

MANAGEMENT PLAN
FOR
ELK IN PENNSYLVANIA
2006-2016



Jon Marc DeBerti
Wildlife Biologist

Northcentral Regional Office
Pennsylvania Game Commission
1566 South RT 44 HWY
Jersey Shore, Pennsylvania 17740-5038

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FOREWORD

The mission of the Pennsylvania Game Commission is to manage all wild birds, mammals, and their habitats for current and future generations. Management Plans have been or are being developed and updated for many of these wild bird and mammal species. This document is an update to the *Management Plan for Elk in Pennsylvania* developed in 1996. The Game Commission has worked hard to accomplish the goals established in that plan. These accomplishments will be presented in greater detail later on in this plan. The goals outlined in the 2006 Plan will build upon the accomplishments achieved during the life of the last management plan. The new goals outlined in this updated plan will provide a better understanding of the life requirements of Pennsylvania elk by seeking additional information through new research initiatives. This Plan was developed to serve as a guide for insight in managing elk by maintaining a self-sustaining population of elk while at the same time minimizing local conflicts and economic losses as a result of having an elk herd.

Tony Ross
Regional Biologist
Northcentral Region

Introduction

Pennsylvania has a small free-ranging herd of elk (*Cervus elaphus*), which ranges over parts of Elk, Cameron, Centre, Clearfield, Clinton and Potter Counties. The herd is a significant tourist attraction that benefits the state and local economies and provides recreational hunting and countless hours of wildlife viewing pleasure for an estimated 60,000-70,000 visitors annually. Management of these animals is the responsibility of the Pennsylvania Game Commission (PGC) under the authorization of Title 34 of Pennsylvania's Game and Wildlife Code and Title 58 of the Pennsylvania Code.

The PGC must consider the biological, sociological, economic, and environmental issues associated with the elk when developing a management plan. The biological issues include population densities, recruitment, movements, survival and mortality. Sociological issues include quality of life issues, recreational viewing and personal acceptance. Economic issues include impacts to agricultural operations, personal encounters such as vehicle accidents and other property damage, hunting, and tourism. The environmental issues include Chronic Wasting Disease (CWD), habitat impacts and impacts to other wildlife and the land as a result of increased development associated with expanded marketing of the area. This plan is intended to provide guidance for the management of the elk herd over the next ten years, at which time the plan will be evaluated, reviewed and revised to meet the ever changing and dynamic trends of wildlife management.

Keywords:

Elk Management Area - Pennsylvania's Elk "Range".

Elk Management Unit - A specified area of elk habitat.

Elk Hunt Zone - A single or combination of Elk Management Units.

Accomplishments

The following is a list of accomplishments and actions from the first *Management Plan for Elk in Pennsylvania* that was approved 1996:

1. Acted on recommendations to expand the Elk Management Area from 227 square miles to 865 square miles (Figure 1).
2. Expanded viewing and educational opportunities on Winslow Hill and other areas. Additions and improvements to PGC property consisted of the construction of a pavilion for outdoor programs, placement of additional information bulletin boards to aid the public, upgraded walkways, enlarged and constructed additional parking areas, provided seasonal toilet facilities, arranged for visitor garbage disposal containers, hired a part-time educational employee during the fall to

operate the newly constructed education building and produced an award winning video entitled *Pennsylvania Elk: Reclaiming the Alleghenies* which has been viewed by thousands of people since its release.

3. The Bureau of Forestry (BOF) and Bureau of State Parks (BSP) constructed viewing facilities at four locations on Department of Conservation and Natural Resources (DCNR) properties. Three of these facilities are located on BOF property and utilize areas already managed as herbaceous openings. The other is located at Sinnemahoning State Park and also utilizes an area managed as an herbaceous opening.
4. Worked aggressively to acquire or assist in acquiring property within the Elk Management Area. Several properties were purchased by the state through the help of the Rocky Mountain Elk Foundation (RMEF), the Northcentral Pennsylvania Conservancy, the Western Pennsylvania Conservancy, the National Wild Turkey Federation, Pennsylvania Wildlife Habitat Unlimited, and the Sinnemahoning Sportsmen's Association. These areas included State Game Lands (SGL) 321, the Gilbert Farm on SGL 311, and several tracts on the Elk State Forest. In addition, the RMEF purchased the Betta Farm adjacent to the Elk State Forest on Winslow Hill.
5. Adopted regulations regarding artificial feeding of elk. Revised wording designed to strengthen the current regulation has been approved and will be implemented shortly.
6. Conducted trap and transfer projects to relocate elk into areas that were not previously occupied by elk. The outcome of these transfers resulted in a mixture of successes and failures. The first and second relocation effort in Clinton County did not fare as well as anticipated. A few animals still inhabit and roam the Tamarack area near Kettle Creek State Park. These are some of the wildest and most elusive animals residing within the Elk Management Area. The third release on SGL 321 near Pottersdale in western Clinton County was indisputably a success. These animals have expanded their range westward while increasing in numbers. Consensus opinion among wildlife professionals is this success was due primarily to available habitat and life requisites of elk being readily available in the Pottersdale/Karthus area. This area is sparsely populated and relatively remote, but contains many active and abandoned surface mines duplicating desirable habitat types found on Winslow Hill. The mixture of large grassy areas, aspen stands, and planted evergreens serving as thermal cover appears to be ideal habitat for elk. Again, to their credit, these elk are very wild and few human conflicts have resulted in this range and population expansion project.

