figure 4) and may be attributed to drought conditions.

Prior to the fire, small numbers of elk had been documented utilizing the southerly, wind-blown slopes of Halfmoon Mountain for portions of some winters. Since the treatment, large numbers of elk have been observed wintering on Halfmoon Mountain, and elk damage on Fayette Ranch has decreased. Fencing and various cattle management alterations have also been important in reducing elk damage and commingling. This burn may have contributed to reduced elk numbers observed on the Fall Creek feedground.

Table 13. Density of shrubs/hectare at treatment sites on the Fayette Ranch and Halfmoon Mountain up to 5 years post-treatment.

Location	Macroplot	Shrub Density/Hectare			
		1996 (pre)	1997	1999	2001
Fayette Ranch	FCFR	24,560	No Data	2,800	3,200
Halfmoon Mountain	FCHM	No Data	3,600	5,120	4,480

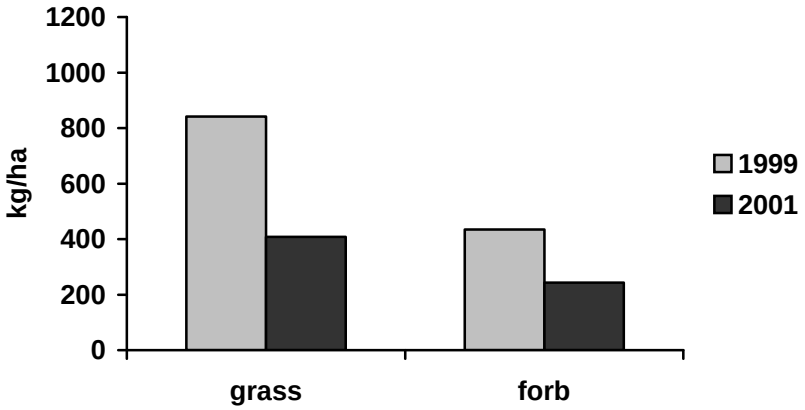

Figure 4. Grass and forb production (kilograms/hectare) at a treated site on Halfmoon Mountain 3 and 5 years post treatment.

Boulder Ridge Prescribed Fire

In 1997, a prescribed burn was implemented on 1,400 acres of Boulder Ridge in a sagebrush/bitterbrush community type. The objective was to improve existing habitat by reducing decadent shrubs and promote regeneration of these shrubs while increasing grass and forb vigor and productivity.

A post-treatment plot was established in the treatment area with the control plot in an adjacent, unburned area. Shrub density increased steadily among years in the treatment area, but remained lower than the control. Mature and decadent plants dominated the age structure of shrubs in the control plot (Table 14). Productivity data was collected from both sites during 1999 and 2001. One-year post treatment (1999), grass and forb production were higher in the treated area (Figure 5). Similar differences between the treated and control sites were observed in 2001.

Boulder Ridge has many attributes similar to Halfmoon Mountain, including wind-blown, south-facing slopes; however, elk use differs. Although elk may be observed on top of Boulder Ridge during winter, utilization of available forage on lower slopes is minimal. Winter recreational activities on Boulder Lake may discourage elk presence on the lower slopes.

Table 14. Post treatment shrub densities from treated and control sites on Boulder Ridge up to 4 years post treatment.

Location	Macroplot	Shrub Density/Hectare		
		1997	1999	2001
Treatment	FCBB	640	1,360	2,640
Control	FCBC	23,200	24,240	17,680

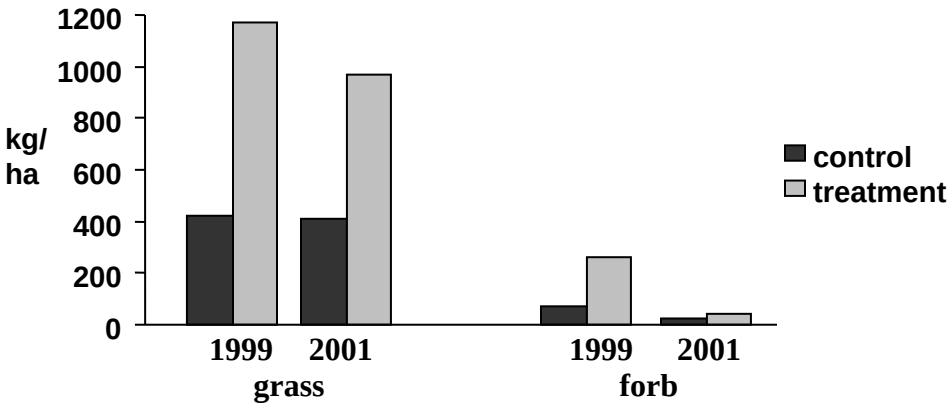

Figure 5. Grass and forb production (kilograms/hectare) 2 and 4 years post-treatment, at treated and control sites on Boulder Ridge.

