MANAGEMENT PLAN and ENVIRONMENTAL ASSESSMENT

for the

CLAM LAKE ELK HERD

April 2000

EXECUTIVE SUMMARY

An experimental herd of 25 elk was released into the Great Divide District of the Chequamegon National Forest in Wisconsin during May 1995. Since release, the herd has nearly tripled in size and now numbers approximately 60 animals. Management responsibility of the herd was transferred from the University of Wisconsin-Stevens Point to the Wisconsin Department of Natural Resources in May 1999. Pending approval by the Natural Resources Board to retain the experimental elk herd and allow it to become a managed herd of wild elk, the Department was given approval to develop this Management Plan and Environmental Assessment.

The presence of an elk herd in the Clam Lake area will benefit citizens at both the local and state level. Recreational opportunities to enjoy elk will be created. Many people will get value out of knowing elk are present, even if they never get to see one. There will likely be economic benefits to local economies resulting from increased tourism by people hoping to view elk, although it is difficult to predict what the magnitude of these benefits will be. Elk hunting may also eventually contribute to local economies.

The Department's preferred elk population management alternative is to allow the herd to increase naturally, without additional stocking. Supplemental stocking of elk in the Clam Lake area is not recommended because of the increased risk of introducing disease, additional expense involved that would divert resources from critical monitoring efforts, and the resulting complication of monitoring impacts of elk on other resources. Elk will be tolerated primarily in core and buffer ranges consisting mostly of public land. There, the herd will be allowed to naturally increase until population goals are reached. Once population goals are reached, public hunting will be used to maintain the population at those levels. Goals in the core range will be set at around 2 elk per square mile. These goals may be adjusted after the population has grown and dispersed to a level at which their interaction with Wisconsin's people, flora, and other fauna can be more thoroughly understood and predicted. Undesirable effects which will be indicators that elk densities are too high would include substantial impacts on winter browse or rare plants, elk occupation of deer yarding areas, declining elk productivity or survival rates, and increasing dispersal or habituation rates. Goals for the buffer range will be set at lower levels to limit dispersal of elk outside of the elk range. In the area outside of the core and buffer ranges (referred to as the X-zone), elk will be tolerated if they are not causing damage or exhibiting nuisance behavior. Animals causing damage or nuisance behavior will first be relocated to the core or buffer range if they can be captured. Those that cannot be captured or that continue to cause damage or nuisance behavior after being relocated will be killed. After public hunting is initiated in the core and buffer ranges, liberal quotas will be developed for the X-zone to keep elk at low densities.

Limited public hunting for bulls will begin when the population reaches 150 elk. Harvest of both cows and bulls will begin when populations exceed management goals. The Chippewa tribes will be allocated 50% of the harvest quota for each zone once public hunting is initiated. Elk hunts will be held every other year to reduce the administrative costs of conducting harvests of small numbers of animals.

The authority for elk habitat management lies with the United States Forest Service, because they are the primary landowner in the designated elk range. Nonetheless, the Department recommends that timber harvest be continued to maintain current levels of young-age aspen stands in the core range. No habitat management for elk outside of the core range is recommended.

A sample of adult elk will be radio-collared to facilitate elk population monitoring. Population monitoring will focus on estimating population size and distribution, productivity, and survival. Aerial surveys incorporating mark-resight or sightability estimates will be used to estimate population size and distribution. Productivity will be assessed by determining calf:cow ratios during late winter. Survival rates will be measured by routine ground-monitoring of radio-collared elk and aging of carcasses, including hunter-killed animals. Whenever possible, elk carcasses will be necropsied using procedures developed by the Department's Animal Health Lab to investigate for disease.

The impacts of elk herbivory on native vegetation are difficult to predict, and a habitat monitoring program will be important for determining these effects. Surveys will be conducted to monitor winter browse utilization by elk, especially for northern white cedar, and competition between elk and deer for winter habitat. Several species of rare plants may also be impacted, and patches of these plants will be monitored for evidence of elk herbivory.

In the designated elk range, habituated animals displaying nuisance behavior near residential areas, roads, or trails will be relocated. Hazing may be attempted in some cases. Those animals that cannot be captured or which continue to display nuisance behavior after 1 relocation attempt will be killed. Elk densities will be reduced through public hunting in areas surrounding those where problems with habituated elk have developed.

The potential for crop damage by the Clam Lake herd will be low. Elk causing crop damage inside the designated range before public hunting is initiated will first be hazed and/or relocated. These animals will be killed if hazing/relocation are unsuccessful. Once public hunting is initiated, additional permits will be issued for areas surrounding those where crop damage problems have occurred. The Department will pursue legislation adding elk to the list of species in the Wildlife Damage Abatement and Claims Program once public hunting is initiated, with $0.50/elk permit application received earmarked for that fund.

Because of the risk of disease transmission from captive elk to wild elk populations and the potential for escaped captive animals to mix with wild elk populations under current regulations, the Department recommends that no new licenses to keep farm-raised elk or red deer be issued within the designated Clam Lake elk range.

Black bears and gray wolves are potential predators of elk in northern Wisconsin. Although some of the Clam Lake elk have been killed by bears and wolves and more undoubtedly will be in the future, predation is not expected to be a major regulating factor for the herd. Predator management goals in the designated elk range will continue to be implemented without consideration for elk.

Human activities have so far been compatible with elk in the Clam Lake area. Because the designated elk range lies primarily within the Chequamegon National Forest, the United States Forest Service is the agency that regulates many of these activities. Other activities, such as hunting and artificial feeding/baiting of wildlife, are regulated by the Department. With one exception, the Department does not currently recommend restrictions on human activities to benefit elk. The Department will pursue legislation to regulate artificial feeding and baiting of elk to limit habituation problems.

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2

TABLE OF CONTENTS 4

ACKNOWLEDGEMENTS 6

INTRODUCTION 7

REINTRODUCTION AREA DESCRIPTION 8

POPULATION MANAGEMENT ALTERNATIVES 8

ELK BIOLOGY AND ECOLOGY 12
- Elk Habitat Suitability 12
  - Winter Cover 12
  - Winter Food 14
  - Spring Food 15
  - Summer and fall habitat use and forage selection 16
- Elk Demographics 16
  - Productivity 16
  - Survival and Mortality 17
  - Population growth rates 17
  - Sex-age ratios 18
  - Home range size and population density 19
- Disease in Elk 19
- Summary 21

SOCIO-ECONOMIC IMPACTS 21
- Elk Depredation 22
  - Forest crop damage 22
  - Agricultural crop damage 23
- Elk-Vehicle Collisions 24
- Impacts of Human Activities on Elk 24
  - Motor vehicles 25
  - Recreational users 25
  - Elk viewing 26

Artificial feeding....26
Logging....27
Tribal Hunting....27
Social Implications....27
Economic Implications....28
Benefits to local economies....28
Costs of elk management....29
Summary....29

ECOLOGICAL IMPACTS....30
Vertebrates....30
Native Vegetation....31
Summary....31

MONITORING AND MANAGEMENT POLICIES....35
Monitoring....35
Elk population....35
Habitat....37
Elk Hunting Regulation....37
Habitat Management....39
Crop Damage Response Protocol....39
Habituation Response Protocol....40
Disease Issues....41
Elk Ranching Policy....42
Protection....42
Predator Management....43
Herd Expansion Protocol....44
Source herd selection....44
Capture....44
Quarantine....45
Transport....45
Acclimation....45

EVALUATION OF PROJECT SIGNIFICANCE....45

LITERATURE CITED....46

APPENDIX A – Estimated costs and revenues for the Wisconsin elk project....52

APPENDIX B – Public Comments and Department Responses....54

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INTRODUCTION

In 1989 the Wisconsin Department of Natural Resources (WDNR) was directed by the State Legislature to explore the likelihood of successfully reintroducing elk, moose, and caribou (Anderson 1999). The resulting publication "Feasibility Assessment for the Reintroduction of North American Elk, Moose, and Caribou into Wisconsin" (Parker 1990) determined that an elk reintroduction effort could succeed, while reintroductions of moose or caribou likely would not. After considering 9 sites for elk reintroduction attempts, the Bayfield Peninsula was selected as the best location. A management plan (Parker 1991) with public comment incorporated into it was prepared by WDNR for the proposed Bayfield Peninsula reintroduction. The objectives were to:

1. Re-establish an animal once native to the state.
2. Increase tourism by providing opportunities to view elk.
3. Provide educational opportunities to visitors about elk and their relationship with their habitat.
4. Provide opportunities for limited hunting of elk by state residents and tribal members.
5. Integrate management of individual species with ecosystem management on the Chequamegon National Forest.
6. Provide opportunities for cooperation and partnerships between the public and private sector.
7. Provide opportunities for new forms of cooperation with the Chippewa on ceded territory.

After reviewing the management plan, the Natural Resources Board voted against reintroducing elk in the Bayfield Peninsula because of the lack of public support, funding, and area for the animals to inhabit (Anderson 1999). The Wisconsin Elk Study Committee (WESCO) was subsequently formed by a group of elk reintroduction supporters to identify other potential release sites. They determined that the United States Forest Service (USFS) Great Divide District (GDD) of the Chequamegon National Forest (CNF) near Clam Lake was most suited for an elk reintroduction. In 1993 the Wisconsin State Legislature authorized the University of Wisconsin-Stevens Point (UW-SP) to evaluate the potential for reintroducing elk to the CNF. UW-SP and WESCO submitted a proposal to USDA-FS requesting permission to conduct studies on an experimental elk herd. After preparing an Environmental Assessment (EA) and soliciting public comment, this request was approved in February 1994. Elk from Michigan were selected as the source for the Clam Lake release. During February 1995, 25 elk were trapped, held in a quarantine facility for 90 days while undergoing rigorous disease testing, and shipped to the Clam Lake release site. After being held in a pen for a 2 week acclimation period, the elk were released into the CNF on 17 May, 1995. A UW-SP research team led by Dr. Ray Anderson immediately began a 4-year project to determine the feasibility of maintaining an elk population in the CNF, and assessing the potential impacts of such a population on other resources of the area. Two research reports (in the form of graduate thesis') have been produced (Lizotte 1998, Anderson 1999), with the third and final report scheduled for completion in early 2000. Since release, the Clam Lake herd has thrived in their new environment, and numbered approximately 60-65 animals in the fall of 1999.

The Department of Natural Resources has assumed management responsibility for the Clam Lake Experimental Elk Herd pending a decision by the NRB on whether elk should remain and become a managed herd. Therefore, the Department must develop appropriate management strategies for the Clam Lake herd, incorporating results

from the experimental study and the literature from other states. This document outlines the preferred alternative of allowing the herd to grow naturally to a population goal of around 2 elk/square mile in the core range and lower densities in the buffer range. This document also describes other alternatives as well as the ecological, social, and economic impacts of each alternative. This document also serves as a management plan, outlining management objectives and policies for the elk herd in the Clam Lake area.

REINTRODUCTION AREA DESCRIPTION

The CNF-GDD consists of 715 mi2 (457,600 acres) in portions of Ashland, Bayfield, and Sawyer Counties in northcentral Wisconsin. State Highway 77 and County Highways GG and M converge near the center of the GDD at the Community of Clam Lake. The topography of the CNF is flat to rolling, with some hilly areas in the northcentral part of the Forest. The soil parent materials are primarily sandy loam glacial till, silt covered glacial tills, and sandy outwash (United States Department of Agriculture 1986). The climate is cool and moist, with an average annual air temperature of 40°F (Lizotte 1998, Anderson 1999). Average precipitation ranges from 30 to 33 in. per year, with snow accounting for less than 25% of the total precipitation. Snow frequently accumulates in depths greater than 23 in. during winter. The GDD is mostly under National Forest ownership (81% or 370,656 acres). The remaining 19% (86,944 acres) is privately owned, with relatively little in agricultural production.

The designated elk range will consist of separate core and buffer ranges. The buffer range will surround the core range, functioning as a buffer between the core range and private lands. It will also provide additional space for herd expansion and dispersal.

Core elk range - The 288 mi^2 core range is centered within the GDD and encompasses the U.S. Department of Navy's Extremely Low Frequency (ELF) Communication System (Figure 1). The ELF line is an X-shaped area kept free of trees and shrubs. Each segment is 18 mi long, and 33 yards wide. Because these open areas are dominated by grasses, sedges, and forbs which are highly pallatable forage for elk, it was initially predicted that the ELF line would provide seasonally attractive elk habitat (Anderson 1999).

Buffer elk range - The 824 mi^2 buffer range surrounds the core range. Land ownership in the buffer range is a mix of national and county forest and private land. Although there is little agricultural land within the buffer range, there are numerous residential areas, primarily associated with Lake Namekagon, Lost Land Lake, and Moose Lake. These areas were excluded from the core range to minimize the potential for habituation problems with elk.

POPULATION MANAGEMENT ALTERNATIVES

The three general population management alternatives are described below. Public hunting would be used to maintain the population at target levels for any of the alternatives. Regardless of which alternative is selected, management of the Clam Lake herd will differ from management of other reintroduced species in Wisconsin. The goal of other reintroductions has been to restore the species to the core of its former range and allow expansion to fill all suitable habitat. To avoid crop damage problems and other conflicts with private landowners that would likely develop if animals were allowed to wander freely throughout northern Wisconsin (Parker 1991), elk will primarily be restricted to core and buffer ranges with high public land ownership. The

range boundaries should be flexible to change with population shifts and alteration of habitat conditions. The core range will contain highest densities of elk. The buffer range will provide habitat for dispersing animals to allow herd expansion. Elk in this zone will be managed at lower densities than in the core range. However, animals outside of the designated elk range (referred to as the X-zone throughout the rest of this document) will be tolerated if there are no damage or nuisance behavior complaints about them. Animals in the X-zone showing nuisance behavior or causing damage that has been verified by authorized Department, county, or USDA - Animal and Plant Health Inspection Service (APHIS) personnel will first be relocated if they can be captured. Animals that cannot be captured or that continue to cause damage or nuisance behavior after first being relocated will be killed. After population goals are reached and elk hunting seasons are established in the core and buffer ranges, liberal quotas in the X-zone will be developed to limit the number of elk in this area. Additionally, elk hunting permits issued for the core or buffer ranges will also be valid for use in the X-zone. As a contingency plan, rules could be amended to allow any licensed deer hunter to shoot elk outside the designated range during the gun deer season in case unanticipated problems develop that could not be solved using the preferred procedures described above.

The 3 population management alternatives are:

1. Natural increase – This alternative would allow the Clam Lake herd to increase to some target level without stocking additional animals. The target population would be below levels at which elk are negatively affecting other resources, at a density of around two elk per square mile in the core range, and lower in the buffer zone. This population goal may change in the future if continued monitoring of the elk herd's growth shows that significant conflicts are likely to occur between elk and people, flora or other fauna. We expect that a herd of this size should provide significant recreational opportunities (viewing and hunting) to the public, while still being manageable within the boundaries of the elk range.

2. Supplemented increase – This alternative would be similar to #1, except that additional elk would be released to reach the population goal of around two elk per square mile in the core range quicker. Hunting would therefore be initiated sooner. The number of animals released would be based on availability from the source herd, and probably would not exceed 25-50. Genetic diversity of the herd could also increase if release animals were selected from a source population other than Michigan's, which was used for the original Clam Lake release.

3. Population reduction – This option could serve as a contingency plan in case elk begin to cause unanticipated problems. The herd would be significantly decreased, probably to <50 animals. It is unlikely that the public would accept a decision to completely eliminate the herd. Management priority would be to limit the size and distribution of the elk population and it's associated negative effects. Elk would be tolerated only in the core range. Lethal removal through hunting and/or shooting by agency personnel would be used to maintain the population at very low levels.

Alternative #1 is the option preferred by the Department. Information which we review later in this document indicates that expansion of the Clam Lake herd is feasible. Expansion would occur more gradually with alternative #1 than with alternative #2. The effects of a reintroduced elk herd can to some degree be predicted,

but not with absolute certainty. If unacceptable impacts on other resources occur, they would happen more gradually with Alternative #1 than with Alternative #2. More time would be available to develop and implement management actions to alleviate unanticipated problems. The considerable costs of stocking additional elk would come at the expense of monitoring efforts for the Clam Lake herd. Finally, stocking additional animals would add the risk of introducing disease to elk already present, a scenario which should be avoided at all costs. Ultimately, the management of elk would be a dynamic process allowing for evaluation and adjustment. In the following sections, elk biology, ecological impacts, and socio-economic concerns relating to management of the Clam Lake herd will be discussed.

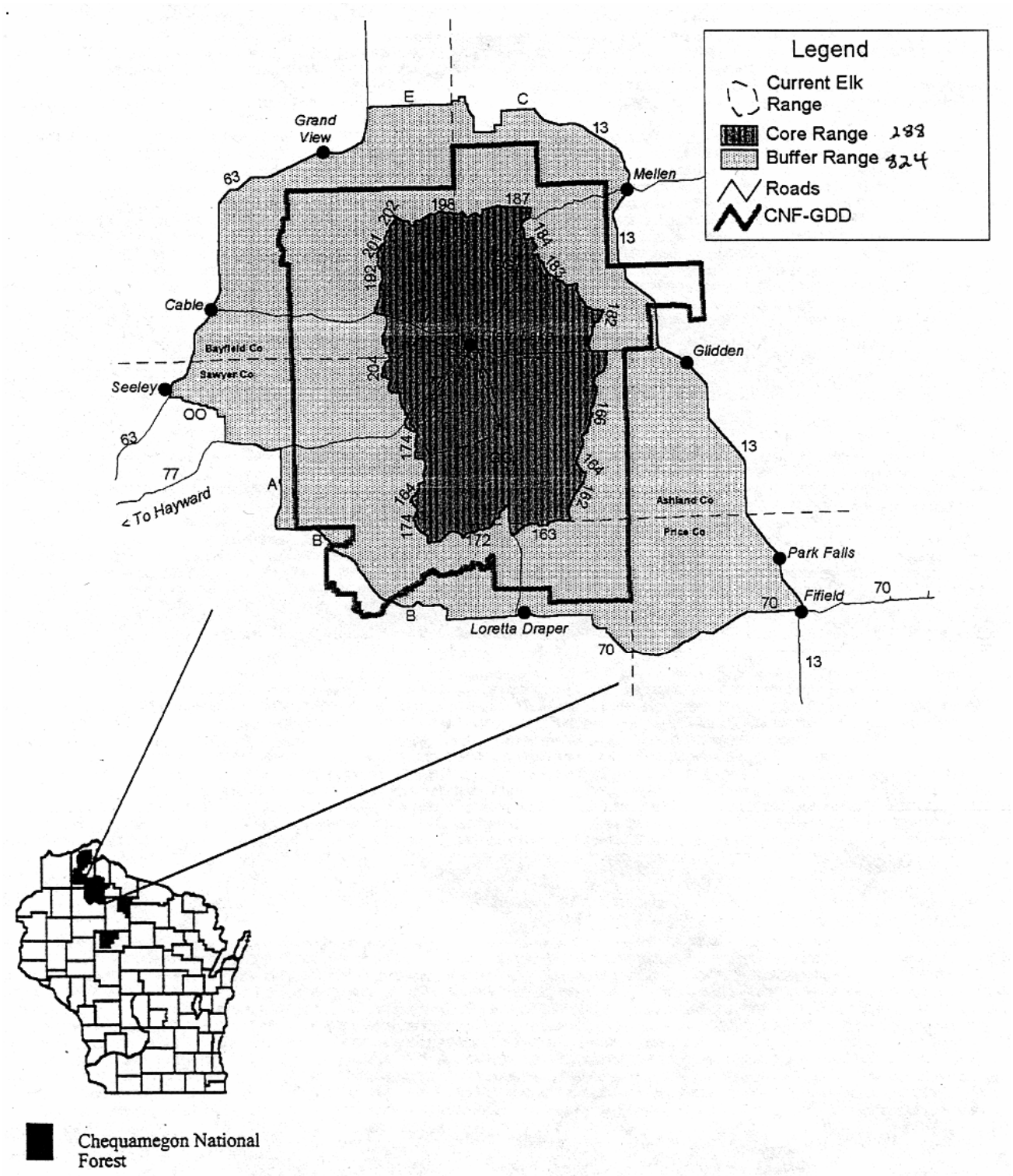


Fig. 1. The proposed elk range for the Clam Lake herd. Core and buffer range boundaries correspond to U.S. Forest Service roads and county, state, or federal highways.