7. Succeeded in lessening habituation of elk to humans by limiting vehicular access on crucial areas on state property. In addition, the PGC adopted land use regulations for all SGL which have effectively given land managers the regulatory tools necessary to direct and limit secondary recreational activities conducted on SGL other than hunting and trapping.
8. Established in 2001, the Elk Habitat Challenge Initiative as a major funding source for providing new and improved elk habitat. A goal of raising one million two hundred thousand dollars over three years was established by the PGC, DCNR and RMEF for habitat improvement and enhancement projects. A total of \$836,326.67 (Improving Wildlife Habitat in Pennsylvania's Elk Range: Final Report on the Habitat Challenge Initiative 2006) was raised and spent on habitat projects over the last four years. Private funding collections were spearheaded by the RMEF. These monies were generated by donations collected from wildlife partners including Safari Club International (Lehigh Valley Chapter), Dominion Resources, Pennsylvania Wildlife Habitat Unlimited, National Wild Turkey Federation, Sinnamahoning Sportsman's Association, Homewood Hunting Ranch, Happy Hunters Hunt Club, Foundation for North American Wild Sheep, Waste Management of PA, Snyder Associated Companies, and numerous private individuals. PGC allocations for the three years were obtained from monies from the elk hunt license applications. While the majority of the money was applied to creating new food plots, some new equipment was purchased to maintain the newly constructed plots. In addition, \$72,995.11 was spent for supplemental help that was hired by the PGC to assist in the construction and maintenance of the plots. This figure is not included in the above total raised and spent for the Elk Habitat Challenge Initiative. DCNR managed the money and handled the administrative aspects of the grant such as contract letting and report writing describing the progress of the initiative. Over 592 acres of new food plots were established in strategic locations throughout the elk area. The remainder of the money was used to upgrade hundreds of acres of existing food plots.
9. Cooperated with the Department of Environmental Protection (DEP), the United States Army Corps of Engineers, the United States Department of the Interior, and the Bennetts Branch Watershed Association to identify and reclaim areas of abandoned mine lands in the Elk Management Area. As a result of these efforts coordinated and administered by DEP's Bureau of Abandoned Mine Reclamation, several projects within the Elk Management Area have been completed and several more are under construction or in the design phase. Using modern technologies such as recycling waste paper products (a mixture of wood fibers and lime) from the Weyerhaeuser Paper Mill in nearby Johnsonburg and incorporating this material into these barren soils, the overall productivity of the soil has improved. This improvement has led to increased plant growth and eventually

will aid in improving water quality. Working with other private industries such as P&N Coal Company and Dominion Resources on re-mining projects and land exchanges has resulted in a profound benefit to the land and the citizens of the Commonwealth. Over the last several years, Dominion annually contributed over \$10,000 to elk related projects along with supplying personnel for community projects.

10. Conducted numerous educational, legislative, and industry tours for the purpose of promoting elk management. In addition, several teachers' workshops were held as part of an on going in-service training for teachers. Pennsylvania was twice selected as the site for the Eastern Elk Manager's Workshop. This annual meeting is for wildlife professionals located in states and provinces east of the Rocky Mountains that have an elk herd. The major funding to conduct both the teacher's workshop and the elk workshops was provided by educational grants of the RMEF. PCN television accompanied and filmed the entire field trip for the latest elk workshop and aired the program statewide on several occasions during the month of May 2005.
11. Expanded elk habitat work within the Elk Management Area by establishing a new PGC Food and Cover crew. This crew is located at a new facility on the edge of the Quehanna Wild Area on the Moshannon State Forest. Along with providing additional manpower to work on habitat projects, the location of the crew headquarters allowed a reassignment of responsibilities within the Food and Covers Corps to increase efficiency and reduce traveling costs of getting to work sites. In addition, the entire elk program responsibilities within the PGC were reorganized. The elk management program is now supervised by the field office of the Northcentral Region. With the hiring of a new regional biologist, additional resources have been placed in the field to handle the supervision of the elk program. A coordinated effort of biologists, foresters, land managers, conservation officers, and food and cover employees is now in place under the direction of one person instead of multiple departments. The result has been better coordination and planning by a team working together to provide the best management program possible.
12. Continued to monitor population, health, and movements of elk within the Elk Management Area. Population surveys have been modified and improved by utilizing a ground survey approach. This has reduced the cost of the program when compared to aerial surveys. In addition, the ground surveys have shown to be a safer method of gathering population information. The technician program has been expanded and will continue to expand with funding in place to initiate a habitat use research study to determine the life requirements of elk, to evaluate and improve land management practices for elk, and give insight to how many elk the available habitat can support. This study

along with others, is being done with a new cooperative program with the Indiana University of Pennsylvania.

13. Assisted in establishing an elk festival in Elk County for the purpose of hosting the annual drawing of the elk hunt applications. This festival has attracted thousands of visitors to the area each September to witness the elk drawing and partake in other elk related activities.
14. Finally, the most important accomplishment since the last elk management plan took effect in 1996 has to be the establishment of the Elk Hunt. With the first modern day hunt beginning in 2001, the Elk Hunt has become one of the most useful tools available for elk management. Problem areas can be targeted to reduce conflicts such as agricultural areas near St. Marys while other areas can be protected such as the established viewing areas. The result has been a highly successful program that has become a favorite of big game hunters. With the establishment of an elk hunt orientation program stressing safety and ethics to the culmination of checking in a harvested elk at the BOF Ranger Station at Quehanna, the elk hunt has been everything and more since it was listed as a goal in the prior management plan. The careful monitoring of the hunt is the key to controlling populations in some areas while permitting the herd to expand in other areas such as the eastern portion of the Elk Management Area. The goal of providing quality hunting is a direct result of continuing habitat enhancement and maintenance projects which all require funding to be successful. Continuing that flow of funding is a crucial factor in the success or failure of an elk management program.