Burnt Lake Prescribed Fire

Prescribed fire was implemented on approximately 400 acres of the Burnt Lake area in 1997. The objective was to improve existing conditions by reducing decadent shrubs and promoting new shrub regeneration while increasing grass and forb vigor and productivity.

Treated and control plots were established in adjacent areas. Shrub density was 92% and 84% lower following treatment in the two burned sites (Table 15). Treatment and control plots increased in shrub density, but the treatment site remained considerably lower than the control. Production estimates were made three years post treatment in 2000. Total herbaceous production was similar between sites with grass production highest in the burn, and forb production greatest in the unburned (Figure 6).

Elk have increased use of this area since the prescribed burn and, in addition to Halfmoon Mountain, may be another cause for a decline in elk numbers at the Fall Creek feedground.

Table 15. Density of shrubs/hectare at treatment and control sites near Burnt Lake up to 5 years post-treatment.

Location	Macroplot	Shrub Density/Hectare			
		1996 (pre)	1998	2000	2002
Treatment	FCB4	22,240	800	3,520	4,480
Treatment	FCML	32,480	No Data	2,560	3,520
Control	FCMC	No Data	No Data	36,160	38,240

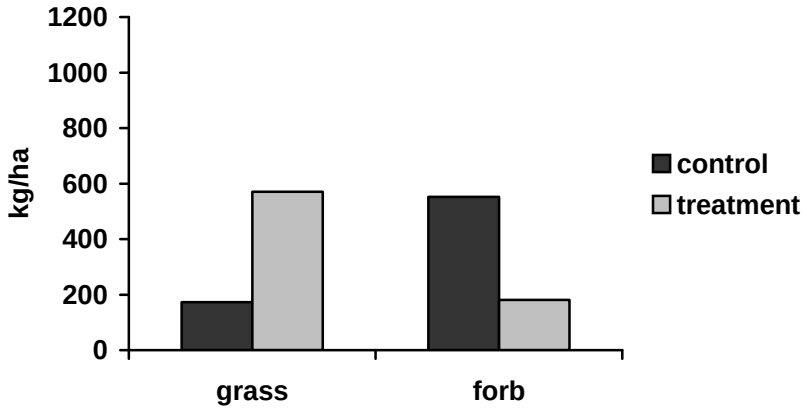

Figure 6. Grass and forb production (kilograms/hectare) at treated and control sites near Burnt Lake 3 years post-treatment near.

South Boulder Prescribed Fire

Prescribed fire was used to treat approximately 1,200 acres of habitat south of Boulder Lake in 1998. Objectives included: improving existing conditions by reducing decadent shrubs, promoting regeneration of new shrubs, and increasing grass and forb productivity.

Two treatment plots and one control were established 2 years post treatment. Shrub density declined approximately 89% in the burned area (Table 16). Mature and decadent shrubs dominate the control site. Production data were collected in 2002 at treatment and control sites, illustrated in Figure 7. This treatment has not appeared to encourage elk dispersal, as elk use has been minimal in the area during winters since treatment.

Table 16. Density of shrubs/hectare at treatment and control sites south of Boulder Lake up to 6 years post-treatment.