ELK BIOLOGY AND ECOLOGY

North American elk, genus *Cervus*, are also commonly referred to as wapiti. With the exception of moose, elk are the largest members of the deer family (*Cervidae)* in North America. The subspecies that once occurred throughout Wisconsin, Eastern elk (*Cervus elaphus canadensis*), is now believed to be extinct. Thus, reintroduction efforts would involve another subspecies, the Rocky Mountain elk, *Cervus elaphus nelsoni*. Elk in Wisconsin were most abundant in the southern and west-central portions of the state where they were associated with grassland/forest edges, open woodlands, and oak openings (Schorger 1954). Records indicate that elk were present in 50 of Wisconsin's 72 counties (Figure 2). Over-hunting led to the extirpation of elk in Wisconsin in the mid to late 1800's (Schorger 1954, Jackson 1961). A reintroduction attempt was made in Vilas County, Wisconsin in 1932 with Rocky Mountain elk acquired from Wyoming. By the early 1950's only two elk were thought to remain. Poaching is believed to be the primary reason for the failure of this reintroduced herd to sustain itself (Schorger 1954).

In the north central Lower Peninsula of Michigan, the release of seven elk in 1918, also from Wyoming, has resulted in an elk herd which today contains an estimated 800-900 animals. This herd is the model upon which much of the criteria for evaluating the feasibility of reintroducing elk in Wisconsin was based.

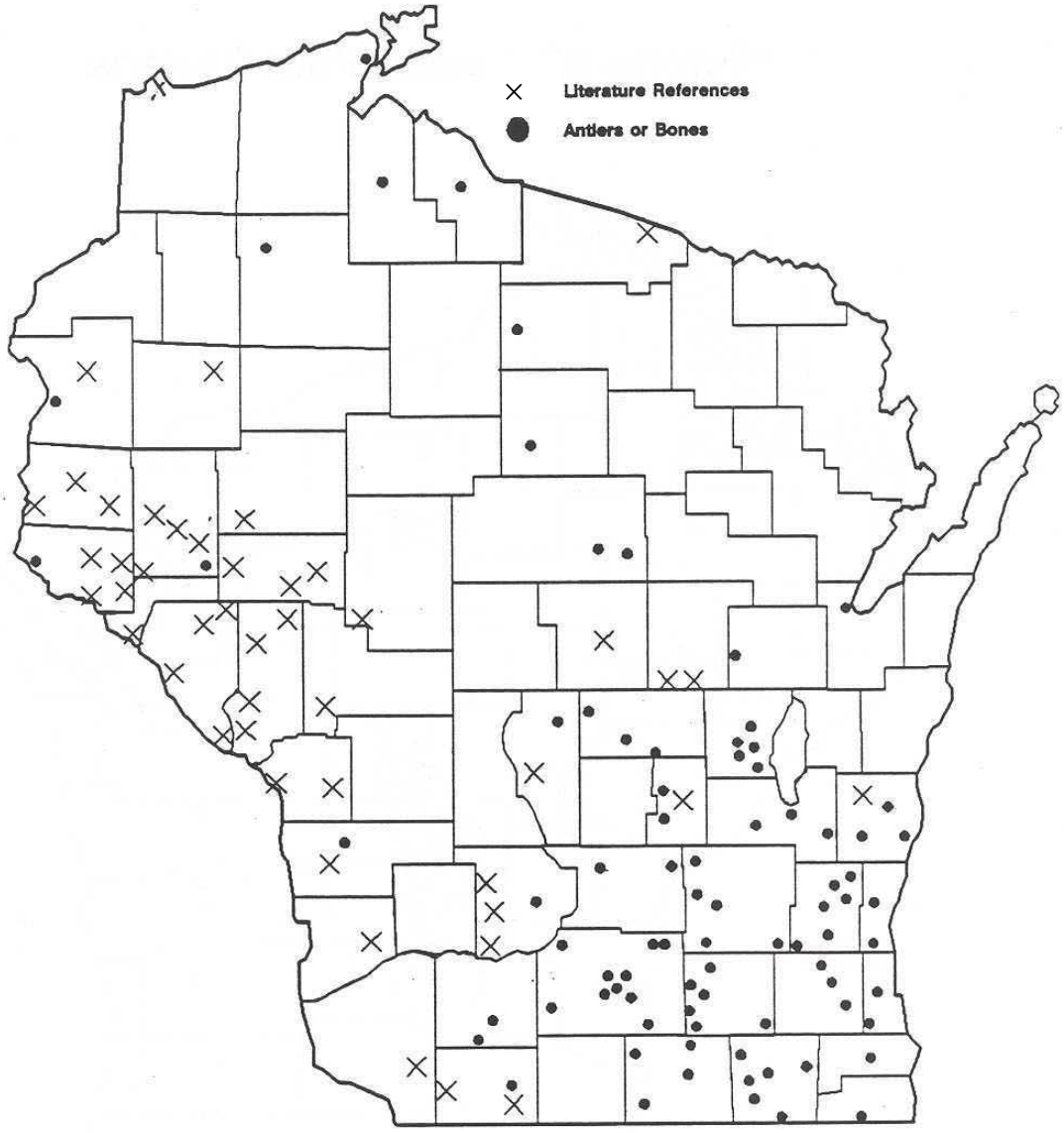
Elk Habitat Suitability

Elk are highly adaptable animals found in a large variety of habitats and are known to exhibit a wide variety of forage preferences. Most studies indicate that elk prefer eating grasses and sedges over woody vegetation. Elk tend to utilize open grassy habitats in spring and fall. Forbs, woody twig growth, leaves, and warm season grasses (if available) are the main sources of summer forage (Winkler, 1989). In winter, elk subsist on all available forage types. However, woody browse is sometimes the major source of winter forage available to elk.

The Habitat Suitability Index (HSI) model developed for the northern Lower Peninsula of Michigan (Beyer 1987) identified winter cover, winter forage, and spring forage as potential limiting factors for eastern elk populations. The CNF-GDD is similar in many respects (climate, vegetation, soil fertility, etc.) to the Michigan elk range. The potential limiting factors identified by the Michigan HSI model (Beyer 1987) probably apply to the CNF-GDD elk range as well (Table 1). When applied to the CNF-GDD, the model indicated that suitable habitat existed to sustain a population of elk (United States Forest Service 1994).

Winter Cover

Lowland conifers such as cedar, fir and spruce, are considered by the Michigan HSI model to provide optimal winter cover (HSI value = 1.0). Upland conifers such as red and white pine will provide some thermal protection for elk (HSI value = 0.5). Additional thermal cover can be provided by mature, deciduous trees such as aspen (HSI value = 0.3), especially dense stands with a well-developed conifer understory. The HSI model specifies that optimum elk habitat should have ≥10% of the area in winter cover types with HSI value = 1.0. Lowland conifers are abundant enough on the CNF-GDD to satisfy this requirement.
As predicted by the HSI model, the Clam Lake elk made heavy use of dense stands of lowland conifers during winter (Lizotte 1998). Snow depths were lower and temperatures warmer than in surrounding areas. Some elk used upland conifers as well. The winters of 1995-96 and 1996-97 were two of the most severe winters on



Note: Schorger does not include a reference of elk near Chequamegon Bay on the Bayfield peninsula made by Radisson and Grosseilliers in the 1600's (Thwaites, 1888).

Fig. 2. Historic records of elk in Wisconsin from Schorger (1954).

Table 1. Cover types on the CNF-GDD considered valuable for winter cover and winter or spring forage by the Michigan HIS model. Cover type percentages are for public forestland only. Similar information is not available for private forestland, however examination of air photos indicates that percentages given for public land are similar to those for non-agricultural private land.

Vegetation Zone	Cover Type	% Cover
Forested Upland	Aspen	19.5
	Northern Hardwoods	18.3
	Sugar Maple	10.2
	Red pine	4.5
	White Pine	1.0
	Birch	1.7
Non-forested Upland	Grass	0.5
	Forb	0.2
	Shrub	0.2
	Other	0.2
Forested Lowland	Mixed Swamp Conifer	7.2
	Lowland Black Spruce	6.7
	Northern White Cedar	2.2
Non-forested Lowland	Shrub Swamp	4.0
	Wetlands	1.8
	Sedge Meadow	1.1
	Other	3.7

record, yet elk survival was high. Because of their large body size and thick coat, elk are well adapted for survival in cold climates. The cover on the CNF-GDD provided sufficient thermal protection, and should not be a limiting factor for elk.

Winter Food

According to the Michigan HSI model, cover types with HSI value = 1.0 for winter food suitability should occupy ≥15% of the area for optimal elk habitat. The model predicts that adequate winter forage for elk is present in the CNF-GDD. Northern white cedar (NWC), aspen, maple, and northern hardwoods, all high quality winter browse species (HSI value = 1.0), are available in adequate amounts. Upland conifers, although suboptimal forage (HSI value = 0.7), are also possible winter forage for elk in the CNF-GDD. Although NWC is present in very limited amounts in the CNF-GDD, wintering elk strongly selected feeding sites where it was abundant and browsed it frequently (Lizotte 1998). NWC was also commonly browsed by elk in Michigan (Moran 1973). NWC was not the only browse species utilized by elk in the CNF-GDD (Lizotte 1998). In the lowland conifer areas primarily used by wintering elk, beaked hazelnut and red maple were used in greater

proportion than their availability. Mountain maple, trembling aspen, mountain holly, and black ash were eaten in proportion to availability. The few elk inhabiting other habitat types during winter also utilized these species plus black and pin cherry, paper birch, balsam fir, and black spruce. Utilization of these species by elk was below levels shown to decrease new twig production.

In addition to woody browse, graminoids were also identified as significant dietary components in early winter (Lizotte 1998). However, snow cover usually limited their availability to foraging elk. Graminoids will probably continue to be used by elk when available, primarily in early winter and during mild winters when snow cover may be shallow.

General winter foraging patterns of the Clam Lake herd correlate well with studies conducted on other eastern elk herds. Michigan elk also relied heavily on woody browse, including NWC, aspen, eastern hemlock, cherry, red maple, willow, and wintergreen (Speigel et al. 1963, Moran 1973). Elk were much less selective than deer in their feeding habits. Bark stripping was found to be a common winter feeding habit (Moran 1973). This activity, along with other types of browsing, can actually hold back succession, providing additional browse material. In Pennsylvania, annual woody growth was important winter forage for elk. Ten species of trees and shrubs were heavily browsed, with red maple and aspen as major components of the winter diet (Hunter et al., 1979). Data collected by the UW-SP research team indicate that the Clam Lake herd is using a variety of browse species. Demographic symptoms of poor nutrition such as low calf survival or birth rates have not been observed. Winter nutritional requirements of the Clam Lake herd are clearly being met, and the CNF-GDD apparently has adequate winter forage to allow the population to increase.

Spring Food

Spring foods are those available to elk immediately after snow cover melts. Elk require highly nutritious forage in early spring to restore their energy reserves, which are depleted during the winter. Green grasses, forbs, and sedges are preferred by elk over woody browse at this time. According to the Michigan HSI model, optimal elk habitat should have ≥10% of the area in cover types with high spring food suitability (HSI value = 1.0). Wildlife openings (fertilized grasses or crop) and cultivated fields (winter wheat, etc.) contain the best forage (HSI value = 1.0). Young aspen stands and natural openings (those that contain native vegetation or are unfertilized) also provide quality spring forage for elk (HSI value = 0.7). Upland conifers, swamp conifers and maple stands are less preferred by elk in spring (HSI value = 0.5) (Beyer 1987). The CNF-GDD is primarily forested, with a small number of fertilized openings. However, unfertilized openings also provide adequate spring forage. Significant open areas, primarily lowland sedge and upland grass/forb meadow, are maintained for the ELF line. Additional spring forage may be provided by regenerating aspen stands.

In Michigan, openings were used by large numbers of elk for the forage provided by the new herbaceous growth in early spring through June. Openings on the Pennsylvania elk range consist of agricultural lands, clearcuts, and reclaimed strip mines. Grasses were found to be of primary importance to elk (Witmer and Cogan 1989), especially in late spring and mid-fall (Devlin and Tzilkowski 1986). Anderson (1999) found that radio collared elk in the Clam Lake area during spring and summer of the first year after release selected upland openings, hardwoods, and conifers, while aspen stands were used in proportion to their availability on the landscape. More extensive data on spring habitat use by the Clam Lake herd over a 3-year period has been collected and is being analyzed (J. Schmidt, personal communication), but is currently unavailable. This

information will allow biologists to better predict how well the CNF-GDD will fulfill the spring habitat requirements of an expanding elk population. Although the CNF-GDD does not contain enough wildlife openings or cultivated fields to be rated as optimal elk habitat, at current population levels elk are apparently obtaining adequate spring nutrition. However, it is possible that spring forage may become the most important factor limiting population growth if the herd is allowed to expand. If funding for the ELF project were terminated (there is currently no indication that this will occur), much of the maintained open area presently available in the core range would be lost if no effort was made to limit growth of trees and shrubs along the ELF corridor. This would decrease the amount of spring forage and overall habitat quality for elk in the core range, possibly leading to a lower elk population.

Summer and fall habitat use and forage selection

The Michigan HSI model concludes that summer and fall habitat are not limiting factors for elk in Michigan. It is assumed that an area providing suitable winter and spring habitat would also be adequate in summer and fall, as well. Forage is generally abundant during these seasons, and thermal demands are low. Moran (1973) found openings to be a key feature on elk range in the fall. Rutting and harem activities occurred largely on these openings (providing viewing opportunities for the public). After the first frost, a pronounced dietary shift towards browsing of woody growth occurred. With the first snow cover, post-rut harem groups broke up and dispersed from openings. During the first year after release, openings were selected for by radio-collared Clam Lake elk while aspen, upland and lowland conifer, and aspen-balsam fir-white spruce stands were used in proportion to their availability on the landscape (Anderson 1999). More extensive data on summer and fall resource selection by the Clam Lake herd has been collected and is being analyzed (J. Schmidt, personal commnication), but is currently unavailable. However, most of the elk have remained in a relatively small area (43 mi^2 or 6% of the forest) within 6 miles of the release site (J. Schmidt, personal communication). This indicates that the area is able to meet all their seasonal requirements, as predicted by the HSI model.

Elk Demographics

Although elk are frequently thought of as productive animals capable of rapid population growth, they have a different life history strategy than Wisconsin's more numerous large herbivore, the whitetailed deer. Pregnancy rates for yearling cows are highly variable depending on factors such as nutrition, but they are generally much lower than those for older cows. Yearling bulls rarely breed. Larger, 7-12 year old bulls outcompete them. Twinning is rare for elk. They are potentially long-lived animals, especially in lightly hunted populations. Cow elk on Yellowstone National Park's northern range may live >20 years (Houston 1982). Therefore, population management considerations for elk must differ from those for deer. The following section will focus on demographic characteristics of elk populations relating to management concerns for the Clam Lake herd.

Productivity

Pregnancy rates of Michigan elk were 89% for adults and 33% for yearlings (Beyer 1987) in 1984 and 1985. During 1985, adult cows had a natality rate (the percentage of cows that produced calves) of 89%, while yearling cows produced calves 50% of the time.

Pregnancy rates for the Clam Lake herd have not been measured. Natality rates for the Clam Lake herd have

improved each year since the release. Natality rate was 13% in 1996, which was lower than expected (Lizotte 1998). This was attributed to a high percentage of yearlings in the population during the previous year's rut, severe winters during 1995-96 and 1996-97, and unfamiliarity of the elk with their new environment. Natality rates improved to 69% in 1997 and 93% in 1998, which compare favorably with published rates for Michigan and other areas. This was probably due to breeder maturation and growing familiarity of the herd with the CNF-GDD.

Survival and Mortality

Annual mortality rates for the Michigan herd in 1963-65 were estimated at 30-46% for the 0–1.5 year olds (Moran 1973). Highest losses occurred during a winter in which 24 inch snow depths continued into April. Adult annual mortality rates were 28% for cows and 33% for bulls in 1964 (Moran 1973). The annual mortality rate for yearling bulls nearly doubled from 26% in 1964 to 49% in 1965, following the first year of hunting. Major sources of mortality prior to the advent of elk hunting in Michigan included illegal shooting, disease, car or trail collisions, and malnutrition (of small calves) (Moran 1973). During 1959-1970, annual losses due to illegal shooting in Michigan ranged from 4 (1966) to 28 (1964) animals from a herd of approximately 150 elk. The parasitic brainworm *Parelaphostrongylus tenuis*, commonly carried by deer in the Great Lakes region, has also been a significant source of mortality in eastern elk herds. In Pennsylvania, 12% (1% of the herd) of all known annual elk mortality was attributed to brainworm (Witmer and Cogan 1989). Brainworm infection also kills 1% of the Michigan elk herd each year.

Survival of the Clam Lake herd has been better than rates observed in Michigan and elsewhere. Overall annual mortality for the Clam Lake herd within a year of their release was 16%. These losses were primarily the result of capture stress, although 1 elk was shot during the gun deer season (Lizotte 1998, Anderson 1999). Survival rates improved markedly after the first year. Calf survival has been excellent. For 1997-99, the annual mortality rates for calves known to have been born were 4%, 2%, and 6%. Confirmed causes of calf mortality have included predation by black bears (n=2) and wolves (n=2), and road kill (n=1). Adult survival has also been high. For 1997-98, there were no known mortalities of adults. In early 1999, 2 yearling bulls died (caused by drowning and car collision) for an annual mortality rate of 4%.

The high survival rates experienced by the Clam Lake herd are typical for a reintroduced population in quality habitat. If the herd is allowed to grow to higher densities, mortality rates will probably begin to increase towards levels reported for other areas as intraspecific competition for resources begins to occur. Several mortality sources were reported which could have impacts on population dynamics and management of the Clam Lake herd. One illegal shooting of a Clam Lake elk has occurred, and poaching has been a problem for other states. Hunter education and law enforcement programs will be important for controlling illegal shooting. Although no cases of brainworm infection have been reported for Clam Lake elk, it probably will eventually affect some animals (as it has in Michigan and Pennsylvania). High black bear densities (1/mi^2) and an expanding wolf population (≥7 packs or 1 wolf/25 mi^2) in the CNF-GDD may affect growth rates of the elk population.

Population growth rates

Population growth rates for the Clam Lake herd have increased each year since release. Growth rates were 8%

in 1996, 27% in 1997, and 32% in 1998. Initially, populations of animals introduced to vacant habitat closely conform to simple exponential growth models (Eberhardt 1969). As the population increases, density-dependent factors begin to decrease population growth rates. Currently, the Clam Lake herd appears to be in the exponential growth phase (Figure 3). The average growth rate, calculated using log-linear regression, is approximately 23% (λ=1.26). This is below the maximum sustainable rate of 28% reported for elk by Eberhardt et al. (1996), but quite comparable to the 24% rate of increase reported by the same authors for an elk herd that had recently colonized vacant habitat in southeastern Washington. Because we don't know when density-dependent limits to population growth may begin to occur for the Clam Lake herd, it is difficult to predict how long the population will exhibit exponential growth.