History of Elk in Pennsylvania

The native elk (*C. elaphus*) was found throughout Pennsylvania during the early 1700s; however rapid expansion and exploitation by early immigrants along with habitat changes caused the elk to retreat (Toweill and Thomas 2002). By 1877, they were extirpated from the state (Gerstell, 1936). Elk were reintroduced by the PGC beginning in 1913. A total of 177 elk were released between 1913 and 1926. These elk were taken from Yellowstone National Park in Wyoming, a game preserve in South Dakota, and a private preserve in Monroe County, Pennsylvania (Gerstell 1936, Lathum 1954). They were subsequently released in 10 counties including: Blair, Cameron, Carbon, Centre, Clearfield, Clinton, Elk, Forest, Monroe, and Potter (Figure 2).

As the elk population increased after the reintroduction, a corresponding increase in the number of local crop damage complaints followed. According to PGC archives (1920-1927), problem animals were removed by either relocating them using trap and transfer techniques or by killing offending animals. In

addition, a hunting season was established in 1923 for the harvest of bulls with four or more points per antler. By 1931, the hunting season was closed because it was determined the herd was steadily declining (Gerstell 1936, Lathum 1954). From 1931 to 1971 very little is known about the elk herd, but it appears the population remained at a few animals. According to Erickson (1965) there were approximately 35 elk in Cameron and Elk Counties in 1965.

Elk population surveys began in 1971 (Harrison 1996). After an estimated low population of 38 elk in 1974, the herd increased approximately 18 to 20 percent annually to 117 in 1980 (Figure 3). During the 1980s the elk population remained stationary to slightly increasing ranging from 117 to 154 animals. In 1991, an aerial survey technique was used to estimate the elk population. The estimate from 1991 to 2001 indicated an increasing population trend at 11 percent annually. A hunting season was established in 2001 to control elk populations in the future, provide a recreation opportunity for sportsmen and women, and address conflict situations. This increasing trend continued until 2002 when the population decreased and now appears steady. In 2004, a ground survey replaced the aerial method to determine the elk population (Rosenberry and DeBerti 2002). Currently, the population is estimated between 500 to 600 elk.

Range and Distribution

Elk were originally reintroduced in Blair, Cameron, Carbon, Centre, Clearfield, Clinton, Elk, Forest, Monroe, and Potter Counties (Gerstell 1936, Lathum 1954). By the late 1920s, according to the *Sayre Daily Times* (1928), elk were reported only in Cameron County, west of the Driftwood Branch of the Sinnemahoning Creek. In the mid 1990s, elk began to expand their range to the east and south. They began to regularly frequent the Bennett's Valley and by the late 1990s began establishing sub-populations on the Quehanna Plateau. Expansion was hastened beginning in 1996 with the transfer of conflict elk from the Weedville area. With the implementation of a three-year Trap and Transfer program beginning in 1998, the range was expanded into Clinton County. In all, 68 elk were transferred and released at three sites in western Clinton County.

Range Boundary

Pennsylvania's current Elk Management Area covers approximately 835 square miles in Cameron, Clinton, Centre, Clearfield, Elk and Potter Counties in the north central section of the state (Figure 4). The elk range includes the Sinnemahoning, Parker Dam, Kettle Creek, and Bucktail State Parks, the Marion Brooks, Johnson Run, Lower Jerry Run, Pine Tree Trail, and Wykoff Run Natural Areas, the Quehanna, Fish Dam Run, and Burns Run Wild Areas, State Game Land (SGL) 14, 34, 94, 100, 311, and 321, and portions of the Elk, Moshannon and Sproul State Forests. Public land comprises approximately 74 percent of the total land base within the current Elk Management Area.

Reported elk sightings have occurred at various locations outside the current Elk Management Area. By officially designating an Elk Management Area with defined boundary limits where elk movement outside these boundaries will not be tolerated, this designation will allow for better planning of available resources for elk management. Habitat projects can be developed in a progressive fashion (pattern) to allow natural migration into areas where elk now visit only infrequently. In addition, by incorporating elk management units within the Elk Management Area a buffer can be created to manage sensitive areas where elk behavior will determine the number of animals permitted to inhabit such a buffer area.

The elk herd has shown an increase. In addition, the elk are expanding to new areas outside of the current 835 square mile Elk Management Area. Consequently, the size of the Elk Management Area will be expanded to 3,750 square miles (Figure 5) to allow these animals to fill areas devoid of elk yet provide the habitat for their survival. Duplicating habitats found on Winslow Hill and the Quehanna Wild Area would allow elk to inhabit new areas if they desire. Currently, the majority of this increased acreage is owned by the Commonwealth. The habitat type is mainly forested with limited acreage in herbaceous openings. By increasing the quality of habitat required by elk, migration and the development of local populations should follow. By locating new herbaceous openings in close proximity to existing openings at the edge of the current range, elk should react and begin using this additional habitat type resulting in range expansion. Building these plots could be compared to building a railroad line. That is, start at an established population center, utilize travel corridors, and then build another population center. This process can be continued and duplicated to have connected habitat complexes. This should encourage elk movement from complex to complex while at the same time providing the opportunity to increase the population.