Location	Macroplot	Shrub Density/Hectare			
		1996 (pre)	1998	2000	2002
Treatment	FCS8	17,520	No Data	2,080	2,640
Treatment	FCS6	21,280	240	No Data	4,320
Control	FCS7	20,320	21,280	19,760	18,240

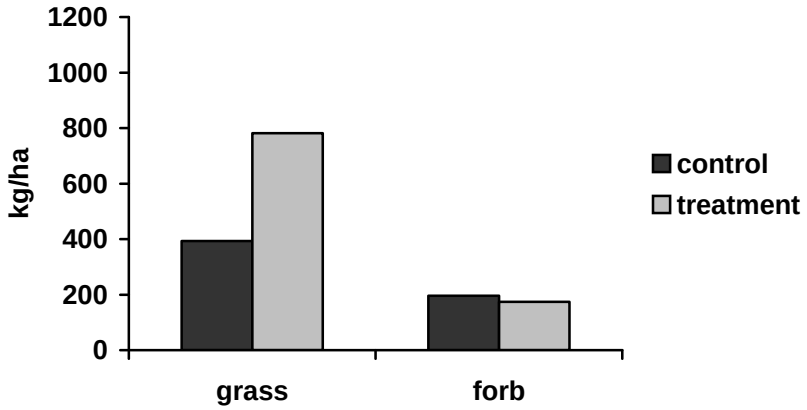

Figure 7. Grass and forb production (kilograms/hectare) at treated and control sites south of Boulder Lake 4 years post-treatment.

Cottonwood Allotment Prescribed Fire

The Cottonwood Allotment was treated with prescribed fire during the spring of 1998. Objectives included reducing decadent sagebrush cover and promoting regeneration of young shrubs, while increasing grass and forb production. Approximately 1,200 acres were treated.

Treatment and control plots were established post treatment in the same year as the treatment. Shrub density declined 95% in the treatment compared to the control site (Table 17). Data indicate grass production increased in treated areas, and minor differences in forb production compared to the control (Figure 8).

This treatment provides the potential for elk utilization of the area, however the location is in close proximity to private lands. The risk of elk damage and commingling with cattle is evident and will likely lead to the hazing of elk back to feedgrounds when present in the treatment area.

Table 17. Density of shrubs/hectare at treated and control sites on Cottonwood Allotment up to 3 years post treatment.

Location	Macroplot	Shrub Density/Hectare		
		1998	2000	2002
Treatment	SCC1	1,120	880	1,360
Control	SCCC	21,600	18,560	20,000

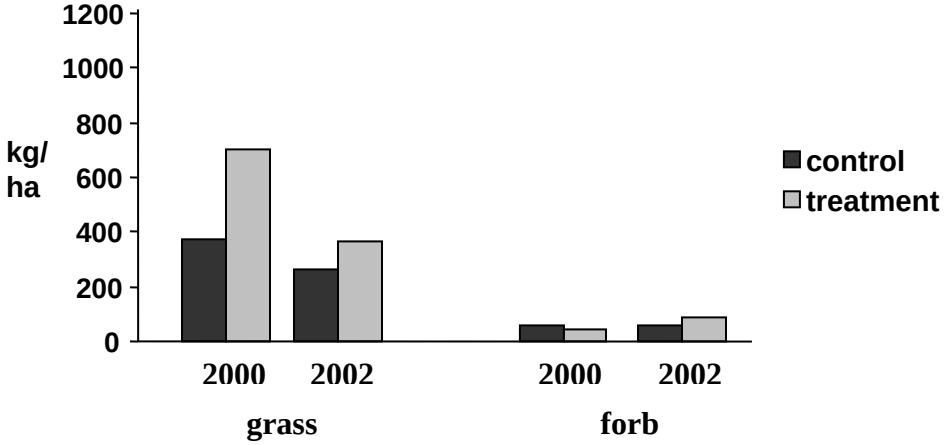

Figure 8. Grass and forb production (kilograms/hectare) at treated and control sites on the Cottonwood Allotment 2 and 4 years post-burn.

Herbicide

West Boulder Herbicide Treatment

The herbicide "Spike" (Tebuthiron) was used to treat 600 acres of sagebrush near Boulder Lake in 1998. The objectives were to reduce sagebrush cover by 50%, to increase plant production and vigor, and to diversify shrub age structure.

A treatment plot was established 2 years prior to treatment. Density and cover of shrubs, grasses, and forbs did not change appreciably post-treatment (Table 18). Production data were not collected prior to treatment. The decline in herbaceous production among years (Figure 9) may be attributed to drought. Overall, these data indicate this herbicide treatment is not meeting desired results.

Table 18. Density of shrubs/hectare on the treated sites at the West Boulder Herbicide treatment up to 5 years post treatment.