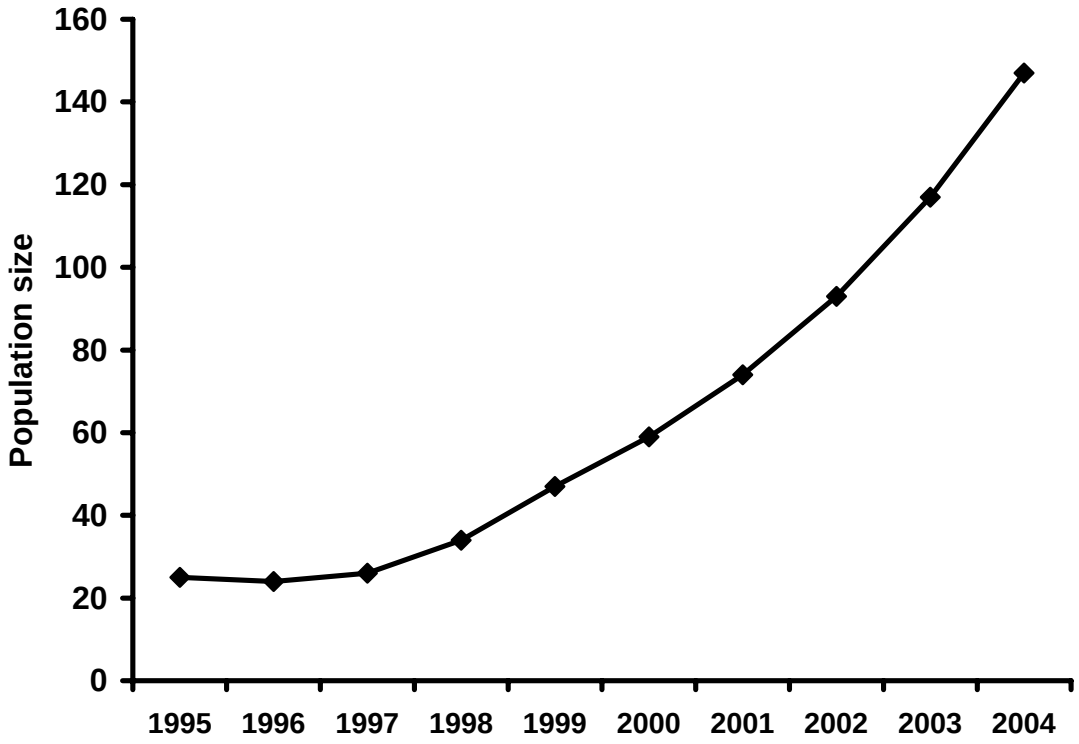


Fig. 3. Population growth of the Clam Lake elk herd 10 years after release. Actual population estimates are shown for 1995-1999. Projected population growth is depicted for 2000-2004 under Alternative #1 using the exponential growth model (λ=1.26).

Sex-age ratios

Calf:cow or bull:cow ratios are commonly used as indices of productivity and survival (Eberhardt 1996), and are reported as the number of calves or bulls:100 cows. Ratios may vary substantially among years with differences in harvest rates, winter severity, etc. Calf:cow ratios of 45-55:100 were reported in Michigan (Beyer 1987), while a lower ratio of 33:100 was observed in Pennsylvania (Witmer and Cogan 1989). These ratios are typical of productive elk populations throughout their range. Calf:cow ratios for the Clam Lake herd

have not been determined and would not be meaningful, due to the small population size. If the population is allowed to expand, calf:cow ratios should be calculated by counting and classifying as much of the population as possible.

In most elk populations, bull:cow ratios depend heavily on bull harvest rates. Heavy hunting pressure in many western states limits bull survival, leading to low bull:cow ratios. Bull:cow ratios tend to be higher in areas where bull harvest rates are restricted, as is common with eastern elk herds. Post-rutting bull:cow ratios of Michigan elk ranged from 52-74:100 (Beyer 1987). If the Clam Lake herd is allowed to remain, it is likely that an elk hunting season will follow. Bull:cow ratios would likely be affected by harvest strategies, as determined by management goals. Calculation of bull:cow ratios would help biologists assess the effects of hunting, and should be part of a future monitoring protocol.

Home range size and population density

Home range sizes of elk vary among habitats and seasons. In Michigan, the average winter home range was 7,463 acres; mean home range sizes of bulls (rut: 13,284 acres, non-rut: 23,136 acres) were greater than those of cows (rut: 6,699 acres, non-rut: 15,923 acres) (Beyer, 1987). Yearly home range sizes of the Clam Lake herd were smaller than those reported for Michigan elk. Females averaged 6,800 acres (10.6 mi^2), while males averaged 10,700 acres (16.8 mi^2) (J. Schmidt, personal communication).

In Riding Mountain National Park, Manitoba, densities of 2-4/mi^2 have been maintained since 1950 following an eruptive phase in which a high of 10/mi^2 was reached. (Blood 1966). Carrying capacity is believed to be about 5/mi^2. Michigan elk density in the late 1930's, approximately 20 years after reintroduction, was estimated at 2.9/mi^2. At that time, 300–400 elk occupied 125–140 $mile^2$ (Shapton 1940). By 1958 the herd had grown to 900–1,000 elk occupying a 400 mi^2area, for a density of 2.25-2.5/mi^2 (Moran 1973). The 1990 winter population estimate was 918 elk on 300 mi^2 of primary range (3/mi^2) and 600 mi^2 of total range (1.5/mi^2) (G. Boushelle, personal communication). Current elk densities on the CNF-GDD are 1.2/mi^2 for the area occupied by most of the elk (J. Schmidt, personal communication), which is lower than densities maintained in other eastern elk herds. Elk densities could be allowed to increase if a decision is made to retain the Clam Lake herd.

Disease in Elk

Elk are susceptible to numerous diseases and parasites. Some of these are of concern to farmers and elk ranchers, because of the potential for disease transmission to livestock or captive elk. A few of them could have serious consequences for elk or deer populations. Brief descriptions of some major diseases and parasites affecting elk and livestock are given below.

1. brainworm – *Parelaphostrongylus tenuis* (brainworm) is a parasitic nematode which can impact elk where they coexist with white-tailed deer. White-tailed deer have evolved with this parasite, and do not develop clinical disease from it. Elk are more likely to develop clinical disease from the parasite than white-tailed deer, but are much more tolerant of it than moose or caribou. Larval worms exit their hosts, normally white-tailed deer, in feces (Kistner et al. 1982). They next enter terrestrial snails that serve as the intermediate host, where they develop into the infective stage. The infective larvae are then transmitted to the host, which could be deer or elk, when the host eats vegetation containing snails. Higher deer densities result in increased transmission

rates of brainworm to elk.

2. brucellosis – This bacterial disease, also known as undulant fever in humans, is caused by the bacteria *Brucella abortus.* It is a health concern for both livestock producers and the general public (United States Department of the Interior 1998). There is no effective treatment or cure for animals infected with it, although treatments now exist for humans. In domestic cattle, acute infection results in abortion. Costly prevention and eradication programs have been implemented by state and federal agencies to reduce the threat of this disease to the livestock industry. The disease probably has little effect on elk populations. Free-ranging elk populations wintering on feed grounds in Wyoming have a high rate of exposure to *Brucella.* Close contact among animals congregated around artificial feed facilitates transmission of the disease. However, elk herds that are not artificially fed are essentially free of this disease (Haigh and Hudson 1993).

3. bovine tuberculosis – Among ungulates such as elk and cattle, this bacterial disease is transmitted through the air or in contaminated feed and water. Close contact among animals facilitates transmission of bovine tuberculosis. Infected animals develop extensive pulmonary lesions, and usually die. Although tuberculosis in wild ungulates is rare, Michigan has recently experienced an outbreak in its deer herd. Elk are present in the affected area. Although they have been intensively monitored, no Michigan elk have tested positive for the disease. High deer densities and artificial feeding are 2 factors cited as contributing to the maintenance of the disease in the deer population, but the original source of infection has not been determined (Davidson and Nettles 1997).

4. chronic wasting disease (CWD) – CWD is a fatal transmissible spongiform encephalopathy disease related to the mad cow disease reported in Europe. This infectious disease appears to develop when an abnormal protein called a prion accumulates in nervous tissue. Primary symptoms include emaciation, incoordination, and excessive salivation of affected individuals (Davidson and Nettles 1997). There is currently no definitive test for this disease in living animals. Instead, brain tissue must be examined after the animal has been killed, revealing swiss-cheese-like holes in infected animals. The only areas where wild deer and elk are known to be infected with CWD are northeastern Colorado and adjacent areas of Wyoming. However, CWD infected captive elk herds have been identified in Saskatchewan, South Dakota, North Dakota, Colorado, Montana, Nebraska, and Oklahoma. Currently, there is no evidence to indicate that CWD can be transmitted to humans or animals other than deer or elk.

5. leptospirosis – Though serologic evidence indicates widespread exposure to the bacteria causing this disease in free-ranging elk and deer, it appears to have little impact on those populations (Kistner et al. 1982, Haigh and Hudson 1993). Elk and deer may serve as one reservoir for the bacteria, because infected animals may shed it in their urine for months. *Leptospira* can be pathogenic to humans and livestock, causing kidney disease, abortion, infertility, and occasional mortality.

6. anaplasmosis – This is a rickettsial disease that probably has little affect on elk health (Kistner et al. 1982) but causes considerable loss to the cattle industry in the southern United States (Davidson and Nettles 1997). The disease is transmitted by biting flies, ticks, or other vectors that transfer blood. Mule deer (which live only in the western states) are the only members of the deer family in North America that have been diagnosed with clinical anaplasmosis. Wild ungulates in the eastern U.S. are probably unimportant anaplasmosis reservoirs.

7. bluetongue (BT) and epizootic hemorrhagic disease (EDH) - These closely related viral diseases are unlikely to cause clinical disease in elk (disease (Haigh and Hudson 1993). Because elk can be infected with the viruses, screening and prohibitions on movement of captive elk testing positive for them are used to prevent transmission to more susceptible sheep and white-tailed deer. Mortality rates for deer during outbreaks in areas where deer have not previously been exposed to these viruses can be >50% (Davidson and Nettles 1997). Although no outbreaks have been reported in Wisconsin's deer herd, both Illinois and Iowa have recently reported unexplainable deer mortality possibly due to BT or EDH. BT and EDH are transmitted by biting midges. Elk are probably not major reservoirs for either disease. Although susceptible, cattle do not usually produce clinical signs of disease.

8. liver flukes – The large liver fluke (*Fascioloides magna*) is found in cervid populations throughout North America (Kistner et al. 1982). Though infection can result in clinical disease, this parasite probably does not have major impacts on free-ranging elk populations. Native ungulates may serve as reservoirs of this trematode parasite for livestock. Large liver fluke infections can decrease value of cattle sent to slaughter, and are frequently lethal to sheep and goats.

No diseases have been diagnosed in the Clam Lake elk, although a severe liver fluke infestation was a contributing factor in the death of one animal (Lizotte 1998, Anderson 1999). Prior to transport from Michigan to Wisconsin, appropriate quarantine and disease testing procedures were followed. Field monitoring has revealed no evidence of infectious diseases, including those that could jeopardize livestock or deer. However, there is the potential for disease problems in the future. Elk in 4 captive Wisconsin herds have been diagnosed with bovine tuberculosis since 1997, and 3 of these have subsequently been depopulated (O'Connor, personal communication). Additionally, animals from a captive red deer herd tested positive for bovine tuberculosis in 1990, and the herd was depopulated. CWD has been diagnosed in captive elk and deer in other states. Currently there is no way to test animals being imported into the state for CWD. Captive elk infected with CWD could be imported to Wisconsin, and the disease could then be transmitted to the elk and/or deer population if contact between free-ranging and captive animals occured. Therefore, disease monitoring and prevention programs will be important in management of the Clam Lake herd.

Summary

Analysis of data collected from the Clam Lake herd since release and review of pertinent literature indicate that the CNF-GDD provides quality elk habitat, and the population is responding well. The three critical factors of winter thermal cover, winter forage, and spring forage are not currently limiting population growth, although spring forage may become a limiting factor if the herd is allowed to expand. Elk are utilizing a variety of forage types. Population growth is currently high, due to good calf production and high survival rates. Most of the elk are inhabiting only a small portion of the forest, at a lower density than has been maintained for other eastern elk herds. The herd is currently free of infectious diseases. The available evidence indicates that the Clam Lake herd could expand to cover more area at higher densities on the CNF-GDD. Therefore, all of the population management alternatives listed earlier in this document would probably be biologically valid options.

SOCIO-ECONOMIC IMPACTS

In this section, potential social and economic costs and benefits associated with elk management are considered. When available, data from the Clam Lake herd were incorporated, supplemented by literature from other areas. Six meetings to inform the public and gauge support for elk restoration and management were held in Hayward, Wausau, Eau Claire, Waukesha, Green Bay, and Florence during September 1999. Survey results and public concerns voiced during these meetings are also discussed.

Elk Depredation

Elk depredation occurs most often to forest and agricultural crops (de Calesta 1983). Forest damage is normally to regenerating trees, which are attractive to elk because they provide easy access to annual growth. Agricultural damage includes competition with livestock for pasture (primarily in western states), losses of cereal and hay crops, and damage to fences, orchards, and ornamental plants.

Forest crop damage

Elk can adversely affect some timber resources. Over-browsing is the primary cause of damage to timber by elk; bark stripping and antler thrashing are secondary factors. In Michigan, there has been concern that browsing may restrict aspen regeneration (Campa 1989). In the early 1960's there was growing recognition that the Michigan elk herd, numbering 1,500-2,000 animals, was damaging forest reproduction. Landowner surveys indicated that 28% of those responding had experienced damage to trees and shrubs. Depredations by elk were ascribed to over-population (Moran 1973). A recent study undertaken by Michigan State University to determine the extent and severity of elk damage to forest crops found that heavy browsing appears to decrease stem densities and cover, and to increase the frequency of some herbaceous species. Browsing of >50% of annual woody production affected tree height and shoot production of big tooth aspen (Campa et al. 1992). Decreases in tree height and twig production of quaking aspen were observed only when 100% of annual woody growth was browsed. Browsing by elk has not been shown to reduce stem density below that of natural thinning, therefore, final stocking densities of stands at harvest are not impacted (Campa 1989). Campa (1989) concluded that "no effects on timber production can be identified to date." Small stands, especially those adjacent to cover, appear to be most susceptible to over-browsing, however, there is no evidence to support this observation (Campa, personal communication).

Additional concern exists that heavy browsing may facilitate conversion of aspen to pine. N. Caveney (personal communication), Forester of the Pigeon River Country State Forest (PRCSF) which contains much of the Michigan elk range, indicated that the best aspen regeneration stands on the PRCSF are most heavily impacted, often resulting in conversion to pine. There is some question of how extensive this problem is; some feel that it is restricted to only one site. Despite aggressive timber management practices, Michigan is predicting a continued decline in the percentage of aspen on state land as a result of natural forest succession. A recent plan to reduce the elk herd to a winter goal of 850 animals was accepted in hopes of preventing damage to the remaining aspen stands. It is likely that as the proportion of aspen declines, the elk population goal may again be lowered (Caveney, personal communication).

A study of the effects of elk and deer browsing in Pennsylvania discovered that most woody plant species remained viable and potentially productive (Hunter et al. 1979). Aspen regeneration, in most sites, provided important winter forage for elk and deer. However, once the aspen grew out of the browsing range of elk, the

stand developed into dense commercial timber. The degree to which heavy browsing affected a site depended on the site characteristics, such as soil moisture and fertility (which determine growth rates of woody plants).

Browse utilization rates reported for the Clam Lake herd (Lizotte 1998) indicate that elk are not seriously impacting any species. However, the literature from Michigan shows that damage to forest crops is a possibility. Big-tooth aspen may be especially susceptible to damage (Campa et al. 1992). Two complaints of damage to forest crops by Clam Lake elk have been received. Anderson (1999) described a report from a tree farmer who claimed that an elk had destroyed 700 scotch pine seedlings on his property. The damage was attributed to cattle fenced within the plantation after inspection of the site by UWSP researchers and USDA Animal and Health Plant Inspections Services personnel. Complaints of forest crop damage by both deer and elk have also been received by the Department from another area landowner, but these reports have also been not been verified.

Agricultural crop damage

Michigan DNR biologists discovered that reports of damage to agricultural crops increased as the elk population expanded in the late 1950's-early 1960's and again in the early 1980's. Eleven percent of landowners surveyed indicated that they had experienced crop damage. Farmers comprised 12% of the landowners on the elk range at that time. Farmers contacted by Moran (1973) most often complained of damage to fences, oats, and sometimes haystacks. There were only a few instances in which serious crop damage was reported, usually on sites bordered by heavily used summer elk range. Currently, Michigan farmers cite damage to alfalfa, beans, and (increasingly) corn most often. Records of estimated crop damage values are not kept in Michigan. Crop damage was one of the issues leading to the development of an elk management plan by the Michigan DNR in 1984. Reducing population goals and heavily harvesting elk in agricultural areas are the main strategies used to limit crop damage.

In the 1980's, elk depredation became highly publicized in Minnesota. Although farmers were concerned with many issues, it was damage caused by elk that drew the most attention. Thousands of dollars of damage to alfalfa bales, sunflower seeds, and corn were reported to the Minnesota State Legislature ($39,000 by one farmer). However, later investigations by USDA found that most reports were overestimated. On 1 property reported to have suffered an 80% loss, only ¼ acre was actually damaged. Despite this, the Minnesota Legislature approved removal of the elk by trapping. After several animals died during the relocation, a court injunction filed by the Sierra Club stopped the removal.

In Pennsylvania, elk have found better foraging on private than on public land (Witmer and Cogan 1989). Open areas account for only 2% of public land, whereas 15-20% of private land is open. Most damage complaints involve corn, hay and oats. A survey of crop damage, began in 1982, revealed that 1-10% of crops planted received damage on 9 and 5 farms in 1983 and 1984, respectively. Fence damage is also occasionally reported in Pennsylvania.

In areas of the West where crops are cultivated, elk commonly damage haystacks and fences (C. Wheaten, personal communication). Orchards are also susceptible to elk depredation, as elk can easily knock down small fruit trees. During the public comment period for the proposed Bayfield Peninsula elk reintroduction, orchard owners were an important interest group opposed to the effort (Parker 1991).

Crop producers now appear to be in support of elk restoration in Wisconsin, although individuals did voice concern about the potential for crop damage. Out of 20 crop producers responding to surveys at the September 1999 public meetings, all indicated that they either strongly favor or favor a statewide restoration program. Crop producers would also support local restoration efforts, with 17 strongly in favor or in favor and 1 neither favoring or opposing such attempts. The low turnout at the public meetings may be an indication that there is not strong opposition to elk restoration from farmers. Perhaps this is because there have been no reports of crop damage by the Clam Lake herd. They have largely remained on national forest land near the release site. Anderson (1999) reported that a cow and a calf elk commonly fed on agricultural land with no complaints from the landowner. If the herd is allowed to expand, some elk will likely disperse to agricultural areas outside of the core and buffer ranges where there could be a greater chance of crop damage occurring.

Elk-Vehicle Collisions

Because elk are grazing animals, they are often attracted to grassy areas along highways and railroads. Vehicle collisions may occur in areas where elk are present. In Banff National Park, Alberta, motor vehicles were once the primary cause of adult elk mortality (Leighton 1988). However, Michigan averages only 1-3 elk-vehicle collisions/year (G. Boushelle and E. Langenau, personal communication). This is surprising given that the elk range is bordered to the west by an interstate highway and by county highways to the north, east, and south. There may be an avoidance response of elk evoked by vehicle traffic (Lyons 1983). In Minnesota, vehicle collisions with elk are rare although they regularly cross highways. There is also the potential for collisions between elk and snowmobile or all-terrain vehicle (ATV) users. In Yellowstone National Park, there are collisions between snowmobiles and large mammals including elk each year on groomed trails (United States Department of the Interior 1999). There have been no known collisions between elk and snowmobiles or ATV's in the Clam Lake area. During February 1999, a yearling bull elk from the Clam Lake herd became habituated to human activity around snowmobile trails, and was relocated to prevent someone from colliding with him. Three known elk-vehicle collisions have occurred since release of the Clam Lake herd. All three elk died from injuries received in the collisions.