Physical Characteristics and Habitat Components

The Elk Management Area lies within the Allegheny Plateau Physiographic Region at an elevation of 900 to 2300 feet. Annual rainfall is 36 to 40 inches per year. The Elk Management Area is heavily forested (greater than 80 percent) and lies in the transition zone between the mixed oak and hickory forest to the south and the northern hardwood forest to the north. On public lands, non-forested areas are comprised of reclaimed surface mine sites, clearcuts and herbaceous food plots. These non-forested areas comprise approximately seven percent of the public lands within the Elk Management Area. It should be emphasized that the Elk Management Area also includes many hundreds of acres of additional existing grazing opportunities for elk and other wildlife in addition to the areas specifically improved for wildlife habitat. In the 835 square mile Elk Management Area this includes:

- Early successional forest containing grassy under story, riparian habitats, burned areas and natural meadows;
- 1400 acres of utility right-of-ways;

- Hundreds of half-acre well sites, maintained in grassy vegetation; and,
- Large areas of reclaimed surface mined lands both on private and public lands.

Openings on private lands within the Elk Management Area consist primarily of agricultural lands and reclaimed surface mine areas. Openings make up approximately 15 to 20 percent of the private lands within the traditional Elk Management Area.

Since 1990, elk have been consistently using habitats south and east of the northwest corner (traditional range) of the Elk Management Area. Currently, elk can be found seasonally across the entire area. The 50,000-acre Quehanna Wild Area, one of 13 such areas statewide, is set aside to maintain the undeveloped character of the forest environment. However, it does include habitat enhancement projects such as planting herbaceous openings, red maple regeneration cutting, wildlife shrub and tree planting, and placement of mineral blocks. The Quehanna Wild Area is jointly administered by the Moshannon (189,000 acres) and Elk (200,000 acres) State Forest Districts. The PGC manages SGL 34 (9,470 acres), portions of which are located within the Quehanna Wild Area.

Telemetry has shown that elk are not distributed evenly across the Elk Management Area. Cows remain primarily in the same areas where they were born; however, bulls often are the first to disperse into new areas. Telemetry has also shown that these are often defined regions that particular groups (or herds) of elk will use. Often there is little intermingling of these groups. Locations of the collared elk were recorded from January 15, 2003 to April 18, 2005 (Figure 6).

Elk Ecology and Biology

Habitat Requirements

An essential part of managing any species is acquiring general knowledge of habitat requirements. There is a great need to scientifically identify and evaluate what habitat types elk are using to determine the effectiveness of the habitat work. The PGC is in support of an elk habitat use study using previous and ongoing telemetry locations.

Although numerous habitat models are available as guides for determining the suitability of habitat for elk, most have been developed for the western United States. Cogan (1996) stated these habitat models seem more appropriate for western populations that migrate and are not applicable to the non-migratory elk populations in Pennsylvania.

In Michigan, optimum elk habitat consisted of a minimum of 10 percent herbaceous openings, 20 percent coniferous cover for winter thermal (cedar), and 45 percent aspen (Beyer 1976). Winter thermal cover, winter food availability, and spring food availability were identified as potential limiting factors for elk. Observations suggest these same habitat requirements are important for elk in Pennsylvania.

In Pennsylvania's Elk Management Area, forest types with herbaceous understory (i.e. herbaceous openings, young timber stands, clear cuts, riparian habitats, natural meadows, pipelines, powerlines) account for approximately 7 percent of the public land base. On private land, at least 15-20 percent is considered openings. Thermal cover or conifer cover comprises approximately 4 percent of the public land base. Currently, approximately 1470 acres of wildlife plots are intensively managed for elk and other wildlife in the 835 square mile Elk Management Area.

The premise that elk are primarily grazers is the most important habitat management factor to consider when enhancing habitat for elk. In Pennsylvania, grasses and legumes are an important component of the elk's diet (Witmer and Cogan 1989) in late spring and mid fall (Devlin and Tzilkowski 1986). In Pennsylvania, elk eat grasses and legumes from agricultural lands, clearcuts, reclaimed surface mines, utility right-of-ways, riparian habitats, natural meadows, and wildlife openings. Clearcuts are heavily used by elk during winter with only limited use occurring during summer and fall (Drake 1985).

Through observation, preferred winter food species in Pennsylvania include red maple (*Acer rubrum*), quaking aspen (*Populus tremuloides*), striped maple (*Acer pennsylvanicum*), witch hazel (*Hamamelis virginiana*), ironwood (*Carpinus caroliniana*), Hercules' club (*Aralia spinosa*) and Juneberry (*Amelanchier spp.*). The best spring food consists of young growth grasses, legumes, and forbs.

Elk Reproduction and Mortality

In Pennsylvania, radio-collared adult cows have been monitored on a regular basis. Reproductive rates were found to average 68 percent (n=161) for 1991-1997 (Cogan 1998a). Calf:cow ratios for aerial winter surveys from 1991-2003 averaged 34:100 (Table 1). Still born calves have been recorded in only three percent (n=4/119) of radio-collared cows. Reproductive data for yearling cows have not been collected.

Pennsylvania's reproductive rate has a six-year average of 68 percent. This is comparable to the elk herd on the National Elk Refuge in Jackson Hole Wyoming and Colorado's Flat Top Wilderness elk herd. In Wyoming's Jackson Hole and Colorado's Flat Top Wilderness herd, reproductive rates of 65 and 70 percent respectively, have been documented (Cogan 1996).

A two-year study was conducted for the Trap and Transfer of 23 cows (greater than 3 years-old) referred to as the Bitumen and Hevner Run Releases

of Clinton County (Table 2). During these two years, 18 calves were born. Cows had higher production in the Bitumen Release as compared to the Hevner Run Release and the traditional Elk Management Area.