Location	Macroplot	Shrub Density/Hectare			
		1996 (pre)	1998	2000	2003
Treatment	FCBL	15,760	18,000	16,080	15,280

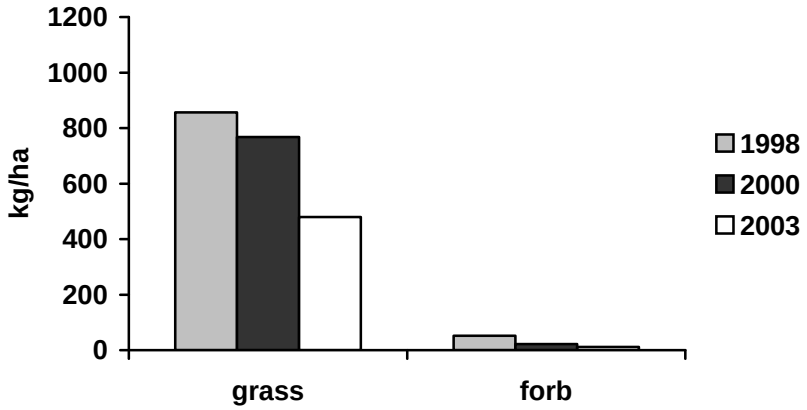

Figure 9. Herbaceous production (kilograms/hectare) on the treated sites at the West Boulder Herbicide treatment up to 5 years post-treatment.

Mechanical

Burnt Lake Mechanical Cutting Treatment

Thirty acres of aspen cutting was employed to treat an aspen community west of Burnt Lake in 1997. The objective was to promote regeneration of the aspen stand. The treatment was inventoried in 2000 to evaluate regeneration response, which showed 29,687 total stems/acre three years post treatment (Figure 10).

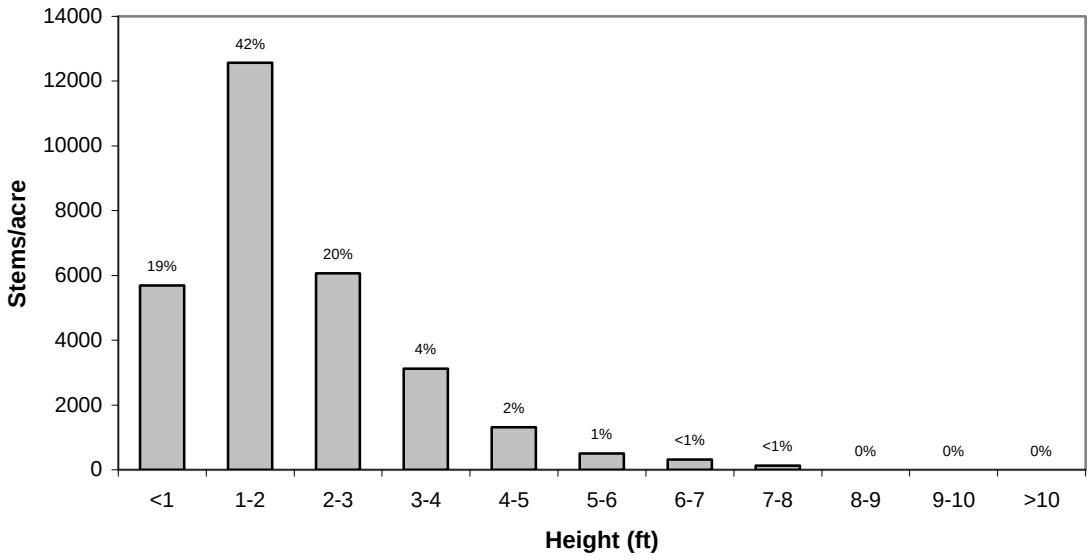

Figure 10. Aspen densities (stems/acre) according to height class (feet) 3 years post-treatment in a mechanical aspen cutting near Burnt Lake.

Habitat treatments in aspen are considered successful for stand rejuvenation when achieving a general height/density objective of 1,000 stems/acre taller than the browsing height of large ungulates (>10 feet) by 10 years post treatment. Essentially, this equates to an average gain of one foot of growth/year. Although data are only 3 years post-treatment, results indicate 5,375 stems/acre >3 feet, which is on track with the objective.

This site is located within a mile of the Fall Creek feedground. This area receives deer spring/summer/fall use and summer cattle use, in addition to winter elk use. Aspen suckers are currently vulnerable to browsing, so heavy browse-use could limit the development and health of the stand.