While statistics on the average amount of damage from an elk-vehicle collision are not available from Michigan, there is general agreement among Michigan DNR personnel that vehicle collisions with elk tend to be much more serious than those with deer (N. Johnson, personal communication). Because elk are much larger than deer, vehicle collisions with elk involve greater risk of human injury and property damage. The State of Wisconsin does not assume legal liability for deer/vehicle collisions nor would the State likely be held liable for collisions with elk (J. Christenson, personal communication). Some survey respondents at the September meetings thought that the Department should develop management strategies for reducing elk-vehicle collisions. Signs warning motorists of elk crossing areas on highways have already been erected in the Clam Lake area. When elk become habituated to human activity around roads or trails, thereby creating a traffic hazard, the management protocol for habituated elk described later in this document will be used to decrease the risk of collisions. However, if the Clam Lake herd is allowed to remain and increase, no management strategy will be able to eliminate the risk of elk-vehicle collisions.

Impacts of Human Activities on Elk

Human activities can negatively impact elk. Changes in land use, including increased recreational activity, on the Michigan elk range were thought to have made portions of "prime elk range ... virtually uninhabitable" (Moran 1973). The presence of human activities has implications for visibility and approachability of elk, which may relate to visitor use and satisfaction. A variety of human activities occur in all seasons on the CNF-GDD. The potential exists for impacts on elk from both recreational and non-recreational users. As a result, many people are concerned that a variety of activities in the CNF-GDD could be restricted to limit impacts on elk.

Motor vehicles

Studies have documented that vehicle traffic may cause declines in habitat use adjacent to roads (Lyons 1983). In Idaho, elk preferred to be over 400 yards from traveled roads at all times (Irwin and Peek 1976). Christensen et al. (1993) declared the amount of roads and motor vehicle use to be the primary factor controlling elk habitat effectiveness in the western National Forests. In Michigan, those areas within the elk range that offered the most protection from human encroachment including roads experienced the highest herd increases (Michigan Department of Natural Resources 1984). Although little research has been conducted to directly assess the impacts of roads and motor vehicle use on elk in Michigan, they appear to be more tolerant of roads than western elk (D. Smith, personal communication).

Disturbance to wintering elk by snowmobiles has the potential to be especially harmful, because winter is the most energetically taxing season for them (Mautz 1978). Activities resulting in elk abandoning areas of high-quality habitat or repeatedly fleeing from disturbance may result in lower survival and productivity rates (Clark 1999). In Oregon, elk counts decreased by half after a winter range began to be used by recreational snowmobilers (Anderson and Scherzinger 1975). In Yellowstone National Park, some elk were displaced from areas near groomed snowmobile trails, while others became habituated to human activity (Aune 1981). Animals habituated to snowmobiling are more at risk of being hit by snowmobiles (Reinhart 1999), creating a safety hazard for both people and elk.

ATV's may also have the potential to negatively affect elk. In Michigan, biologists have observed that elk seemed to be temporarily displaced from areas experiencing frequent summer ATV use (D. Smith, personal communication). Some farmers feel that this has caused elk to move from public land onto private farmlands, where they have caused crop damage problems. However, there is currently a lack of published scientific information available documenting the impacts of ATV's on elk.

Both snowmobiling and ATV use occur on the CNF-GDD. Although no statistics are available documenting the amount of use that the forest receives, snowmobiling appears to be a more popular activity than ATV use (D. Nelson, personal communication). There are now numerous designated snowmobile trails totaling 219 miles and one 56 mile-long designated ATV trail on the CNF-GDD. Snowmobile trails occur both inside and outside of the core elk range, and the single ATV trail is inside the core elk range. However, motor vehicles are not restricted to designated trails throughout much of the CNF-GDD, so the area used by them is undoubtedly larger. The only impacts on the Clam Lake herd associated with motor vehicles have so far involved collisions with cars. There is currently no indication that snowmobiles, ATV's, or other motor vehicles have displaced elk from important habitat. However, more conflicts between elk management and motor vehicle users may occur in the future if the Clam Lake herd is allowed to increase.

Recreational users

Beyer (1987) studied Michigan elk herds during the first two hunting seasons, following 20 years with no elk harvest. He found that elk visibility was not reduced by hunting, presumably because the hunts were of a short duration. Schultz and Bailey (1978) reported that elk visibility increased after population control hunts were discontinued in Rocky Mountain National Park. It is likely that elk visibility is reduced as elk hunting pressure and season length increase. Deer hunting had little effect on elk in the Clam Lake area (Anderson 1999). The responses of elk to bear hounding activities were also monitored, and no animals moved out of their previous or established home ranges. Hunting of other species is unlikely to affect elk behavior.

Human activities such as cross-country skiing and snowshoeing can impact elk. Schultz and Bailey (1978) noticed that hikers, snowshoers, and cross-country skiers sometimes disturbed elk along trails. Approaching skiers regularly caused nonhabituated elk in Yellowstone National Park to flee (Cassirer et al. 1992). In Alberta, winter elk distribution was largely unaffected by skiing, although elk tended to move away from heavily used trails during the ski season (Ferguson and Keith 1982). On the CNF-GDD, cross-country skiing is a popular activity occurring primarily on the 5 designated ski trails, which total approximately 36 miles in length (D. Nelson, personal communication). Only 1 of these trails is within the core elk range. Other recreational uses such as snowshoeing and hiking, although increasing in popularity in recent years, are also restricted primarily to 2 trails outside of the core elk range. Because these activities occur primarily in very restricted areas outside the core elk range, it is unlikely that they will ever have noticeable impacts on elk.

Elk viewing

Elk movements in Rocky Mountain National Park, where elk hunting ceased in 1962, did not appear to be affected by people watching elk from parking areas (Schultz and Bailey 1978). Elk generally fled a short distance when approached by people, but were often reluctant to leave the area completely. Michigan offers successful viewing opportunities to visitors of the elk range in designated viewing areas. These areas are especially popular with both elk and humans in the fall. Elk visibility is carefully monitored on the Michigan elk range. Beyer (1987) recommended modification of elk viewing areas to keep observers far enough away so that disturbance to animals is lessened and they do not become habituated to humans. Elk easily become habituated to predictable, harmless human activity (Thompson and Henderson 1998). This is a very undesirable condition that can lead to safety concerns for both people and elk. Habituated animals can create tension among those wishing to eliminate problem animals by any means necessary and those who enjoy their presence (Thompson and Henderson 1998). Additionally, the goal of the reintroduction was to restore a wild population of elk to Wisconsin, and habituation would decrease their “wildness”. Some survey respondents at the September meetings thought that tourism and elk viewing should not be promoted, to decrease the chances of animals becoming habituated and losing “wildness”. The Clam Lake elk have not been very visible thus far, due to the low number of elk present and the thick cover characterizing the CNF-GDD. Few problems associated with people viewing elk have been noted. However, 2 yearling bulls did become habituated to humans. Both of these animals subsequently died, 1 from injuries sustained in a collision with a car and the other from drowning. The USFS has proposed installing wildlife viewing areas on the CNF-GDD. The potential for habituation would be high at these areas, and management strategies should be developed to prepare for it.

Artificial feeding

Artificial feeding of deer is a popular, legal activity throughout northern Wisconsin. Many people derive great enjoyment out of watching deer feed in their yards, and feel as though they are contributing to the maintenance of healthy deer populations. Problems with artificial feeding of elk are almost certain to develop if the herd is allowed to expand. Elk accustomed to artificial feeding rapidly become habituated, and nuisance problems soon develop, including destruction of trees and shrubs in areas adjacent to where elk were being fed and safety concerns with motorists and/or people. Artificial feeding could also facilitate disease transmission among elk because animals are in closer contact with one another than they would be under normal circumstances (Davidson and Nettles 1997).

Logging

Edge and Marcum (1985) found that elk in Montana tended to stay 500-1,000 yards away from logging activity, but moved into logging areas during nonactive periods. There is also evidence that elk may become habituated to logging activities occuring over a long period of time (Beall 1976). Anderson (1999) reported that logging activities in the CNF-GDD did not adversely affect elk movements near logging units. Disturbance of elk due to logging would not be a major management concern.

Tribal Hunting

If elk are allowed to remain in the CNF-GDD, hunting would be prohibited for a period of time in order to allow the establishment of a viable population. Harvest of elk could not take place until it was determined that a harvestable surplus exists. All Wisconsin Chippewa tribes currently have closed elk hunting seasons on public lands off reservations. Because the CNF-GDD is in the ceded territory, treaty rights entitling the tribes to 50% of the harvest quota for each hunting zone will apply once public elk hunts are initiated. Elk harvests by tribal members on reservations could not be regulated by the state. The opportunity to harvest elk would be viewed favorably by tribal members, as hunting is a culturally important activity for many of them. However, relations between some non-Indians and Chippewa tribal members have been strained as a result of tension over treaty rights. An apportionment of the annual harvest of elk to the Chippewa may intensify these problems.

Social Implications

Elk have essentially been absent from the state for >100 years. There is no doubt that elk are a magnificent animal with high intrinsic value and appeal. If allowed to remain, many citizens of Wisconsin would receive an "existence value" from the presence of a wild population of elk. They would take pleasure or pride in knowing that elk occur here, even if they do not visit the herd or gain from it economically. Species reintroduction efforts often result in a sense of pride and stewardship among the residents of the reintroduction area. Community pride and local support for elk reintroduction is readily apparent in the Clam Lake area, where businesses display elk pictures and herd updates from the UW-SP research team. A wild elk herd would provide residents of Wisconsin and other states with an opportunity to view the animal outside of captivity. This experience would be highly valued by many. Visitation to the Clam Lake area, a region where the economy relies heavily on tourism, would probably increase if the elk herd is allowed to grow and becomes more visible. The

economic benefits of an increase in tourism would be welcome by many residents. There are probably also those who do not want to see more visitors to the area because of the potential problems like increased traffic causing greater congestion and road maintenance costs, or decreased aesthetic values and environmental quality resulting from more development. However, the September meetings indicated that public support for elk restoration is strong. Statewide restoration was strongly favored or favored by 97% of survey respondents, while 3% neither favored nor opposed. All 22 local respondents were strongly in favor or in favor of the Clam Lake program. These results may be biased, as 40 of the 103 meeting attendees were Rocky Mountain Elk Foundation (RMEF) members, a non-profit organization dedicated to preservation of elk and their habitat. Nonetheless, little opposition to elk restoration was encountered.

Hunting is an important tradition throughout Wisconsin. If the Clam Lake herd were allowed to remain, limited opportunities to hunt elk would probably eventually be available to citizens of this state. Many residents of Wisconsin travel to western states each year to go elk hunting. However, such long distance elk hunts are no doubt cost-prohibitive and/or logistically impossible for many people. The opportunity to hunt elk in Wisconsin would be very attractive for many individuals.

Successful elk management would require the joint cooperation of many public and private groups. The formation of partnerships among these groups is considered by many to be an exciting prospect. Some public meeting attendees felt that this would be a good opportunity for the Department to engage in working relationships with the tribes. A partnership between the State and the Lac Courte Oreilles Band of the Chippewa would provide an opportunity to publicly illustrate how groups can work in cooperation to manage natural resources. There is tremendous potential for continued partnerships with the RMEF. Currently there are 18 chapters of RMEF in Wisconsin with a membership of approximately 4,600. A successful reintroduction and management program may also improve public confidence in the natural resource management agencies involved: Wisconsin Department of Natural Resources, U.S. Forest Service, Great Lakes Indian Fish and Wildlife Commission, and County Forestry Department. However, if problems were to develop such as failure to control damage or keep the herd in the desired area, public confidence in the involved agencies could decline.

Economic Implications

A variety of economic gains and costs can be expected if the decision is made to retain the Clam Lake herd. Economics must be considered in elk management decisions. The economic potential of tourism and hunting, along with anticipated management costs, are discussed in the following section.

Benefits to local economies

There is ample evidence that the Michigan elk herd is a significant attraction. However, specific information such as the number of tourists visiting the elk range or the amount of money tourism generated was unavailable when the 1991 management plan for the proposed Bayfield Peninsula reintroduction was drafted. Instead, a re-polling was conducted of individuals who had indicated on an earlier survey that they enjoyed watching wildlife. This information was used to estimate the economic benefits of elk tourism in Bayfield County. Parker (1991) estimated that 53,000 people per year would visit to view elk, and would remain in Bayfield County accommodations for an average of 1.7 nights. An average of $35.00/day/person would be spent, for a total economic contribution of $3,153,500 to local economies. However, these figures may not apply well to the

Clam Lake area, as it is difficult to predict how many people would actually come to view elk. Because the Bayfield Peninsula site has much open habitat and the CNF-GDD is heavily forested, opportunities to view the Clam Lake elk may be more limited. If elk do not become more visible, people traveling to the Clam Lake area to see them may become discouraged and not return. Additionally, although availability of food and lodging has already improved in the Clam Lake area since reintroduction, they are less than in the Bayfield area. If the Clam Lake herd is allowed to grow, the probability of seeing elk will likely increase. Wildlife viewing areas currently being considered by the USFS may further increase elk visibility if they are located in areas frequented by animals. Local and state interest in elk is high, as evidenced by continually large numbers of requests for information about the elk study, and statewide support of RMEF functions and fund raisers. There would likely be an economic contribution to local economies from elk tourism if the Clam Lake herd were allowed to increase, although amounts are difficult to estimate. Minimal economic gains would probably result if the Clam Lake herd were kept near current population levels.

Hunting will become part of elk management in Wisconsin if a harvestable surplus exists. Local economies would receive some economic gains from elk hunting. Hunters would be expected to spend money on food, lodging, fuel, and hunting equipment. However, the number of elk licenses available will be limited (probably <100). The economic impacts of elk hunting in the Clam Lake area will probably not be very large.

Costs of elk management

If the Clam Lake herd is retained, there will be substantial costs for an elk management program (Table 2, Appendix). Some people may feel that an elk management program would divert money, time, and public interest away from other wildlife management projects which already lack funding and staff. One of the largest funding sources for the elk program is revenue from Indian gaming. The 1999-2001 state budget earmarked $200,000 in gaming revenue for this purpose in fiscal year 2001. Some costs could also be shared by the USFS. Private organizations such as the Rocky Mountain Elk Foundation can match dollars contributed by state and federal agencies. RMEF contributed $290,500 of the $400,000 required to establish the Clam Lake herd and for the studies done by the UW-SP research team. RMEF has indicated a desire to continue to provide funding for the management of elk in Wisconsin. The sale of elk hunting permits and application fees would generate revenue. In 1988-89, Michigan generated $223,500 from the sale of 235 permits, at $4.00/application and $100.35/license (Table 3, Appendix). Although an elk management program would incur additional costs for the Department, these expenses could be somewhat alleviated by cost sharing with other agencies and private groups, allocation of gaming revenues, and elk hunting permit revenues.

In addition to adequate funding, additional personnel will be necessary to successfully manage the Clam Lake herd. Currently included in the state budget for fiscal 2000-2001 is funding for a 0.5 FTE elk biologist position from the Indian gaming revenue. However, a 1.0 FTE elk biologist stationed near Clam Lake (probably at Hayward) will be essential, along with support from limited term employees when needed. Responsibilities of elk management will include a long list of duties such as field monitoring, public contact, and handling problem situations. Without adequate funding and personnel devoted to elk management, the Department will be unable to fulfill its obligations described in this document.

Summary

Economic and social impacts will be associated with elk management decisions. There is support from the general public and crop producers for both the Clam Lake herd and statewide elk restoration. A decision to retain the Clam Lake herd and allow it to increase would probably bring money into local economies from tourism and elk hunting. Many people would enjoy having the opportunity to view wild elk, or like just knowing that the animals were there. Local residents might take pride in the elk program. Tribal members and non-Indians might eventually have the opportunity to hunt elk. At current levels, the elk population is compatible with other uses of the CNF-GDD. However, an increasing population could also lead to economic loss and frustration with elk management for private landowners suffering crop damage. Although other eastern states have had few elk-vehicle collisions, that risk might increase if the population grew. Conflicts could develop between elk management interests and motor vehicle or other recreational users if these activities began to have negative impacts on elk. An elk management program would also incur additional costs on the Department, although options for funding the program exist.

Different socio-economic impacts could be expected under each of the 3 population management alternatives. There will be greater potential for forest/agricultural crop damage, elk-vehicle collisions, and conflicts with recreational and non-recreational users of the CNF-GDD for Alternatives #1 and #2 than with #3, because population goals are higher for those alternatives. However, local and state pride, economic benefits to local economies, and recreational opportunities to view and hunt elk for both tribal and non-tribal members would also be greater for Alternatives #1 and #2. Costs of management will be greater for Alternatives #1 and #2 than for #3. Alternative #2 is distinct from #1 in that associated socio-economic impacts would be expected to occur more quickly, because the elk population will grow faster.

ECOLOGICAL IMPACTS

An elk population in the CNF-GDD will have impacts on other resources. Some impacts might be acceptable, while others would not. The following section discusses potential impacts of the Clam Lake herd on other resources.

Vertebrates

Deer and deer hunting are culturally and economically important in Wisconsin. Public concern has been expressed that elk will compete with deer, resulting in fewer deer. While elk and deer are closely related sympatric cervids, there is usually not a high degree of interspecific competition between the two (Nelson 1982). In Michigan, the white-tailed deer herd is compatible with elk (Moran, personal communication). Over-winter deer densites are 30-40/mi^2. In Minnesota, overwinter deer densities of 25/mi^2 are maintained on the elk range. Resource partitioning by elk and deer is partly a result of the ability of elk to utilize a wider range of food and cover types (Moran 1973). Deer normally begin yarding in conifer swamps and lowlands when snow depths reach 12 inches. At depths of 24 inches or more, elk will move into conifer stands with less snow (Leege and Hickey 1977). However, elk movements do not appear to be seriously curtailed until snow depths reach 30 inches or more (Adams 1982). In Michigan, elk movements were restricted when snow depths exceeded 18 inches. However, they freely moved between cuttings and heavy cover and were never restricted to conifer yards for an extended period of time (Moran 1973). Competition is expected to occur primarily during severe winters when both elk and deer occupy conifer yards. Competition between elk and deer in the CNF-GDD has been negligible so far (Lizotte 1998). Elk were not observed using traditional deer yards, and

utilization of browse was not high enough to limit twig production. However, the browse available in conifer yards is limited. If elk densities increase, they could begin seriously impacting browse availability and crowding deer out of yards. This potential would be greatest with Alternatives #1 and #2. Population goals for elk would be set at levels below which competition with deer occurs. Competition between elk and deer would not be expected to occur with Alternative #3.

Gray wolves are a state threatened and federally endangered species in Wisconsin. The CNF-GDD is high quality wolf habitat (Mladenoff et al. 1995), and contains several packs (Wydeven and Wiedenhoeft 1999). Although elk are preyed upon by wolves in the West (Bangs et al. 1998, Kunkel et al. 1999), in this region wolves prey primarily on deer. We expect that elk will occasionally be killed by wolves, as at least two of the Clam Lake herd already have (J. Schmidt, personal communication). However, it is unlikely that elk will ever be abundant enough to become a significant addition to the prey base for wolves in the CNF-GDD. The potential exists for elk to reduce deer densities through competition. Elk might then become more important prey for wolves. It is unlikely that a serious reduction in deer densities due to competition with elk would occur, as elk population goals will be set at lower levels and maintained by hunting. Therefore, none of the elk management alternatives would be expected to have an appreciable impact on wolves in the CNF-GDD.