In Pennsylvania, newborn calves are marked with expandable-breakaway radio-collars equipped with mortality sensors which are monitored using telemetry equipment. All captured calves are monitored until the transmitters fail (approximately 20 months), the animal dies, or sheds the collar. During 1993, 1994, 1995, and 1996 annual elk calf survival was 71 percent (n=30) (Cogan 1998b). Two calves died from clostridium, a bacterial infection of the intestines that causes emaciation and dehydration. One calf died of each of the following causes: winter kill, poaching, drowning, and black bear predation. One animal died of brainworm (*Pneumostromgylus tenuis*) at 1 year 4 months of age. In Colorado's Flat Top Wilderness elk herd, calf survival is 90 percent (Cogan 1996). Given that Pennsylvania's reproductive rate is 65 percent and calf survival is 71 percent, then we should expect to find approximately 50 percent of the cows, are 3 years of age or older with a calf during winter aerial surveys.

The number of known elk mortalities, excluding legal harvest, from 1975 to 2005 was 627 animals (Table 3). The highest mortality was associated with crop depredation (149 or 24 percent). A fencing program was established in 1992 to address elk impacts to farming areas. Crop kills fell to less than 3 elk for the next several years. However, since 1999, the 3 highest years for elk crop damage kills have been recorded. The highest number of kills (17) was in 2002. Since then, fencing policies have become more flexible to meet the demands of the farmers and crop damage kills have decreased.

Illegal kills continue to be an important factor of the mortality component. Since 1975, 134 illegal kills have been documented including several instances where mature bull elk were shot and left lay.

Elk Behavior and Movements

By nature, elk are crepuscular with the main foraging periods occurring at dusk and dawn. During cold, wet, or windy weather, elk tend to forage on south-facing slopes during daylight and bed in adjacent thick cover. During extreme low temperatures and deep snow (more than 20 in), elk forage and bed primarily on south-facing slopes during daylight then retreat to bed in adjacent areas with heavy cover. During the summer, most foraging occurs after dark when temperatures are lower.

Currently, elk in Pennsylvania are non-migratory but have a large home range (Cogan 1987). This is compared with elk in the western states that have distinctive summer and winter ranges. Movements up to 11 miles in a single night have been recorded. Elk occasionally take long (up to 25 miles) exploratory trips outside of their home range but they usually return to previously occupied activity centers. Seasonal movements of elk are often in response to biological changes (i.e. breeding, post rut break-up, parturition) and changes in food availability; they also reflect the gregarious behavior of elk (Cogan 1987).

Elk home range and movements vary greatly between sexes and seasons (Cogan 1987). Bulls typically use home ranges that are larger than those used by cows (Cogan 1987). Home range and movements also vary by season. Breeding males travel greater distances and use larger areas during the rutting season than at other times of the year. In 1985, radio-collared bulls and cows in Pennsylvania have average home ranges of 20.5 square miles and 6.8 square miles, respectively (Cogan 1987). During 2004-2005, mean home range for bulls has been 17.5 square miles and 16.3 square miles for cows (Table 4).

Population Survey and Distribution

To properly manage any wildlife species, knowledge of that species' population is critical. Managing elk in a relatively small area, approximately 835 square miles in Cameron, Centre, Clearfield, Clinton, Elk and Potter Counties, in close proximity to agricultural areas, presents conflicting and complex problems (Witmer and Cogan 1989).

Since 1991, the PGC estimated the elk population using Chapman's (1951) mark-resighting procedure. The survey estimate was for the previous year's population, i.e. a survey conducted in January 1992 was an estimate of the 1991 population. Prior to hunting (1991-2001), winter aerial surveys estimates indicated an average annual rate of increase of 11.3 percent (PGC Annual Reports). During these surveys, the winter sex and age composition of the herd averaged 17 percent branched-antlered bulls, 7 percent spike bulls, 56 percent adult cows, and 20 percent calves. Branched bull:cow, spike:cow, and calf:cow ratios averaged 34:100, 14:100, and 34:100 respectively (Table 1). In January 2003, the last aerial survey was conducted using Chapman's (1951) mark-resighting procedure. The survey results showed a decreasing population with an estimation of 552 elk. During this survey, the winter sex and age composition of the herd averaged 15 percent branched-antlered bulls, 4 percent spike bulls, 58 percent adult cows, and 20 percent calves. This estimate was reinforced by the highest recorded known mortality of 111 (including 61 legal harvest).

In the fall of 2003, the PGC began to implement Bowden's survey technique (Bowden and Kufeld 1995) that would provide a better estimate of the population over the entire 835 square mile Elk Management Area. This technique reduces the cost of conducting the annual population survey, is more flexible in terms of personnel and hours, eliminates weather as a consideration, and increases safety for participants. Furthermore, the technique will be conducted during the breeding season to provide a less biased and more management-oriented estimates and will engage a broad group of participants.

The PGC conducted the survey in several phases to make corrections prior to the first full effort in the fall of 2004. This is a ground-based survey that utilizes designated routes and opportunistic sightings to record elk numbers over

a given time. This will be an evolving process as we continue to evaluate this technique so as to produce the most consistent results. The estimate for the fall of 2004 was approximately 500 elk.

Elk Management Issues

Population

All problems in wildlife management fall into three categories: (1) too many (over abundance), (2) too few (conservation), (3) and too many harvested (exploitation) (Caughley 1976). These categories define one concept, carrying capacity (CC). There are many types of CC and some have the same meaning but referred to by different names. The two most important to us are Biological Carrying Capacity (BCC) and Sociological Carrying Capacity (SCC).