Several other federal or state threatened or endangered vertebrate species are present in the CNF-GDD as well, including Canada lynx, bald eagles, ospreys, red-shouldered hawks, trumpeter swans, spruce grouse, martens, and wood turtles. These species are not expected to be impacted by elk. Large tracts of conifer forests are beneficial to spruce grouse (Wisconsin Department of Natural Resources 1997), lynx (Hickenbottom et al. 1999) and martens (Kohn and Eckstein 1985). Therefore, habitat management such as converting conifer stands to early succession forest cover types beneficial to elk would be detrimental to these species (Gieck 1986). It should be noted, however, that this document does not recommend such habitat manipulations for elk management.

Ruffed grouse are a popular game bird in Wisconsin, and are generally abundant throughout much of the state. Aspen is a critical habitat component, used by grouse for both food and cover. It is possible that elk could browse aspen heavily enough to reduce stem densities, thereby affecting grouse production and/or survival. However, Campa (1989) concluded that browsing of aspen by elk in Michigan does not reduce stem densities below naturally thinned levels. None of the elk management alternatives are predicted to affect ruffed grouse abundance.

Native Vegetation

Elk are large herbivores with broad dietary preferences including many herbaceous species (Kufeld 1973). Concern exists among both resource managers and the public that elk may adversely affect some species of native vegetation, including rare herbaceous plants. Elk were native to the reintroduction area, and co-existed with native plants including currently rare herbaceous species until they were extirpated after European settlement. The potential effects of elk herbivory on rare herbaceous plants are difficult to predict because of the complex nature of the issue and the fact that much of the information required to evaluate it better is now lacking. For example, the elk range has not been thoroughly surveyed for rare plants, so there is a great deal of uncertainty regarding what plants may or may not be present. It is also difficult to predict which plant species are likely to be impacted by elk herbivory. Although numerous studies examining the diets of elk have been

published, almost all of them were conducted in the western part of the continent where plant communities are very different from those occurring in northern Wisconsin. It is therefore uncertain how heavily elk may utilize different species. Perhaps most importantly, it is difficult to predict how rare plant populations may be affected by the addition of elk herbivory to deer herbivory. Several researchers have indicated that high-density deer populations are having deleterious effects on some species of rare plants throughout northern Wisconsin (Martin 1995, Alverson et al. 1988). For species that are already impacted by deer herbivory, any herbivory by elk would exacerbate those problems. Unfortunately, basic information regarding direct impacts of herbivory by deer at known population levels on specific species of rare plants in Wisconsin is lacking (Martin 1995), which further complicates efforts to predict how elk herbivory will affect rare plant populations.

Some inferences regarding the potential impacts of elk on specific species of rare plants can be made based upon the limited information available. There are currently 14 plant species listed as state endangered, threatened, or species of concern that are known to occur in the core and buffer ranges, several of which are also designated as region or forest sensitive by the USFS (Table 5). There are no federally threatened or endangered plants known to occur in the core or buffer elk ranges. There are also 40 species of rare plants that may be present in the elk range because the proper habitat exists for them, but because the area has not been thoroughly surveyed it is unknown whether or not they occur. Species that could be affected by the cumulative impacts of elk and deer herbivory include Showy Lady's Slipper (Alverson et al 1988, Martin 1995), Small Yellow Lady's Slipper (Alverson et al 1988, Martin 1995), American Ginseng (Martin 1995), Calypso Orchid (M. Sheehan, personal communication), Downy Willow-Herb (M. Sheehan, personal communication), Maidenhair Spleenwort (M. Sheehan, personal communication), and Fairy Slipper (M. Sheehan, personal communication). Additionally, Crinkled Hairgrass (Jost et al 1998) and Marsh Valerian (Kufeld 1973) were both strongly selected by foraging elk in other areas of the country. These plants may be at risk from elk herbivory alone. Future research and monitoring efforts could reveal more species at risk from elk herbivory, as well.

NWC is a species of concern in northern Wisconsin with serious regeneration problems, partially due to browsing of small trees by deer (Alverson et al 1988, Davis 1998)). Deer yards in the upper Great Lakes region are commonly located in dense stands of NWC, and are frequently heavily browsed (Blouch 1984). Elk in the eastern states also strongly select NWC for winter food and cover (Moran 1973, Lizotte 1998). NWC is clearly heavily utilized by both elk and deer wherever it is available to them. Elk utilization of NWC will be of concern to biologists if the herd is allowed to remain and expand. Aldous (1952) simulated different levels of deer browsing by clipping various percentages of the browse available under 7 feet on small (7 foot tall) and larger (15 foot tall) NWC trees. He found that the growth of larger trees was not impaired by removal of 25% and 50% of the available browse, and declared that it had a similar effect as natural pruning of the lower branches. At these same levels, the growth of small trees was retarded and eventual death of the trees became likely. He estimated that small trees would probably not be able to withstand annual utilization of more that 15-20% of the available browse and still survive to maturity. Elk utilization of mature NWC at feeding sites in the CNF-GDD averaged 27% of the available browse (Lizotte 1998). In addition, elk moved from stand to stand throughout the winter (J. Schmidt, personal communication), rather than remaining in a single stand for an entire winter and utilizing all available browse as deer commonly do (Blouch 1984). Therefore, elk browsing should not affect mature NWC trees but would likely damage areas of regeneration. There are currently few areas on the CNF-GDD where NWC regeneration can be found. Lizotte (1998) noted that no evidence of NWC regeneration was encountered in the CNF-GDD during his study. Elk browsing is not one of the reasons for the current lack of

NWC regeneration, but the cumulative impacts of deer and elk browsing may further decrease the potential for stands of NWC to successfully regenerate in the future.

The largest impacts on native vegetation could be expected with Alternatives #1 and #2, because they have the highest elk population goals. An appropriate vegetation monitoring program, described later in this document, would be important to help determine impacts of elk herbivory on native vegetation with either of these alternatives. Insignificant impacts could be expected with Alternative #3, because elk would be at very low densities. Vegetation monitoring would therefore not be necessary.

Summary

Some impacts of elk on other resources of the CNF-GDD may occur. There may be competition between elk and deer, and definite potential for damage to native vegetation including some species of rare herbaceous plants and regenerating stands of NWC. These impacts will be minimized by maintaining elk densities through hunting at levels below which substantial negative effects occur. The potential for these impacts would be greatest under Alternatives #1 and #2, because they have the highest elk population goals. Impacts could occur quicker with Alternative #2, because elk population growth rates would probably be greater. Minimal impacts would be expected under Alternative #3. State or federally listed terrestrial vertebrates, ruffed grouse, or other wildlife species are not anticipated to be affected under any of the 3 alternatives.

Table 5. Rare plants in the core and buffer elk ranges of the Chequamegon National Forest-Great Divide District. Species of special concern (sp concern) are those which may qualify for listing as state or federally threatened or endangered species, but insufficient data is available to assess their status. Regionally (r) or forest (f) sensitive species are those that are not listed as federally threatened or endangered, but are given special management consideration by the United States Forest Service because they are rare in that Forest Service Region or on the Chequamegon National Forest. Deliberative species are those that are under consideration for listing as regionally sensitive.

Species	Federal Status	WI Status
Little Goblin Moonwort (*Botrychium mormo*)	r sensitive	endangered
Broad-Leaved Twayblade (*Listera convallarioides*)	none	threatened
Braun's Holly Fern (*Polystichum braunii*)	r sensitive	threatened
Blunt-lobe Grape-Fern (*Botrychium oneidense*)	r sensitive	sp concern
Rugulose Grape-Fern (*Botrychium rugulosum*)	r sensitive	sp concern
Fragrant Fern (*Dryopteris fragrans var. remotiuscula*)	none	sp concern
Purple Clematis (*Clematis occidentalis*)	deliberative	sp concern

Downy Willow-Herb (*Epilobium strictum*)	none	sp concern
Crinkled Hairgrass (*Deschampsia flexuosa*)	none	sp concern
Adder's Tongue (*Ophioglossum vulgatum*)	none	sp concern
Maidenhair Spleenwort (*Asplenium trichomanes*)	f sensitive	sp concern
Fairy Slipper (*Calypso bulbosa*)	r sensitive	threatened
Showy Lady's Slipper (*Cypripedium reginae*)	none	sp concern
Northern Black Current (*Ribes hudsonianum*)	none	sp concern
Small Round-Leaved Orchis (*Amerorchis rotundifolia*)	r sensitive	threatened
Northern Wild Comfrey (*Cynoglossum boreale*)	r sensitive	none
Ram's-head Lady Slipper (*Cypripedium arietinum*)	r sensitive	threatened
Butternut (*Juglans cineria*)	r sensitive	sp concern
Large-Flowered Ground Cherry (*Leucophysalis grandiflora*)	r sensitive	sp concern
White Adder's-mouth (*Malaxis monophyllos*)	r sensitive	sp concern
Large-Leaved Sandwort (*Moehringia macrophylla*)	r sensitive	endangered
American Ginseng (*Panax quinquifolius*)	r sensitive	sp concern
Small Shinleaf (*Pyrola minor*)	r sensitive	endangered
Marsh Valerian (*Valeriana sitchensis*)	r sensitive	threatened
Mingan's Moonwort (*Botrychium minganense*)	f sensitive	sp concern
Pale Sedge (*Carex pallescens*)	f sensitive	sp concern
Sm Yellow Lady's Slipper (*Cypripedium parviflorum*)	f sensitive	sp concern
Marsh Willow-Herb (*Epilobium palustre*)	f sensitive	sp concern
Marsh Grass-of-Parnassus (*Parnassia palustris*)	f sensitive	threatened

Arrow-Leaved Sweet-Coltsfoot (*Petasites sagitattus*)	f sensitive	threatened
Large Round Leaf Orchid (*Platanthera orbiculata*)	f sensitive	sp concern
Small Yellow Water Crowfoot (*Ranunculus gmelinii*)	f sensitive	endangered
Torrey's Bulrush (*Scirpus torreyi*)	f sensitive	sp concern
White Mandarin (*Streptopus amplexifolius*)	f sensitive	none
Northeastern Bladderwort (*Utricularia resupinata*)	f sensitive	sp concern
Toothwort (*Cardamine diphylla*)	sp concern	none
Large Yellow Lady's Slipper (*Cypripedium pubescens*)	deliberative	none
Rough Cotton-Grass (*Eriophorum tenellum*)	deliberative	none
White Trout Lily (*Erythronium albidum*)	deliberative	none
Carey's Smartweed (*Polygonum careyi*)	deliberative	none

MONITORING AND MANAGEMENT POLICIES

The following section discusses monitoring and management needs relating to the Clam Lake herd if it is allowed to remain. Unless otherwise noted, discussion focuses on monitoring and management protocols to be implemented for Alternative #1 (the preferred alternative).

Monitoring

In any species reintroduction, it is impossible to predict with certainty how other resources will be affected. Therefore, it will be crucial to continue intensive monitoring of the elk population and its relationship to the environment. Many management decisions will need to be based on information derived from monitoring. An effective monitoring program will be the only way to identify when elk populations are reaching maximum tolerable levels. Indicators that the population is reaching that level will include substantial impacts on winter browse or rare plants, elk occupation of deer yarding areas, declining productivity or survival rates, and increasing dispersal or habituation rates. If some of these indicators are detected by monitoring, elk numbers will then be reduced through hunting. Documenting the outcome of the reintroduction for the benefit of other states considering a similar attempt would also be useful (Gogan 1990).

Elk population

Knowledge of basic population parameters will be essential for making appropriate elk management decisions.

The most important parameters would be population size and distribution, so that biologists will know how elk numbers compare to goals for core and buffer ranges. Numerous techniques exist for estimating populations. Michigan DNR uses short, intensive air and ground surveys. During a 3-day period in January 1984, 65 people used 2 airplanes and numerous trucks, snowmobiles, and snowshoes to survey approximately 600 mi^2. An estimated 80% of the total population is counted each year using this technique (Michigan Department of Natural Resources 1984). In February 1999, the Department conducted an aerial survey in which straight-line transects were flown over the reintroduction area from a fixed-wing aircraft in an attempt to get a total herd count. Prior to the flight, the pilot was given recent locations of instrumented elk and their transmitter frequencies. Twenty-four of 28 elk known to be present, all in 3 groups with at least one instrumented elk per group, were counted from the air. This technique may be sufficient when the elk population is low and a high percentage of the population is instrumented. However, it will become much more difficult to obtain a total herd count from aerial surveys as the population grows and begins occupying a larger area. Mark-resight (Eberhardt et al. 1998) or sightability-adjustment (Cogan and Diefenbach 1998) techniques will therefore be used with aerial and ground surveys to obtain population estimates. Some elk will need to be marked with radio collars visible to survey aircraft. Good spatial distribution of marked animals throughout the population will be important for the technique to work well.

Productivity and survival rates will also be monitored. Capture and collaring of new-born calves, which has been done by the UW-SP research team each year since release, may be unnecessary to continue in the future. Biologists will attempt to count and classify groups of elk from the air and/or the ground to obtain calf:cow:bull ratios, providing a valuable index of productivity and survival (Taber 1982) that would be used to assess elk population dynamics. Survival rates of adults will be measured by routine ground monitoring of radio-collared animals. Aging of hunter-killed elk will also be conducted once public hunting is initiated.

Routine ground-monitoring of radio-collared animals will be used to detect dispersing elk. However, chances are that dispersing elk will often not be instrumented. Aerial surveys might sometimes reveal the presence of these animals. The Department will usually have to rely on reports from the public to detect these animals.

Monitoring for disease in the Clam Lake herd will be continued. UW-SP and/or DNR personnel have conducted field necropsies on all elk carcasses when they were recovered. Tissue samples, and in a few cases entire carcasses, were examined by DNR wildlife health specialists. With the exception of a severe infestation of liver flukes detected in 1 animal (Lizotte 1998, Anderson 1999), no diseases or substantial parasitism have been reported in Clam Lake elk so far. Field and laboratory necropsy of elk carcasses using standard procedures devised by the DNR Wildlife Health Team will be used for continued disease monitoring of the Clam Lake herd. This type of monitoring will be critical for detecting the presence of potentially devastating diseases like CWD, which can only be definitively diagnosed with tissue from dead animals.

Radio collars facilitate the collection of much useful information. Many of the Clam Lake elk are already radio-collared. The batteries on these collars will soon expire, which will require additional elk to be captured and instrumented. There is an inherent risk of injuring or killing animals when capturing and handling them, but this risk will be minimized by developing approved capture procedures that will be reviewed by experienced professionals before they are implemented. The number of collared animals required for good population estimates will depend on what survey technique is used. Capturing adequate numbers of elk for collaring with reasonable spatial distribution will prove challenging. Chemical immobilization with dart guns is unlikely to

work in most cases, due to the thick cover dominating the CNF-GDD and the skittish nature of the elk. However, there may be cases where elk offer the opportunity for darting. Corral traps have been successfully used in the past and are likely going to be the best option available for collaring significant numbers of elk, although adequate spatial distribution of collared animals may be difficult to obtain. The Department will use both of these techniques when applicable to collar elk with good spatial distribution. In addition, each time an unmarked elk is captured for management purposes it will be marked, preferably with a radio collar.

Larger populations spread over broader areas are more difficult to estimate than smaller populations in restricted areas. Alternative #3 would probably require only a minimal population monitoring effort to determine population size and distribution. Population monitoring would therefore require more time, personnel, and expense for Alternatives #1 and #2 than with #3.

Habitat

The Department will continue to monitor habitat utilization by elk and their impacts on native vegetation. Winter browse utilization surveys were conducted by the UW-SP research team, and will continue to be an important part of future monitoring efforts. Data will be collected on what species elk are browsing and how heavily they are being utilized, especially for NWC. Deer surveys will be conducted near wintering groups of elk to determine if they are competing with deer for winter habitat.

Rare herbaceous plants will also be a part of the monitoring program, given that elk herbivory has the potential to impact several species. Much needed base-line data on rare plant occurrences should continue to be collected, although such efforts are often limited by funding. Patches of rare plants likely to be affected by elk herbivory will be monitored. Target species should include Showy Lady's Slipper, Small Yellow Lady's Slipper, American Ginseng, Calypso Orchid, Downy Willow-Herb, Maidenhair Spleenwort, Fairy Slipper, Crinkled Hairgrass, Marsh Valerian, and any others that data suggest should be monitored.

Although there have been no apparent adverse impacts on elk caused by motor vehicles or other recreational uses, there is a considerable amount of published scientific information available to indicate that this could become an elk management concern in the future if the herd is allowed to increase. Investigations should be conducted if the herd is allowed to expand to determine if impacts on elk continue to be negligible or if they are being excluded from important habitat in the core range by various human activities.

Artificial feeding and baiting could lead to habituation problems for elk, even if they are not the target species. Surveys will be conducted to determine where these activities occur within the designated elk range, especially in relation to groups of elk, to allow predictions of where habituation problems might develop. Public contacts will be made to supplement the surveys.

Habitat monitoring will be more involved and expensive with Alternatives #1 and #2 than with Alternatives #3. Larger elk populations will lead to increasing impacts on habitat, and the monitoring programs described above will be important. Low elk populations such as those that would be associated with Alternative #3 would be expected to have inconsequential impacts on habitat, and therefore would not require intensive monitoring.

Elk Hunting Regulation

Hunting will be the preferred method of maintaining elk population goals. It is a culturally important activity for many people in the state, and could also generate money for elk management. If the herd continues to thrive, hunting will be initiated before the population reaches its upper limit. In polygamous animals like elk, small numbers of bulls can breed most of the cows (Geist 1982). Harvesting a small number of bulls has no effect on population growth rates. This type of limited harvest for bulls will begin when the population reaches 150. By establishing a hunting season early on, additional funding for the elk program could be generated, elk could be added to the Wildlife Damage Abatement and Claims Program (WDCAP) list so that farmers could be compensated for crop damage, and the administrative work involved with establishing a hunting season would be completed by the time a hunting season became necessary to control the size and distribution of the elk population. Harvest rates will be increased when population goals are reached, with a goal of removing the annual increment to the herd. Antlerless elk as well as bulls will then be harvested. Bull harvest rates will be controlled so that good bull:cow ratios are maintained to allow adequate numbers of older age class bulls for breeding. Most tourists and hunters would be interested in the opportunity to view or kill mature, large antlered bulls. Bull:cow ratios of approximately 40-50:100 are comparable to those for the Michigan herd, and will allow for adequate viewing and hunting opportunity. Assuming a population growth rate of 13% (as in Michigan), a range of harvest goals would be 26 elk if the population were 200 or 58 from a population of 450. The Chippewa tribes will be allocated 50% of the harvest quota for each zone.

Legislation will have to be written establishing the legal structure of an elk season in Wisconsin. Aspiring elk hunters will need a permit to kill an elk. The tribes would allocate permits to tribal members for their harvest quota in whatever manner they like. The remaining permits available to non-tribal members will be distributed by lottery, with no preference system. The Department may restrict the number of permits an applicant can receive in their lifetime, or set a waiting period that successful applicants must observe before they could begin applying for elk permits again. Permit and permit application fees will be set. Michigan charges $4.00/application and $100.00/permit. This system would be affordable to a broad section of the public, and the Department may charge similar fees. The Department suggests that revenue generated from elk license sales be used to fund the elk program, except for $0.50/application of which would go to the Wildlife Damage Abatement and Claims Program. The Department has been asked to consider donating 1 tag to the RMEF to be raffled by them, with the understanding that all of the money received from the raffle would be donated to the state’s elk management account. This would help generate additional revenue to help pay elk management expenses.

Elk hunting seasons will have to be set. Hunting seasons may be held every other year to reduce the administrative costs of a hunt involving a small number of permits. Both Michigan and Arkansas have multiple seasons, with permits only valid for one season. These seasons are generally in mid-late September and early December, with 5-7 days/season. The Department will consider both of these options when structuring seasons. Success rates for bulls might be best in September, as they are generally more active during the rut. Antlerless elk are typically more vulnerable after the rut in early winter (Mohler and Toweill 1982), when there is usually snow cover to concentrate animals in wintering areas, facilitate tracking, and increase elk visibility. Elk hunters will be able to use any weapon that is legal for deer hunting including rifle, shotgun, handgun, muzzleloader, or bow.

Elk hunting zones would be established to direct the harvest of elk numbers in different areas according to population goals. The buffer range would have lower goals, and therefore higher harvest rates, than the core range. Buffer and core ranges could roughly be used as hunting zones, which could be split into additional zones if finer spatial resolution was necessary to reduce or protect elk in specific areas. Finer-scale hunting zones cannot be established until we know more about how the herd will distribute itself on the landscape as it increases.

Harvest goals will be larger with Alternatives #1 and #2 than for #3, providing more hunting opportunity for tribal and non-tribal members. Accordingly, hunting season frameworks would be more complex, requiring more supporting legislation. Administrative costs for hunting seasons would be higher as well, although they may be offset by greater revenue.

Habitat Management

Much of the elk range is currently designated for pulp production, with a considerable amount of young aspen. Literature review indicates that this is an important habitat component for elk. A rigorous analysis of seasonal habitat selection by the Clam Lake elk will be available early in 2000 (J. Schmidt, personal communication), but right now we don't know how essential young aspen stands are for elk in the CNF-GDD. Because much of the designated elk range is owned by the USFS, including virtually the entire core range, that agency would have ultimate authority over habitat management projects. The USFS is currently revising their 10-15 year forest management plan for the CNF, which is scheduled to be released for public comment in fall of 2000. Timber management alternatives being considered range from maintaining current harvest levels to those that could substantially reduce harvest levels, including aspen clearcutting (B. Paulson, personal communication). Current management of the CNF-GDD is apparently highly compatible with elk. Reduced aspen management would mean an eventual decrease in aspen cover types. It is therefore possible that the long-term suitability of the CNF-GDD for elk could decline if reduced aspen cutting alternatives are selected for the revised management plan. Although habitat management decisions will be made by the USFS, the Department recommends maintaining current levels of aspen in the core range through continued harvest of timber, but without converting other cover types to aspen solely to increase habitat quality for elk. No special habitat management considerations for elk outside of the core range are recommended.

Given the potential for impacts on elk from roads and motor vehicle users, elk habitat management strategies must address these issues. At the present time, the Department does not recommend additional restrictions on motor vehicle or other recreational uses in the CNF-GDD for elk management purposes, because there is currently no biological justification for them. If serious negative impacts on elk from motor vehicles or other recreational users in the core elk range become apparent in the future, the Department may recommend additional restrictions. These recommendations could include seasonally closing areas to motor vehicle use, re-routing snowmobile, ATV, and/or ski trails, or routing any new snowmobile, ATV, and/or ski trails to protect important elk habitat within the core elk range. Several highways regulated by the state and counties pass through the CNF-GDD. Many of the major forest roads are jointly managed by the USFS and local townships. Authority for regulating motor vehicle traffic on all other roads in the CNF-GDD is with the USFS. Most areas in the CNF-GDD are open to motorized vehicle use, although the draft 10-year forest plan being developed by the USFS includes alternatives that would restrict motor vehicle use much more than current regulations. Any decisions to regulate motor vehicle or other recreational uses to protect elk within the core elk range would

have to be made and implemented by the USFS with the support of the Department.

Crop Damage Response Protocol

In the area outside the core and buffer ranges, elk will be tolerated if they are not causing damage or exhibiting nuisance behavior. As described earlier in this document, elk outside of the core and buffer ranges will be subject to liberal harvest regulations. In the designated elk range before the population becomes large enough to initiate public hunting, hazing and/or relocation will first be attempted. A variety of exclusion techniques could also be used. Electric fences have been successfully used by Michigan and Pennsylvania (Parker 1991). However, effective exclusion devises such as electric fencing are typically expensive to implement. There will likely not be sufficient funding to implement exclusion techniques. Therefore, the Department does not plan to use them. If hazing and relocation efforts fail, the offending animals may be killed. Once the population becomes large enough that public hunting is initiated, additional elk hunting permits will be issued for areas where elk are causing crop damage. Shooting permits may also be issued to landowners experiencing crop damage if their complaints have been investigated and approved by Department personnel.

The Department prefers to implement a crop damage compensation program for elk similar to that which exists for deer. However, elk would have to be added to the Wildlife Damage Abatement and Claims Program (WDACP) by the state legislature. This program is entirely funded from hunting license revenue, and there is currently no elk season. As was recently the case with sandhill cranes, neither the public nor the Department would support adding elk to the WDACP until a season is opened on them. Hunters should not have to pay for damage caused by species that are not hunted. The Department will pursue legislation adding elk to the WDACP and earmarking $0.50/elk permit application for the fund. This is part of the reason for initiating an elk hunting season as soon as it becomes biologically feasible. Until this is accomplished, crop damage complaints will be minimized by prompt management action on animals in agricultural areas using the techniques described above.

Crop damage programs would differ among the 3 alternatives. Alternative #3 would require a minimal crop damage program. Elk would be restricted to the core range at low levels. The chances of crop damage problems developing would be slight. If they did develop, aggressive lethal management techniques would be implemented. Alternatives #1 and #2 would involve the more expensive and complicated programs described above including hazing, relocation, damage permit allocation, and crop damage payments.

Habituation Response Protocol

Habituation of elk will definitely be an issue if the Clam Lake herd is allowed to remain. Preventative action will be taken to decrease the chances of habituated nuisance elk problems from developing. Informational materials will be prepared to inform the public of the possible negative effects of habituation, and how to avoid them. These materials will be posted at wildlife viewing areas and elsewhere throughout the CNF-GDD, natural resource agency offices, and local businesses. The Department recommends prohibiting artificial feeding and baiting of elk in the core, buffer, and X-zones.

More habituated elk problems could be expected with Alternatives #1 and #2 than for #3, because elk would be more numerous. Prompt action for managing habituated nuisance elk will be important with any of the

Alternatives. Department personnel will monitor elk that are exhibiting habituated nuisance behavior, and take management action if needed. Examples of nuisance behavior requiring management action would include habituated elk lingering near residential areas where they are damaging trees and posing a safety concern for people or their pets, or those near roads or trails where they present a hazard to motor vehicle users. Management techniques will be more aggressive with Alternative #3 than for Alternatives #1 and #2. Lethal control will primarily be used under Alternative #3 to minimize costs and effort for management. More consideration for non-lethal techniques will be given to habituated elk in the designated elk range under Alternatives #1 and #2, because maintaining the population at or near goals would be high priority. Hazing by agency personnel may be used to disperse habituated elk from areas where they are in conflict with people in some cases. However, hazing was successful in only 3 of 6 attempts by the UW-SP research team (Anderson 1999) and will therefore not be a primary solution for habituated elk problems. Habituated elk displaying nuisance behavior near areas with high human usage or major roadways will first be relocated to the core range if Department personnel are able to capture the animal(s). Nuisance elk not captured after reasonable effort has been made or those that have been relocated once and continue to exhibit habituated nuisance behavior will be killed. These carcasses may be donated to food pantries. Reducing elk densities may also help reduce habituation problems by decreasing intraspecific competition (Thompson and Henderson 1998). The Department will reduce elk densities in areas surrounding those where problems have developed through allocation of hunting permits.

Disease Issues

Much concern exists about the possibility of disease transmission between elk and livestock. The risks of disease transmission from wild elk to livestock, or vice versa, are different among the 3 alternatives. The greatest risk of disease transmission would be expected with Alternative #2. Bringing animals into Wisconsin from other regions of the country includes a risk that diseased animals could be brought in. Michigan, which is a likely source for future elk stocking efforts, has experienced a bovine tuberculosis outbreak in its deer herd within the area also occupied by elk. However, Michigan's elk population is likely the most thoroughly bovine tuberculosis-screened elk population in North America, and the disease has not been detected. Alternative #1 would have a low risk of disease transmission, because no additional animals would be brought in. However, elk would be at higher densities than with Alternative #3, thereby increasing both the potential for contact with livestock allowing disease transmission and possible spread of disease through the elk population if a disease were introduced. As we have already described, this risk could be minimized using appropriate management strategies to prevent elk occupation of agricultural areas where they may contact livestock. Alternative #3 would have the lowest risk of disease transmission, because elk would be at low densities in a very restricted area.

Risk of disease transmission can be minimized. First, additional elk brought into the state for release will be tested using a protocol developed by DNR wildlife health specialists, incorporating Wisconsin Department of Agriculture, Trade, and Consumer Protection (WDATCP) requirements to ensure they are free of brucellosis, bovine tuberculosis, anaplasmosis, BT, bovine virus diarrhea, and leptospirosis. Whenever possible, elk captured for management purposes will be examined for signs of ill health and tested for a variety of diseases, including bovine tuberculosis. Second, management strategies will be developed to maintain spatial separation of free-ranging elk and livestock. The boundaries of the elk range were designed to exclude agricultural operations, so there are very few livestock within the designated elk range. Elk may wander outside of the

designated range where they could contact livestock. However, elk will not be tolerated in these areas, and they will be removed when in close association with livestock.

Brainworm can affect elk populations. Because white-tailed deer and terrestrial snails occupy the CNF-GDD, it is likely that some elk will succumb to it. However, based on data from populations in Michigan and Pennsylvania, it will probably not be a major limiting factor for the Clam Lake herd. The only management action that could decrease the impact of brainworm would be to reduce deer densities, thereby inhibiting transmission of the parasite to elk. Because of the cultural and economic importance of deer in Wisconsin, the department may not attempt to reduce deer densities to accommodate elk.

Elk Ranching Policy

Elk and red deer (the European counterpart to the North American elk, classified as the same species) ranching is a growing industry in Wisconsin. They are raised for sale of meat, antlers, breeding stock, and trophy hunting. There are currently 191 elk/red deer ranches in the state. Concern has been expressed by elk ranchers about the potential effects of reintroducing wild elk populations to Wisconsin on the elk ranching industry. Elk ranchers fear that the state may place additional regulations on their operations to protect wild elk, or that wild elk transported into the state could transmit disease to their captive herds. Bovine tuberculosis has been diagnosed in captive elk in Wisconsin, so the possibility of disease transmission from captive elk to wild elk populations is also a definite concern. Captive elk are subject to disease testing requirements to minimize the risk of disease transmission. A health certificate showing that all animals have tested negative for bovine tuberculosis and brucellosis is required for interstate transfer of farm-raised deer, including captive elk (Wisconsin Statute 95.49). The Wisconsin Department of Agriculture, Trade, and Consumer Protection has the authority to at any time test farm-raised deer for bovine tuberculosis (Wisconsin Statute 95.25) or brucellosis (Wisconsin Statute 95.26). Four captive elk or red deer herds in Wisconsin have been depopulated due to infection with tuberculosis (O'Connor, personal communication). Animals unknowingly affected by a disease, such as CWD for which there is no live-animal test, could be transported into the state. If such animals escaped from captivity or otherwise mixed with wild elk populations, disease could be transmitted to those wild populations.

Captive animals sometimes escape from fenced areas. Under Wisconsin Statute 29.875, the state has the authority to seize or dispose of any escaped farm-raised deer if it has traveled >3 miles or if it has not been returned to captivity within 72 hours. However, state law does not require the licensee to report escaped farm-raised deer. Both captive elk and red deer have escaped in Wisconsin, although comprehensive records do not exist and the magnitude of the problem is unknown (O'Connor, personal communication). Escaped animals frequently cannot be recaptured. Escaped animals could mix with wild elk, potentially transmitting disease or introducing unwanted genetics (especially red deer) into wild populations.

In Wisconsin, all keepers of captive elk or other cervids must have a license from DATCP. The Department has no authority to regulate elk ranches. There are currently no elk ranches within the designated range for the Clam Lake herd. Because of the potential negative impacts of mixing among wild and captive elk, the Department recommends that no new elk ranches be licensed within the designated Clam Lake elk range, regardless of which Alternative is selected.

Protection

Because poaching and accidental shootings have been a problem with virtually all eastern elk reintroductions, it is clear that an effective protection program integrating law enforcement, education, and stiff penalties must be developed. This approach has been used successfully by Michigan since the mid-1970's to reduce illegal killings (Parker 1990). Presently, the Clam Lake herd is small with many intensively monitored radio-collared animals, which probably discourages poaching attempts. Wisconsin statutes have already been amended to increase penalties for illegal killing of elk. Elk are now legally classified as game animals with a closed season. Penalties for illegal killing of elk include fines of $1,000-$2,000 and mandatory revocation of hunting privileges for 3-5 years (Wisconsin Statute 29.971.3m). If the herd is allowed to remain and expand, additional law enforcement presence on the elk range will become necessary. The Department estimates that within the next several years, elk-related law enforcement duties for area wardens will require funding equivalent to a 0.5 FTE position. This money would have to come from law enforcement budgets separate from existing elk project accounts. It may also be possible to establish a law enforcement partnership with the Great Lakes Indian Fish and Wildlife Commission (GLIFWC), which has 30-35 conservation officers patrolling off-reservation on the ceded territories of the three lake states. Several officers were recently cross-deputized in Wisconsin. GLIFWC conservation officers were empowered to enforce State fish and game laws off-reservation within the ceded territory, and State conservation officers were empowered to enforce Chippewa codes off-reservation.

In the fall of 1995, public education and awareness efforts to prevent accidental shooting of elk by deer hunters were begun (Anderson 1999). Brochures describing differences between elk and deer were distributed. This information was also released for publication to the media, including local and state newspapers and outdoor publications. Deer hunting camps located near areas occupied by elk were contacted by USFS and research personnel to warn hunters that elk were present. There has been only 1 known accidental shooting of an elk since the Clam Lake herd was released, indicating that this program has been successful. Public education would continue to be an important part of the elk protection program to minimize accidental shooting

Alternatives #1 and #2 would require greater effort and expense for elk protection. A larger elk population would mean increased potential for illegal killing of elk and more extensive elk hunting seasons requiring greater law enforcement presence. Public education and awareness needs would also be greater. Under Alternative #3, elk protection programs would be low priority, with minimal effort and expense applied.

Predator Management

The CNF-GDD contains high densities of potential elk predators, with black bears the most numerous. Bears are able to prey only on calves within the first few weeks of life. Wolves are also present on the CNF-GDD, and are more effective predators potentially able to kill both calves and adults. Where elk and deer are both present, wolves usually select deer (Mech 1970, Kunkel et al. 1999) because they are smaller and more vulnerable. On rare occasions, coyotes have been known to kill elk (usually calves) (Taber et al. 1982), although they are not considered a major predator of elk. Predation has been of low significance to the Clam Lake herd, and is not expected to seriously limit future elk abundance. We expect that a percentage of the annual increment to the herd will be taken by predators. In the September 1999 public meetings, some attendees were concerned that those opposed to predators would use elk reintroduction as a reason to promote predator reduction policies. Black bear populations could be reduced by increasing the harvest rate. Wolves are listed under both the state

and federal Endangered Species Act. They would have to be delisted before control efforts could even be considered.

A predator reduction policy to boost elk population growth is not biologically necessary and would be unacceptable to many people. The Department will not implement predator control to support elk populations. There will be no differences in predator management among the Alternatives.

Herd Expansion Protocol

Management alternative #2, which is not the Department's preferred alternative, includes stocking the Clam Lake herd with additional elk. Several reasons exist for opposing stocking additional elk. It would increase the risk of introducing disease to the Clam Lake herd. The cost of a stocking operation would divert resources needed for monitoring of the Clam Lake herd. Stocking would also complicate efforts to monitor impacts on other resources in the CNF-GDD. However, if the decision is made to augment the Clam Lake herd with additional elk, the Department must have a protocol for capturing, transporting, and releasing wild elk into the state. The following section describes capture and release procedures that would be used.

Source herd selection

If the decision is made to import more elk into the state for release at Clam Lake, a source herd would have to be selected. Selection of a source herd would be based on availability of elk, logistics, source habitat, availability of 90-day quarantine facilities, and their status relative to several important diseases. Michigan elk were selected as the source herd for the Clam Lake release in 1995 because of similarity in climate, habitat, recreational uses, and timber management between Michigan's elk range and the CNF-GDD, low cost (all animals were donated), ease of logistics, presence of quarantine facilities, and disease-free status of the herd (Anderson 1999). Michigan DNR has indicated that additional elk might be available for capture and relocation to Wisconsin in the future. Michigan would probably continue to be the best source for additional stocking of elk in Wisconsin. However, Michigan's elk herd is currently near population goals. The number of elk available probably would not exceed 25-50 animals. The primary concern with using Michigan elk would be the potentially low genetic diversity among these animals. Michigan's elk are all descended from 7 animals released in 1918 and may lack genetic diversity, although genetic problems have not been noted. If this was determined to be a problem, animals could be captured from a different population and released on the CNF-GDD. However, there are currently no other potential source herds that satisfy the requirements listed above. With the spread of chronic wasting disease in captive and wild elk populations in many western states, potential sources such as South Dakota's Wind Cave National Park would be risky. The Department feels that the risk of releasing animals infected with testable diseases like tuberculosis is much less than the risk associated with releasing animals potentially infected with untestable diseases like CWD.

Capture

Before trapping of could elk begin, a Memorandum of Understanding between the source and WDNR would be signed which specified the agencies' responsibilities for the project. Responsibilities of the WI DNR under such an agreement would include securing adequate funding, arranging quarantine facilities, disease testing, obtaining a certificate of veterinary inspection and premovement permit number from WDATCP for shipment

of elk, and notifying WDATCP Division of Animal Health of intent to import elk ≤5 days before transport. Collecting permits would also be obtained from MDNR. The permit granted by MDNR to UW-SP to capture, handle, tranquilize, and transport elk restricted trapping to private land unavailable to the public for hunting, during January (after the elk season) to minimize impacts of a capture operation on elk hunters. Elk known to have caused damage or nuisance could not be trapped for transport to Wisconsin (Anderson 1999). Such conditions would probably apply for future capture operations, as well. After permits were obtained, WDNR would be given a list of private landowners for potential trapping sites. Permission would be obtained from landowners for WDNR to trap at 1 or more of these sites. Portable single-entry traps with guillotine doors would be used to trap elk. Trapped elk would be sorted until the desired sex-age composition was obtained. A sex ratio skewed towards cows would be chosen because they may be less likely to stray from the release area, and to increase population growth rates (Parker 1991). A balanced age structure would also be sought to avoid potential problems associated with a clumped distribution.

Quarantine

After capture, elk would be transported to a quarantine facility and held for 90 days. Facilities at a nearby elk ranch were used for the original Clam Lake release (Anderson 1999). Elk would be isolated from all other bovids and cervids for 90 days, during which time 2 rounds of disease testing would occurr. Tests for bovine tuberculosis, brucellosis, paratuberculosis, leptospirosis, salmonella, bovine virus diarrhea, EHD, BT, anaplasmosis, and bovine adenovirus would be conducted at the beginning and end of the quarantine period. Positive tests from any animal for exposure to tuberculosis, brucellosis, anaplasmosis, or BT would prevent the entire herd from being transported to Wisconsin. Elk would also be treated for internal and external parasites. During the second round of testing, elk would be fitted with radio-collars and ear tags denoting that they had been disease tested. Blood samples would also be collected for DNA analysis and pregnancy tests. If disease tests were negative, a stocking permit would be issued by WDNR to allow transport and release of the elk in Wisconsin.

Transport

Elk would be transported from the quarantine area at the source site to the acclimation pen in the CNF-GDD using livestock trailers (Anderson 1999). Antlers would be sawed off of adult bulls, and they would be separated with compartments to prevent them from injuring each other. Cows and yearling bulls would be transported separately from calves.