BCC is the population level that the abundance of animals begins to negatively impact reproduction, survival, and habitat (Schmitz and Sinclair 1997). Once a population nears BCC, growth of the population decreases as resources become limited. At BCC, population growth stops. In elk, some indications of this may include the following: decreased reproductive success, reduced birth weights of calves, extended or increased intervals between births, later successful birthing age, reduced antler growth, reduced body weight, disease and mortality due to malnutrition during winter months.

SCC is the population level based on society's tolerance of the species and it will vary between the different groups based on their point of view (Sinclair 1997). These groups include sportsmen and women, local and non-local residents, businesses, tourists, natural resource agencies, conservationists, politicians, farmers, and foresters.

The BCC for elk in Pennsylvania is unknown, but there is no indication that the population is reaching it. None of the studied indications mentioned above have been observed. In fact, elk appear to be reproducing and reaching weights above what is expected and survival rates are normal to high. The SCC is also unknown at this time. However, indications are that number hasn't been reached either. Most interested parties haven't complained of too many elk and would actually like to see more. As we gather more information, we will balance the numbers so that we do not go over the BCC but still maintain an elk population that provides enjoyment for the people of the Commonwealth.

Impacts on Land

Agricultural Conflicts

During the 1980s, elk killed for crop depredation accounted for 39 percent (n=122) of all known elk mortalities (Table 3). State law (Title 34, *The Pennsylvania Game and Wildlife Code*) permits farmers to kill game or wildlife to protect property under their control that is being used to grow cultivated crops and to protect livestock, poultry, and beehives from damage by wildlife.

Agricultural damage by elk includes losses to grain fields, hay crops, pastures, fruit trees and fences. In addition to actually eating crops, elk can cause damage to fruit trees by browsing, "barking" (stripping the bark from the tree), and rubbing the trees with their antlers. Currently, Pennsylvania farmers cite damage most often to corn, alfalfa, clover, and oats. Most damage occurs in late summer and fall with fields bordering heavily forested areas suffering the most damage. Other property receiving damage include fences, posts, corncribs, and outbuildings. Bulls cause most damage inflicted upon this type of property using their antlers to scrape and spar. Landowners also have reported harassment of domestic stock by elk. From 1982-1984, the PGC monitored the movements of 21 radio-collared elk in relation to agricultural areas in Pennsylvania (Witmer and Cogan 1989). Collared bulls were more likely to visit farmlands than cows (Witmer and Cogan 1989).

Forest Regeneration

In Pennsylvania, elk have generally not been reported as causing adverse impacts to forest regeneration. Over-browsing of aspen (*Populus sp.*) seedlings has been documented at several sites. Elk have also been reported to "bark" trees with preferred species being red maple, striped maple, witch hazel, Juneberry, and devil's club. The DCNR foresters have reported that places where extensive wildlife openings have been created, the surrounding forested areas are experiencing reduced browsing pressure by elk thus aiding in increased tree regeneration.

Negative Human Impacts

Detrimental activities that potentially cause death to elk

Because elk are primarily grazing animals, they are often attracted to grassy areas near highways and railroads where collisions may occur. From 1975-1989 only five elk were known to have died from vehicle collisions. Pennsylvania's elk population increased during the early 1990s and began to disperse south and east. This increase, along with more visitors coming to the area, appears to have contributed to an increase in automobile/train mortalities. Since 1990, 110 elk were known to have died from vehicle and train collisions. Most of these collisions have occurred in the Bennetts Valley, along Route 555.

Even though there are no statistics available concerning the average amount of damage done to vehicles from collisions, elk tend to do considerably more than deer simply because of their large size.

Illegal shooting has had a significant negative impact on the Pennsylvania elk herd. These kills account for 21 percent of all known elk mortalities since 1975 (Table 3). Some of these shootings are elk shot in mistake for deer during our deer hunting seasons.

Since 1990, artificial feeding of elk has increased. Residents and tourists have been artificially feeding elk, mainly bulls, large quantities of corn, apples, and alfalfa hay to increase their chances of collecting elk antlers. Ultimately, bulls that were fed have become accustomed or "trained" through a conditioned response, (whistle, human voice, rattling bucket) to expect food. These bulls gather and remain in the immediate area where the feeding occurs throughout the winter. After the bulls shed their antlers, the artificial feeding often stops and the bulls wander off to find other food sources. Coincidentally, complaints of elk being in residential areas are rare until after antlers are shed which normally occurs around mid April.

The PGC does not support artificial feeding of elk for the following reasons:

- 1) Feeding creates a public safety hazard for vehicles along roadways, especially Route 555,
- 2) The feeding creates a public safety hazard because elk display aggressive behavior in artificial feeding situations,
- 3) Diseases such as brainworm and chronic wasting disease (CWD), along with parasites such as winter ticks are of paramount concern when large concentrations of elk are fed for a prolonged period of time in the same vicinity,
- 4) Elk may become dependent upon the artificial feeding sites to survive the winter,
- 5) Elk also become acclimated to humans making them more susceptible to poaching,
- 6) tourists travel to the elk range to view elk in their "natural" environment,
- 7) Studies indicate that the habitats near feeding locations can be degraded because of the high use by concentrations of elk and deer (Michigan DNR 1999).