Acclimation

After transport, the elk would be unloaded into an acclimation pen, where they would spend 2 weeks. The purpose of a “soft release” would be to give the animals time to recover in a controlled environment from the stress of capture, testing, and transport. Soft releases also help animals acclimate to their new environment, thereby decreasing the chances of them immediately straying far from the release area (Parsons 1998). The release pen used for the original Clam Lake release is still present, and would be used for future stocking efforts as well. Baled hay would be fed to elk in the pen each day. After 2 weeks, the pen doors would be opened to allow elk to exit. Release would occur around mid-May to coincide with spring green-up, so that animals would find optimal forage conditions in close proximity to the pen.

EVALUATION OF PROJECT SIGNIFICANCE

Social and economic benefits are expected to result from the establishment of an elk population in the Clam Lake area. These benefits would be greatest under Alternatives #1 and #2. However, these alternatives would also involve the greatest effort and cost for management and monitoring, in addition to greater chances of problems with elk developing. All of the alternatives will require long-term commitment of resources for elk management.

There is currently a high level of interest in establishing elk herds in other areas of Wisconsin. The release of elk into the CNF-GDD will set precedence for this. Many of the same methods used to establish and manage the Clam Lake herd would be directly applicable elsewhere in the state as well. For example, elk herds established in other areas would also be restricted to designated ranges, and would not be tolerated outside of those areas. However, it is unlikely that the precedence set by the Clam Lake reintroduction would affect reintroductions of other species in the state.

The potential for cumulative economic and ecological effects resulting from the long-term establishment of an elk population in the Clam Lake area are minimal. There could be some cumulative effects on native vegetation with Alternatives #1 and #2 resulting from elk and deer herbivory. Habitat monitoring and elk population management strategies described in this document will be implemented to minimize such impacts. No cumulative effects would be expected with Alternative #3.

LITERATURE CITED

Adams, Arthur W. 1982. Migration. Pages 301-321 *in* J. W. Thomas and D. E. Toweill, editors. Elk of North America: ecology and management. Stackpole Books, Harrisburg,PA.

Alverson, W. S., D. M. Waller, and S. L. Solheim. 1988. Forests too deer: edge effects in Northern Wisconsin. Conservation Biology 2:348-358.

Anderson, E. W., and R. J. Scherzinger. 1975. Improving quality of winter forage for elk by cattle grazing. Journal of Range Management 28:120-125.

Anderson, S. C. 1999. Experimental elk reintroduction in northern Wisconsin: planning and initial results. M.S. Thesis, Univ. Wis- Stevens Point, Stevens Point, WI. 103 pp.

Aune, K. 1981. Impacts of winter recreationists on wildlife in a portion of Yellowstone National Park, WY. Thesis, Montana State University, Bozeman, Montana.

Bangs, E. E., S Fritts, J. Fontaine, D. Smith, K. Murphy, C. Mack, and C. Niemeyer. Status of gray wolf restoration in Montana, Idaho, Wyoming. Wildlife Society Bulletin 26:785-798.

Beall, R. C. 1976. Elk habitat selection in relation to thermal radiation. Pages 97-100 *in* E. R. Hieb editor. Proc. Elk-logging Roads Symp., Univ. Idaho, Moscow, ID.

Beyer, Dean E., Jr. 1987. Population and Habitat Management of Elk in Michigan. Dissertation, Michigan State Univ., Dept. of Fisheries and Wildlife. 148 pp.

Blood, D. A. 1966. Range relationships of elk and cattle in Riding Mountain National Park, Manitoba. Wildlife Manage. Bull. 1(19). Can. Wildl. Serv. Ottawa, Quebec, Canada. 62 pp.

Blouch, R. I. 1984. Whitetail population and habitats in the northern Great Lakes and Ontario forests. Pages 391-410 *in* L. K. Halls, editor. White-tailed deer: ecology and management. Stackpole Books, Harrisburg, PA.

Campa, Henry III. 1989. Effects of deer and elk browsing on aspen regeneration and nutritional qualities in Michigan. PhD Dissertation, Michigan State Univ., Dept. of Fisheries and Wildlife. 122 pp.

Campa, Henry III, Jonathan B. Haufler, and Dean E. Beyer, Jr. 1992. Effects of simulated ungulate browsing on aspen characteristics and nutritional qualities. Journal of Wildlife Management 56:158-164.

Cassirer, F. E., D. J. Freddy, and E. A. Ables. 1992. Elk responses to disturbance by cross-country skiers in Yellowstone National Park. Wildlife Society Bulletin 20:375-381.

Christensen, A. G., L. J. Lyon, and J. W. Unsworth. 1993. Elk Management in the Northern Region: Considerations in Forest Plan Updates or Revisions. General Technical Report INT-303. Ogden, UT: USDA-FS, Intermountain Research Station. 10 pp.

Clark, W. 1999. Effects of winter recreation on elk. Pages 17-29 *in* T. Oliff, K. Legg, and K. Baeding, editors. Effects of winter recreation on wildlife of the Greater Yellowstone Area: a literature review and assessment. Report to the Greater Yellowstone Coordinating Committee. Yellowstone National Park, WY. 315 pages.

Cogan, R. D., and D. R. Diefenbach. 1998. Effect of undercounting and model selection on a sightability-adjustment estimator for elk. Journal of Wildlife Management 62:269-279.

Davidson, William R., and Victor F. Nettles. 1997. Field manual of wildlife diseases in the southeastern United States, 2nd edition. Southeastern Cooperative Wildlife Disease Study. University of Georgia. Athens, GA. 417 pp.

Davis, A., Puettman, K., and Perala, D. 1998. Site preparation treatments and browse protection affect establishment and growth of northern white-cedar. Res. Pap. NC-330. St. Paul, MN: USDA, Forest Service North Central Forest Experiment Station. 9 pp.

de Calesta, David S. 1983. Elk. Pages 35-44 *in* Prevention and control of wildlife damage. Instit. of Agric. & Nat. Res., Univ. of Nebraska, Lincoln.

Devlin, Daniel and W. M. Tzilkolwski. 1986. Grass use by elk and white-tailed deer in Pennsylvania: habitat

management. Proceedings of the Pennsylvania Academy of Science, 60:51-54.

Eberhardt, L. L. 1969. Population analysis. Pages 457-495 *in* Robert H.Giles, Jr., editor. Wildlife Management Techniques, third edition. Edward Bothers, Inc. Ann Arbor, MI.

Eberhardt, L. L., R. A.Garrott, P. J. White, and P. J. Gogan. 1998. Alternative approaches to aerial censusing of elk. Journal of Wildlife Management 62:1046-1055.

Eberhardt, L. E., L. L. Eberhardt, B. L. Tiller, and L. L. Caldwell. 1996. Growth of an isolated elk population. Journal of Wildlife Management 60:369-373.

Edge, Daniel and Les Marcum. 1985. Movements of elk in relation to logging disturbances. J. Wildlife Mgt. 49:926-930.

Ferguson, M. A. and Lloyd B. Keith. 1982. Influence of nordic skiing on distribution of moose and elk in Elk Island National Park, Alberta. Canadian Field Naturalist. Vol. 96:69-78.

Geist, Valerius. 1982. Adaptive behavioral strategies. Pages 219-277 *in* J. W.Thomas and D. E. Toweill, editors. Elk of North America: ecology and management. Stackpole Books, Harrisburg,PA.

Gieck, C. M. 1986. Pine marten recovery plan. Wisconsin Department of Natural Resources. 33 pp.

Gogan, Peter J. 1990. Considerations in the reintroduction of Native Mammalian Species to Restore Natural Ecosystems. Natural Areas Journal 10:210-217.

Haigh, J. C., and R. J. Hudson. 1993. Farming Wapiti and Red Deer. Mosby-Year Book, Inc., St. Louis, MO.

Hickenbottom, J. R., B. Summerfield, J. Aardahl, G. Halekas, M. Hilliard, L. Jackson, D. Prevedel, and J. Rupe. 1999. Biological assessment of the effects of National Forest Land and Resource Management Plans and Bureau of Land Management Land Use Plans on Canada lynx. USDA Forest Service 149 pp.

Houston, D. B. 1982. The northern Yellowstone elk herd. MacMillan, New York, New York.

Hunter, Nick, John George and Daniel Devlin. 1979. Herbivore-woody plant relationships on a Pennsylvania clearcut. Pages 145-151 *in* M.S. Boyce and L.D Hayden-Wing, editors. North American Elk: Ecology, Behavior and Management. University of Wyoming, Laramie, Wyoming. 294 p.

Irwin, Larry and James Peek. 1976. Habitat use relative to forest succession in Idaho. J. Wild. Manage. 47:664-672.

Jackson, H. 1961. Mammals of Wisconsin. The University of Wisconsin Press, Madison, WI. 504 pp.

Kistner, T. P., Kenneth R. Greer, David E. Worley, and Oscar 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, PA.

Kohn, B. E., and R. G. Eckstein. 1985. Research report: status of pine marten in Wisconsin. Wisconsin Department of Natural Resources. 18 pp.

Kunkel, K. E., T. K. Ruth, D. H. Pletscher, and M. G. Hornocker. 1999. Winter prey selection by wolves and cougars in Glacier National Park, Montana. Journal of Wildlife Management 63:901-910.

Leege, T. A. and W. O. Hickey. 1977. Elk-snow-habitat relationships in the Pete King drainage, Idaho. Wildl. Bull. No. 6. Boise: Idaho Dep. Fish and Game. 23 pp.

Leighton, Douglas. 1988. Helping the animals cross the road with fences and underpasses. Can. Geographic. 108:22-28.

Lizotte, T. 1998. Productivity, survivorship, and winter feeding ecology of an experimentally reintroduced elk herd in northern Wisconsin. M.S. Thesis, Univ. Wis-Stevens Point, Stevens Point, WI 110 pp.

Lyons, Jack. 1983. Road density models describing habitat effectiveness for elk. J. Forestry 81:592-595.

Martin, Mark. 1995. Pages 13-22 *in* William Vander Zouwen and Keith Warnke, editors. Deer population goals and harvest management environmental assessment. Wisconsin Department of Natural Resources. 305 pp.

Mautz, W. W. 1978. Nutrition and carrying capacity. Pages 321-348 *in* J. L. Schmidt and D. L. Gilbert, editors. Big Game of North America: ecology and management. Stackpole Books, Harrisburg, PA.

Mech, L. D. 1970. The wolf: ecology and behavior of an endangered species. Natural History Press, New York. 384 pp.

Michigan Department of Natural Resources. 1984. Elk Management Plan.

Mladenoff, David L., Theodore A. Sickley, Robert G. Haight, and Adrian P.Wydeven. 1995. A regional landscape analysis and prediction of favorable gray wolf habitat in the Northern Great Lakes Region. Conservation Biology 9:279-294.

Mohler, Levi. L. and Toweill, Dale. E. 1982. Regulated elk populations and hunter harvests. Pages 561- 597 *in* J. W. Thomas and D. E. Toweill, editors. Elk of North America: ecology and management. Stackpole Books, Harrisburg, PA.

Moran, Richard J. 1973. The Rocky Mountain elk in Michigan. Res. Dev. Rep. 267, Mich. Dept. of Natural Resources, Lansing, MI. 93 pp.

Nelson, Jack R. 1982. Relationships of elk and other large herbivores. Pages 415-441 *in* J. W. Thomas and D. E. Toweill, editors. Elk of North America: ecology and management. Stackpole Books, Harrisburg, PA.

Overton, W. S., and David E. Davis. 1969. Estimating the numbers of animals in wildlife populations. Pages 403-455 *in* Robert H. Giles, Jr., editor. Wildlife Management Techniques, third edition. Edward Bothers, Inc. Ann Arbor, MI.

Parker, L. R. 1990. Feasibility assessment for the reintroduction of American elk, moose and caribou into Wisconsin. Wisconsin DNR, Madison. 86 pp.

Parker, L. R. 1991. Management plan for the proposed reintroduction of elk into the Bayfield Count Peninsula, northern Wisconsin. Wisconsin DNR, Madison. 91 pp.

Parsons, Davis R. 1998. "Green fire" returns to the Southwest: reintroduction of the Mexican wolf. Wildlife Society Bulletin 26:799-807.

Reinhart, D. 1999. Effects of winter recreation on habituated wildlife. Pages 151-154 *in* T. Oliff, K. Legg, and K. Baeding, editors. Effects of winter recreation on wildlife of the Greater Yellowstone Area: a literature review and assessment. Report to the Greater Yellowstone Coordinating Committee. Yellowstone National Park, WY. 315 pages.

Schultz, Richard D. and James Bailey. 1978. Responses of National Park elk to human activity. Journal of Wildlife Management 42:91-100.

Schorger, A. W. 1954. The elk in early Wisconsin. Wisconsin Academy of Sciences, Arts and Letters, 43:5-23.

Shapton, W. 1940. Report of an elk survey in the Pigeon River State Forest during the deer hunting season, 1939. Michigan Department of Conservation. Game Report No. 498. 15 pp.

Speigel, L. E., C. H. Huntly, and G.R. Gerber. 1963. A study of the effects of elk browsing on woody plant succession in northern Michigan. The Jack Pine Warbler 41:68-72.

Taber, R. D., K. Raedeke, and D. A. McCaughran. 1982. Population characteristics. Pages 279-298 *in* J. W. Thomas and D. E. Toweill, editors. Elk of North America: ecology and management. Stackpole Books, Harrisburg, PA.

Thompson. Michael J., and Robert E. Henderson. 1998. Elk habituation as a credibility challenge for wildlife professionals. Wildlife Society Bulletin 26:477-483.

United States Forest Service. 1994. Elk research study environmental assessment. USDA-FS, Chequamegon National Forest, Glidden Ranger District.

United States Forest Service. 1986. Final Environmental Impact Statement: Chequamegon National Forest Land and Resource Management Plan. United States Department of Agriculture – Forest Service – Eastern Region.

United States Department of the Interior. 1999. Winter use plans draft environmental impact statement for the Yellowstone and Grand Teton National Parks and John D. Rockefeller Jr. Memorial Parkway. National Park Service, Yellowstone National Park, WY.

United States Department of the Interior. 1998. Draft Environmental Impact Statement for the interagency bison management plan for the state of Montana and Yellowstone National Park. NPS D-655.

Winkler, Charles. 1989. Rocky Mountain elk food habits and interrelation ships with other large herbivores. Unpublished Report.

Witmer, G. W. and R. Cogan. 1989. Elk and crop damage in Pennsylvania. Pages 220-224 *in* S. Craven, ed. 4th Eastern Wildlife Damage Control Conference Proceedings, University of Wisconsin, Madison, Wisconsin.

Wydeven, Adrian P., and Jane E. Wiedenhoeft. 1999. Gray Wolf Population, 1998-1999. Wisconsin Wildlife Surveys 9:133-140.

APPENDIX A – Estimated costs and revenues for management and monitoring of the Clam Lake elk herd, and establishment of elk herds elsewhere in the state.

Table 2. Estimated annual expenses for management and monitoring of the Clam Lake elk herd with Alternative #1 and establishment of elk herds elsewhere in the state during fiscal years 2000-2002. Law enforcement expenses will be drawn from law enforcement accounts separate from existing elk project money.

	Dollars			
Expense	2000	2001	2002	Total
Salaries	55,910	64,155	94,155	214,220
Meals, Lodging, Personal Miles	3,205	3,205	3,205	9,615
State Vehicle Mileage	12,700	12,700	15,700	41,100
Equipment	6,900	21,500	25,500	53,900
Capture and Collaring	9,500	12,000	12,000	33,500
Flight Time	1,375	1,375	5,375	8,125
Law Enforcement	0	27,600	27,600	55,200
Herd Establishment	0	57,465	66,465	123,930
Total	89,590	200,000	250,000	539,590

Table 3. Estimated revenue from recreational elk hunting by non-Indians in Wisconsin, based on an annual harvest of 13% of the herd and a projection of 200 applications ($4.00/application) for every permit ($100.00/permit) available. Population goals of options 1, 2, and 3 are 250, 200, and 450 animals, respectively. The projected harvest by non-Indians would be 16, 13, and 29 for options 1, 2, and 3, respectively.

Source	Revenue		
	Option 1	Option 2	Option 3
License applications	$12,800	$10,400	$23,200
License sales	$1,600	$1,300	$2,900
Total	$14,400	$11,700	$26,100

APPENDIX B – Public Comments and Department Responses to the *Draft Management Plan and Environmental Assessment for the Clam Lake Elk Herd* and *Draft Wisconsin Elk Herd Establishment Protocol*

As a part of the Environmental Assessment process, the Draft Management Plan and Environmental Assessment for the Clam Lake Elk Herd and the Draft Wisconsin Elk Herd Establishment Protocol were released for public review in February 2000. The public comment period began on February 21 and concluded on March 20. Public meetings were held in Hayward, Stevens Point, and Waukesha to describe the documents to interested citizens and hear their concerns with them. Fifty-one citizens attended these meetings, all in support of elk re-establishment in Wisconsin. Twenty-six comments were also collected through mail and e-mail. Twenty of these comments were general expressions of support for elk re-introduction; 3 were general comments of opposition, and 3 offered suggestions for edits to the draft documents. Of the comments favoring elk restoration, 8 were general comments in favor of elk restoration but not specifically supporting any one of the alternatives; 4 were in support of Alternative 1 (natural expansion of the Clam Lake herd); 3 were in support of Alternative 2 (supplemented expansion of the Clam Lake herd); 2 were in support of the preferred alternative and favored establishing elk herds elsewhere in the state; and 3 were in support of establishing additional elk herds in the state along with expansion of the Clam Lake herd in a non-specified manner.

Specific comments received about the documents are summarized below.

Dale Olson, Sawyer County Conservationist – He thought that in addition to Department personnel, authorized county or USDA - Animal and Plant Health Inspection Service (APHIS) agents could also verify crop damage complaints.

Department Response: We agree, and language has been changed to clarify this point.

He thought that the Department should pay 100% of agricultural damage including destruction of crops or fences and loss of livestock caused by elk prior to establishment of hunting.

Department Response: There is no precedent for such a policy in Wisconsin, and the Department does not wish to establish one. Crop damage reimbursements are only made for those species on the WDCAP list, all of which are game species with open hunting seasons in the state. As the management plan/EA points out, this program is entirely funded by revenue from hunting license sales. The Department feels that hunters should not have to pay for damage caused by species without an open hunting season in the state, including elk. Additionally, alternate funding sources for paying crop damage claims for elk are unavailable.

Jean H. O'Neil, Menomonie, WI – She thought that since elk are expanding as rapidly as the state's deer herd, they will soon become a major traffic hazard for motorists. The designated area would also soon be unable to support elk, and they would do untold damage to agricultural lands as they moved about in search of food.

Department Response: As the management plan/EA points out, the demography of elk populations differs from white-tailed deer populations. Deer are capable of much higher rates of population increase. Therefore, the elk population will not expand as quickly as she thinks it might. The management plan/EA also recognizes the problems that likely would be caused by an elk population allowed to expand indefinitely, including elk-vehicle collisions and agricultural crop damage. Provisions were included in it to regulate both the size of the elk population and the area inhabited by elk in the Clam Lake region, primarily through public hunting. Additionally, we propose adding elk to the list of species on the

WDCAP list after a hunting season is initiated. Farmers could then be compensated for verified crop damage caused by elk. We have a great deal of confidence that while the risk of elk-vehicle collisions or crop damage from elk cannot be eliminated, these problems would be minimized by the implementation of the management strategies outlined in the management plan/EA.

Richard R. Hogue, Clam Lake, WI – He owns and lives on 240 acres of land inside the core elk range, and is adamantly opposed to the Clam Lake elk reintroduction. He believes that the deer population on private and public land in the area of his property and throughout northern Wisconsin is out of control, and is wiping out forest shrubs, flowers, and other herbaceous species, and preventing the regeneration of many tree species (especially NWC). He believes that the Department has not adequately addressed this issue before reintroducing elk, and that elk will make all of these problems worse. He blames the Thompson Administration, the State of Wisconsin Legislature, the UW-SP research team, the USFS, and the Department for not conducting a 4-year Environmental Impact Study (EIS) before releasing the elk in 1995. He feels that the management plan/EA is not satisfactory, and an EIS needs to be prepared immediately before any elk management decisions can be made.