In October 1995, the PGC (Commissioners) voted unanimously to prohibit the artificial feeding of elk under 58 Pa. Code §137.32. However, prosecution of this violation will remain difficult until the interpretation of this violation is accepted as intended by the judiciary. A new regulation closing loopholes will be in effect beginning in 2006. With the passage of this revised regulation, the PGC will begin to address artificial feeding situations on a case by case basis.

Public Viewing

The interest in elk by the public has both negative and positive impacts on the elk herd. While tourism provides economic benefits, local residents do not always welcome the increase in tourism generated by elk viewing. There are those who do not want to see visitors to the area because of the problems associated with increased traffic, littering, trespassing, overcrowding, and recreational spotlighting. Numerous complaints have been filed by local residents, many of which cite the lack of parking areas for the visiting public as a primary concern.

Additionally, the increased tourism can potentially have negative effects on the land. This area does not have the infrastructure to handle the increased number of visiting people especially during the peak-tourism season. Roads, restrooms, and litter collection are not adequate to handle the additional demand placed on the infrastructure resources.

Several studies have documented that vehicular traffic causes a decline in elk habitat use near roads (Lyons 1983, Irwin and Peek 1979). Elk preferred to be more than 400 yards from traveled roads at all times in Idaho (Irwin and Peek 1979). Disturbance and harassment by all-terrain vehicles and snowmobiles in Michigan are thought to result in behavioral changes and interference in reproductive activities. In Michigan, areas that provided the most protection from human activities recorded the highest population increases (Moran 1973).

Although not specifically studied, vehicular traffic seems to have a minimal impact on some elk in Pennsylvania. Elk frequently feed near traveled roadways without apparent disturbance; however, disturbance and harassment from all-terrain vehicles and snowmobiles does cause elk to seek less accessible areas. There has been a general attempt by the PGC and the DCNR BOF to limit vehicular access within the Pennsylvania elk range to minimize elk disturbance and use in nonconflict areas. Motorized vehicles are generally not permitted on public lands. This prohibition aids in reducing habitat destruction and harassment of wildlife. While some roadways are gated and posted "closed to motorized vehicles", most other forms of entry and use are permitted. There are fewer restrictions concerning all-terrain vehicles and snowmobile use on private lands. Impacts from other human related activities such as horseback riding, hiking, skiing, and snowshoeing haven't been closely monitored. So far, these types of activities have not created enough disturbance to adversely affect elk.

In Michigan, Moran (1973) discouraged development of tourist "attractions" offering close observation of elk, calling them an ultimately self-defeating use of the resource. Human pressure, including public viewing, can potentially have a negative effect on elk. Elk are a valuable resource for recreational viewing and areas should be designated for this purpose, but in breeding, calving, and wintering areas, viewing must be limited. Elk viewing opportunities should be made available in areas that provide observation of elk at a reasonable distance so as not to become detrimental to the resource. Elk have become habituated to humans in Pennsylvania, Michigan, Yellowstone National

Park and may other areas. If elk are viewed at close range, visitors can more easily artificially feed the animals and ultimately elk lose their natural fear of people. In Pennsylvania and other areas, elk that lost their fear of humans have become aggressive toward people and have caused a public safety problem, which could result in destruction of the animal.

Benefits Elk Provide for the Public

Viewing

Pennsylvania's elk herd is the eastern most free-ranging herd in the United States. The herd attracts thousands of wildlife watchers each year. During 1987 an estimated 7,200 recreational visitor days (RVD) and \$11.85 per day per viewer were spent by the public viewing elk in Pennsylvania (Shafer and Wang 1989). The economic value of the viewing experience; i.e., the amount the public was willing to pay, was estimated at \$147,096 (Shafer and Wang 1989). The number of visitors traveling to Pennsylvania's elk range has increased dramatically since 1987. It is not uncommon to see 1000 vehicles per weekend day on Winslow Hill, during the fall rutting season. Winslow Hill is the PGC elk viewing area because of the increased likelihood of seeing elk compared with the rest of the Elk Management Area. In 1997, Penn State University reported 76,000 visitor days with approximately \$17.11 spent per day (\$1.3 million total) (Strauss 1999). This figure has likely increased since the study was conducted. The influx of tourists within the Elk Management Area has benefited the local economy through lodging and meal expenditures, and the purchase of fuel, groceries, and sporting goods.

Many visitors cite the "wilderness" experience of being within the northwoods as the main attraction of the elk range. Others cite the idea of Pennsylvania's wildlife habitat supporting this massive cervid, especially bulls with impressive antlers.

Elk viewers not only benefit from the experience of seeing elk but also seeing other wildlife species sharing the same habitat such as deer, turkey, grouse, cottontails, snowshoe hares, woodcock, beaver, bear, song birds, other small mammals, and avian predators.

Pennsylvania Wilds Project

Pennsylvania Wilds is a project developed by DCNR to "encourage the growth of tourism and related businesses in Northcentral PA" based on the available outdoor experiences in this region of the State. "The goal is to enhance the visitor experiences in this region, while protecting and conserving these treasured natural resources. The focus includes improvements to the natural resources, infrastructure and visitor services of the region." The intention of this project is to provide additional recreational experiences and opportunities in Northcentral Pennsylvania including the Elk Management Area. Benefits derived from increased tourism and money spent by these tourists should aid the

economy of local communities. *A Plan for Elk Watching and Nature Tourism in North Central Pennsylvania* has been developed and is being implemented as funding permits.

Hunting

Although classified as a big game animal, elk were not hunted in Pennsylvania from 1931-2000. In 1998, a 15-member committee proposed a plan to hunt elk in Pennsylvania. This plan was displayed across Pennsylvania at open houses for public comment. Using input from these meetings, the plan was revised and approved by the Executive Director of the PGC. In 2001, the legislature created an elk license.