Department Response: The impact of deer herbivory on various species of native vegetation in northern Wisconsin is an issue of major concern to the Department. There is no doubt that deer may have serious impacts on vegetation, and that there is uncertainty about how serious these impacts now are. However, the available evidence indicates that he has greatly overstated these effects. The management plan/EA addresses the potential for damage to native vegetation and forest crops by elk. It discusses the need for monitoring to detect serious impacts if they occur. Finally, it describes management strategies that would be used to prevent or limit these impacts if they occur. These include public hunting to reduce the number of elk in places experiencing serious agricultural or environmental damage; relocation, hazing, or lethal removal of animals causing agricultural damage; and adding elk to the WDCAP list so that agricultural producers can receive compensation for damage caused by elk. We believe that the management plan/EA is a comprehensive and thorough treatment of the subject, and that an EIS is not necessary.

He blames the Thompson Administration, the State of Wisconsin Legislature, the UW-SP research team, the USFS, and the Department for not cooperating with him as he attempts to prevent the widespread damage to vegetation on his property caused by overabundant deer, and recently elk.

Department Response: We acknowledge that deer populations in many deer management units (DMU's) in northern Wisconsin, including DMU's 13 and 14 which encompass the elk range, have been substantially above goals for the past several years. A series of mild winters in recent years has been the primary factor allowing deer populations to expand. The Department has been seeking ways to increase antlerless deer harvests to reduce deer populations. An aggressive approach to increasing antlerless deer harvests has been proposed for this year in many of the northern DMU's, including units 13 and 14. There are additional mechanisms in place to assist landowners experiencing agricultural or forest crop damage by deer. If losses of at least $1,000 to forest crops are verified by investigating authorities, landowners are eligible to receive damage payments and/or shooting permits to reduce local deer numbers. However, landowners must first allow authorized personnel to investigate their property to verify damage. They must also allow limited public hunting on their property to help reduce the number of deer. He has been unwilling to concede to either of these measures, and is therefore ineligible to receive this type of assistance. The same policy will be in effect for damage caused by elk if they become a species with an open hunting season, as we have proposed.

Neil Paulson, Drummond, WI – He fully supports expansion of the Clam Lake herd, but favors Alternative 2

(supplemented increase) over the Department's Preferred Alternative. He feels that stocking animals from a source other than Michigan would improve the genetic diversity of the herd. He questions whether an intensive search for alternative sources has been done, and recommends that the Department begin working on that. He believes that there is no information presented in the management plan/EA that precludes this option, including concerns about introducing diseases. He feels that if appropriate quarantine and testing procedures are used, transporting elk into the state to supplement the Clam Lake herd would be as safe as the transporting of game farm elk or livestock that commonly occurs.

> Department Response: We recognize and appreciate his support for the elk reintroduction program. However, we do not agree that supplemented stocking of the Clam Lake herd is either necessary or desirable. Stating that the genetic diversity of the herd could be improved by stocking animals from outside sources directly implies that Michigan elk and the Clam Lake herd are lacking genetic diversity, and that this is causing problems for them. There is currently no evidence that the genetic diversity of the Clam Lake herd is unusually low or that the herd is experiencing problems due to a lack of genetic diversity. Michigan's elk herd was originally stocked in 1918, and no genetic diversity problems have been discovered there. If information becomes available in the future indicating that genetic diversity of the herd does need to be improved, the Department would consider an intensive review of alternative sources for stocking. Currently, we do not feel that there is a need to conduct such a review. As discussed in the management plan/EA, we do not want to complicate efforts to monitor the impacts of an increasing elk herd on other resources of the area by stocking additional animals. We also believe that the disease considerations presented in the management plan/EA outweigh the potential benefits of supplementally stocking the herd with elk from outside sources. As the management plan/EA points out, chronic wasting disease has spread into captive elk herds in 7 states and provinces, and captive elk or red deer from 5 herds in Wisconsin have been diagnosed with bovine tuberculosis in recent years. Given this information, his statement that bringing in additional elk from outside sources would be as safe as transporting game farm elk does little to persuade us that we should stock elk from outside sources at Clam Lake.

He wanted more detail in the costs and revenues section. As an example, he suggested a list of equipment to be purchased should be included along with more detail on projected staffing requirements. He expressed skepticism that a warden would be assigned 0.5 FTE to work elk alone when local wardens are funded less than a pay period a year to work snowmobiling, from which many people are killed and injured each year. He also thought that the estimates of revenue for the project generated by the sale of elk hunting applications and permits was too low, and that more than $4.00/application could be charged without screen out many applicants.

> Department Response: Table 2 has been adjusted to include costs of elk management efforts elsewhere in the state. We do not believe that it is necessary to include details such as itemizing equipment purchases for the purposes of this document. Costs and revenues were included to provide the public with a good idea of how much elk management at Clam Lake is expected to cost, along with information on where the money to pay for the program would be coming from. We believe the management plan/EA satisfies that intent. The management plan/EA simply states that projected Law Enforcement needs for the elk project will require the equivalent of a 0.5 FTE conservation warden, and that this money would have to come from a separate budget. We believe that it is realistic to project this type of LE support for the elk herd, and it is currently being pursued by LE staff. We acknowledge that he may be correct that the revenue estimates are too low. This was a conservative estimate generated using data from Michigan. The management plan/EA states that the $4.00 application fee was one possibility, because this is what Michigan has been charging. The actual fee charged may be different.

He thinks it would be a mistake to begin establishing elk herds elsewhere in the state until the Clam Lake project has been successful. Otherwise, budget and personnel limitations would dilute the Department's ability to effectively manage the Clam Lake herd, the beginning of a hunting program would be delayed, and it would not provide a genetics improvement program for the Clam Lake herd.

> Department Response: His comments raise valid concerns that must be addressed during the process to determine whether to introduce elk herds elsewhere in the state. Budget and personnel constraints could be factors that limit the ability of the Department to effectively manage the Clam Lake herd if elk restoration efforts are simultaneously occurring elsewhere in the state. It is doubtful that elk restoration programs elsewhere in the state would affect when elk hunting seasons became established at Clam Lake, unless the Clam Lake herd was chosen as the source for stocking efforts elsewhere. As we stated above, a genetics improvement program for the Clam Lake herd is not an important consideration at this time.

He commented that after working 32 years as a resource manager in western elk country, he knows that the impacts of roads upon elk depends on the context. He believes that if there are not many roads and little traffic the elk are more bothered by traffic, and that if there are many roads the elk are not as bothered by traffic because they see more of it.

> Department Response: Although there is certainly some truth to these statements, these statements could easily be taken to mean that more roads are better for elk. As the management plan/EA states, there is a large body of published scientific information available indicating that elk habitat quality decreases as road densities increase. Many of these studies were conducted in environments quite different from the CNF-GDD, but nonetheless it is clear that although roads and motor vehicle use have not affected the Clam Lake herd, there may be future impacts.

He wanted to know why the management plan/EA suggests initiating a hunting season when the elk population reaches 150 animals.

> Department Response: This was a somewhat arbitrary figure proposed because it balances biological and socio-economic concerns. As the management plan/EA points out, a small number of bulls could be harvested at this population level without impacting herd growth rates. Also, as he points out in a different comment, it would be advantageous to establish a hunting season as early as is biologically feasible, and we believe that 150 is a level that satisfies that criteria. By establishing a hunting season early on, additional funding for the elk program could be generated, elk could be added to the WDCAP list so that farmers could be compensated for crop damage, and the administrative work involved with establishing a hunting season would be completed by the time a hunting season became necessary to control the size and distribution of the elk population.

He supports the careful development of an elk viewing program because more people enjoy wildlife through viewing than by hunting.

> Department Response: We agree, and this issue has been addressed in the management plan/EA.

He hopes that the Department will ban all baiting and feeding of deer and elk to return to a more reasonable "fair chase" policy for hunting and to eliminate the potential to "facilitate disease transmission."

> Department Response: We acknowledge that feeding and baiting of deer and elk has the potential to

create problems in the elk range, and the management plan/EA addresses this potential. We recommend that artificial feeding of elk be prohibited. However, feeding and baiting for deer in Wisconsin is a very complex issue affecting a much larger area than just the elk range. The Department is currently examining potential alternatives to the current policy on feeding and baiting for deer, and it is clear that many people have strong opinions on either side of the argument. The Department's policy on feeding and baiting for deer is beyond the scope of this management plan/EA.

Robert E. Hecht, Racine, WI – He owns 120 acres of land south of Clam Lake in the core elk range, and supports bringing in elk from other areas to foster more strains and avoid in-breeding.

Mark W. Wilsing, Sheboygan Falls, WI – He believes the elk reintroduction will work if people let it, and supports the supplemented increase alternative.

Department Response: These concerns have been addressed in the previous comments.

Erik Anderson, River Falls, WI – He thought the plan was well thought out, and supports the preferred alternative. As an outdoorsman, he is very excited about the return of elk to Wisconsin.

John R. Hecht, Belvidere, IL – His father owns property near Clam Lake. While hunting for deer they have often seen elk, and he is very excited about the return of elk to Wisconsin. He believes that the elk use recently cut areas quite heavily, and would like to see more timber cutting along the ELF line. He supports the preferred alternative because it would give the Department the opportunity to assess competition for food between elk and other species.

Department Response: We appreciate their interest in the project and support for the management plan/EA.

Al Harrison, Wabeno, WI – He likes the management plan/EA and supports the preferred alternative. He also supports restoring elk to the Nicolet National Forest.

James Thomas, Sayner, WI – He supports the management plan/EA and would like to see elk herds established in other areas of the state, especially in the north.

John V. Modrijan, Chippewa Falls, WI – He is excited about the continued expansion and further research and development of the elk herd in Wisconsin, and would like to see them restored to the Chippewa Falls area.

Greg Eirschele, Tomah, WI - He strongly supports the management plan/EA and would also like to see elk restored to the Black River Falls area.

Joel Clark, FL – He grew up in Ashland and now lives in Florida, and is delighted that elk have been brought back to Wisconsin. He would also like to see other herds established in the state. He feels that elk will offer a great deal of economic and social benefit to northern Wisconsin.

Department Response: We appreciate their interest in the project and support for the elk management plan. Further elk reintroductions in the state will have to be carefully considered, and will follow the process described in the Wisconsin Elk Herd Establishment Protocol.

Dan Casey, Eau Claire, WI – He is enthused about the return of elk to Wisconsin, and would like to see the department maintain or if feasible expand the elk herd in Wisconsin.
Randy Cheske – He is excited about the return of elk to the state, hopes the program will be as successful as that for wild turkeys has been, and expresses general support for the program.

Andrew Malovrh - He fully supports restoring elk to Wisconsin, and feels they would offer good hunting opportunities and would provide another food source for wolves.

Unsigned Comment – This person's comment simply said, "Go for it!"

> Department Response: These responses were general declarations of support for elk management in Wisconsin, although no preferences specific alternatives were mentioned. We acknowledge and appreciate this input.

Chuck Grystar - He read an article in the Lakeland Times newspaper from Minoqua about the management plan/EA, and objected to the fact that the Chippewa Tribes would get half of the harvest allocation. He wondered whether the tribes had financial or other input to the project.

> Department Response: The tribes have played an active role in the elk management process. They declared their support for the reintroduction of elk to Clam Lake in 1995. They have been involved with the preparation of the management plan/EA. Personnel from the Great Lakes Indian Fish and Wildlife Commission are playing key roles in the Suitable Elk Habitat Mapping Project, which is discussed in the Wisconsin Elk Herd Establishment Protocol. Since the Clam Lake area is in the ceded territory, the federal ruling on treaty rights in this area requires that the tribes be allocated half of the harvest, regardless of what role they played in the establishment and management of the herd.

The following comments regarding the Clam Lake elk herd were sent to State Senator Bob Jauch in December 1999, and he forwarded them to Department staff.

Chelsea Bakker, Shell Lake, WI – She expressed cautious support for the Clam Lake elk reintroduction. She believes that elk the elk population and its distribution needs to be kept under control to prevent crop damage problems from developing.

> Department Response: We agree that the size and distribution of the Clam Lake herd needs to be carefully controlled to prevent large-scale crop damage problems from developing. The management plan/EA describes strategies that will be used to accomplish this including public hunting; hazing, relocation, or lethal removal of elk from problem areas; and adding elk to the WDCAP list once a hunting season is initiated so that farmers can be compensated for verified losses caused by elk.

Mike Carpenter, Shell Lake, WI – He supports establishment of a permanent elk herd in Wisconsin and believes they will not cause problems for other ecological and economic resources in the area.

Joshua Bush, Shell Lake, WI – He supports a permanent elk herd at Clam Lake and believes that hunting will be necessary to prevent them from becoming overly abundant and causing environmental damage.

Kristi Hotchkiss, Shell Lake, WI – She supports a permanent elk herd at Clam Lake, believes hunting will be necessary to control the population, and does not think that elk will cause problems with other ecological and

economic resources in the area.

> Department Response: We acknowledge and appreciate these expressions of support for managing a permanent elk herd at Clam Lake. The concerns and suggestions made by them were addressed in the management plan/EA.

Adrian Wydeven, WI DNR Mammalian Ecologist, Park Falls - He had several suggestions for editorial changes.

> Department Response: These changes have been made to the management plan/EA where approporiate.

He thought potential impacts of elk on all terrestrial vertebrates on the state or federal threatened or endangered list should be discussed.

> Department Response: We agree, and this discussion has been included in the management plan/EA.

He stated that an aggressive habitat management program to benefit elk including construction of large openings and expanding aspen cover types would be detrimental for marten and spruce grouse.

> Department Response: While we agree that an aggressive habitat management program for elk could be detrimental to spruce grouse and marten, the management plan/EA does not recommend substantial habitat manipulations to benefit elk. It recommends maintaining current aspen cover types, and the only proposed additional openings involve the creation of several wildlife viewing areas. Language has been changed to clarify that we do not support converting other habitat types to aspen. The management plan/EA points out that most habitat management for the Clam Lake herd would probably occur on National Forest land, and would require the approval and cooperation of the USFS.

He thought that the management plan/EA overstated the economic benefits of elk to the Clam Lake area, and that it should include more potential negative impacts of increased visitation to the area resulting from the elk herd such as increased lakeshore development or urban sprawl, and increased traffic on forest roads leading to greater maintenance costs or pressure to improve the quality of forest roads.

> Department Response: We agree with him that the Clam Lake area is probably not economically depressed, and have changed this language in the document. We do not think that the potential economic benefits of an expanded elk herd were overstated. The management plan/EA concludes simply that there would be some economic benefits resulting from an expanded elk herd due to increased tourism, but that it is difficult to predict how great these benefits may be. Language in the management plan/EA was changed to clarify that there could be decreases in aesthetic values and environmental quality associated with an expanded elk herd.

He thought that there should be more coverage of the effects of roads and motor vehicles on elk.

> Department Response: We agree, and more discussion of these topics were incorporated into the plan. No changes in recommended policy regarding roads, motor vehicles, or other recreational uses were made.

United States Forest Service – They suggested several editorial changes.

> Department Response: These changes have been made.

They thought that the possibility of the ELF line being abandoned and how this could affect elk should be addressed.

Department Response: We agree, and a discussion of this was inserted into the document.

They thought that there should be more coverage of potential conflicts between elk management and roads/motor vehicles, especially ATV's.

Department Response: We agree, and more discussion of these topics were incorporated into the plan. No changes in recommended policy regarding roads, motor vehicles, or other recreational uses were made.

They thought that more discussion should occur between the USFS and the Department about the potential for elk habituation problems to develop at wildlife viewing areas.

Department Response: We agree, and such discussions are already occurring. Plans to development wildlife viewing areas on the CNF-GDD will go through a separate process from the one being addressed by this management plan/EA, and will be best addressed at that time.

They were unaware of any discussion between the Department and USFS to share specific costs of elk management.

Department Response: Discussions on cost sharing have occurred.

They thought that conflicts with other resources such as marten, spruce grouse, or rare plants could occur if high levels of aspen management were required to maintain an increasing elk population.

Department Response: This issue was addressed in a previous comment and response.

They thought that potential impacts to rare plants were understated. They thought that more species than just showy lady's slipper could be impacted. They thought that the list of rare plants that could be affected by elk herbivory should be expanded to include other rare plants that occur on the CNF in unknown locations and species that may occur in the CNF-GDD because the proper habitat is there. They thought more detail on monitoring for impacts of elk herbivory on rare plants should be included.

Department Response: Many of these suggested changes to the management plan/EA have been made. Language was changed to indicate the uncertainty involved in predicting the impacts of elk on rare plants. However, we believe that the level of detail they suggested for describing monitoring plans and protocols is unnecessary for this document.

They wanted more discussion of the potential effects of elk on NWC.

Department Response: We agree, and this discussion has been expanded in the document.

Great Lakes Indian Fish and Wildlife Commission - They suggested several editorial changes.

Department Response: These changes have been made where appropriate.

They thought that if changes were made to core and buffer range boundaries, the tribes should be involved with making those decisions since they could have implications for tribal hunting.

> Department Response: This matter would be addressed at the appropriate time by the Department and the tribes, and does not have to be detailed in the management plan/EA.

They believe that because only 1% of the CNF-GDD is in open cover types rather than the 10% necessary for high quality elk habitat according to the Michigan habitat suitability index, the area cannot be considered high quality elk habitat. They believe that spring forage is the critical limiting factor for the Clam Lake herd.

> Department Response: The management plan/EA states that spring forage may likely become a limiting factor for the herd if it is allowed to expand. However, we cannot state this with certainty until more data on spring habitat selection for the Clam Lake herd is available. Elk may be finding adequate spring forage in cover types other than those classified as openings on the CNF-GDD, such as regenerating aspen stands. Important data on seasonal habitat use has been collected by the UW-SP research team and is currently being analyzed, as the management plan/EA points out. When the results are released, biologists will have a much better understanding of how essential openings are for the Clam Lake herd.

They thought that more discussion should be included regarding the potential impacts of elk on native vegetation, especially for those species such as cedar, yew, and bluebead lily that are already impacted by deer.

> Department Response: As discussed in a response to an earlier comment, many of these changes have been made.

They wanted to know why 150 was chosen as the number to initiate elk hunting at.

> Department Response: This question was addressed in a previous response to a comment.

They favor fewer, larger elk hunting zones rather than many, smaller ones. They also wanted to clarify that the tribes would be able to set their own seasons for elk hunting.

> Department Response: These matters would be addressed at the appropriate time by the Department and the tribes, and do not have to be detailed in the management plan/EA.

They thought that relying on radio-collars to monitor the elk population would be too expensive and time consuming, and that radio failures would make it difficult to obtain the necessary data. They thought other methods should be considered.

> Department Response: Monitoring of radio-collared animals is a widely used and effective technique for determining sex and age specific survival rates, estimating population size, and collecting other critical data for large mammal populations including elk. Because elk are large animals, they can carry a transmitter package containing batteries that provide at least 3 years, and more often 6-8 years, of collar life. Therefore, after the initial batch of collars was put out, large-scale capture and collaring efforts would not have to be made each year. It would only be necessary to put enough collars out to replace those on animals that died or whose transmitters failed, or to try to get collars on groups of elk in areas where there weren't any instrumented animals. Capture and collaring efforts are expensive and time

consuming, but so are any other methods that could be used to obtain the necessary data. Although they thought other methods should be considered, they had no suggestions for alternative methods that they would like to see used. We believe that monitoring of radio-collared elk is feasible and will provide us with the most accurate and comprehensive data to make sound management decisions.

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