This success story was due in great part from dedicated sportsmen and women of Pennsylvania and conservation groups that supported the elk herd prior to hunting. The first elk season was held November 10-16, 2001. Thirty licenses were issued for the first elk season in 70 years.

Management areas were devised the first year to target subpopulations of elk based on radio telemetry data and observational sightings for the last twenty years. The goal was to harvest elk where needed to address elk/human conflicts and manage densities. These management areas also permitted distribution of hunters across the Elk Management Area. A no hunting area was established on Winslow Hill, the prime viewing area, to eliminate the negative stigma of harvesting habituated elk.

Since the first year, applications have decreased but have leveled out at around 20,000 (Figure 7). For the first five years of hunting, the harvest success has been 80 percent.

Impacts on other Wildlife Species

Disease Transmission

Elk are susceptible to a variety of diseases and physical anomalies (Kistner et al. 1982). The most common is brainworm (*Pneumostrongylus tenuis*) which is referred to as meningeal worm. Brainworm can and often does become a debilitating disease for elk. They do, however, have the ability to survive exposure to small numbers of brainworms (Samuel et al. 1992).

The brainworm is the most common cause of disease among elk populations in the eastern United States (Severinghaus and Darrow 1976, Eveland et al. 1979, and Raskevitz et al. 1991, Larkin et al. 2003). From 1975-2004, brainworm was reported as the cause of death for 45 elk. The brainworm attacks the central nervous system and can cause lethal neurological disease (Anderson et al. 1966, Samuel et al. 1992), but its effects on the abundance and distribution of cervid populations are unknown (Nudds 1990). Brainworm was implicated in the failure of some elk reintroductions (Carpenter et al. 1973, Severinghaus and Darrow 1976, and Raskevitz et al. 1991) and was thought to

have limited elk population growth in Pennsylvania (Eveland et al. 1979). More recently, Larkin et al. (2003) reported that juvenile elk in Kentucky appeared to be more susceptible to brainworm than adults. A similar finding was reported for Pennsylvania elk (Cogan 1996). Its potential effect on population growth in Kentucky's elk herd has warranted a three year study.

Other diseases such as CWD, brucellosis, and bovine tuberculosis also can affect elk. CWD is a fatal neurological disease. It attacks the brain and causes the animal to become emaciated, display abnormal behavior, lose bodily functions and die (Colorado Department of Natural Resources). Brucellosis is an infectious disease that lacks the display of symptoms. The bacteria *Brucella* collects in the reproductive tissues and can cause reduction in pregnancy and also lead to abortion (Greater Yellowstone Interagency Brucellosis Committee). Bovine Tuberculosis is caused by bacteria that attack the respiratory system. Animals display nasal secretions, have difficulty in breathing and become emaciated (Michigan Department of Natural Resources). Fortunately, none of these diseases have been documented in Pennsylvania. The PGC has been monitoring for the presence of these diseases. Each elk harvested during the elk season is required to be checked at the Elk Check Station. Tissue and blood samples of each animal are taken for testing of these diseases. So far, negative findings for these diseases have been the result of this information collected on these animals.

Elk and Deer Interactions

In Pennsylvania, there does not appear to be a high degree of interspecific competition between white-tailed deer and elk, except during severe winters when both deer and elk occupy conifer stands and lowland drainages. In winter, deer tend to concentrate in conifer stands, swamps, and cuttings, while elk spend more time in aspen-hardwoods and conifer-hardwoods. Deer normally begin to yard in conifer stands and lowlands when snow depths exceed 12 inches. Elk tend to move to conifer stands and lowland drainages when snow depths reach 24 inches.

In Pennsylvania, managers have found no evidence the presence of elk suppress deer populations. In fact, elk have been beneficial to other wildlife because of the interest generated by the elk's high profile status. This keen interest in the status of the elk has generated funding for elk habitat projects that also benefit many types of other wildlife and help to protect our natural resources.

Biodiversity

Many wildlife species such as bobolinks, eastern meadowlarks and savannah sparrows, depend on open grassland. These species have declined in recent decades, or have restricted habitats, as their native habitat continues to be compromised. Such species would likely benefit from the creation of herbaceous openings within the elk range. The creation of herbaceous openings for elk also benefits other game species such as deer, turkey, and furbearers.

Habitat enhancement projects within the elk range improve the quality of the landscape and water, thereby increasing biological diversity as well as the overall quality of the elk range. Furthermore, many species benefit from lands purchased and managed with monies provided by those interested in elk management.

Elk Habitat Management Practices

Optimal habitat for elk should be provided, within the elk range, on state owned land and cooperative private lands to provide the life requisites for elk and to minimize landuse conflicts and conflicts with other wildlife species. Optimal habitat for elk is critical for two reasons. Elk need suitable areas of winter and spring food to simply survive. Summer and winter thermal cover is also required to help elk endure the heat and cold. These factors appear to affect the maximum productivity of elk. Equally important, optimal habitat for elk within the key areas will help reduce or deter elk from foraging in conflict areas such as agricultural lands.

Habitat Management

Within Pennsylvania's 835 square mile (534,400 acres) Elk Management Area, the BOF is the largest landowner with approximately 526 square miles (336,742 acres), which include portions of the Elk, Moshannon, and Sproul State Forests. The PGC manages an additional 44 square miles (28,270 acres) that include portions of SGL 14, 34, 94, 100, 311, and 321. Habitat enhancement projects have been concentrated in the southern range on portions of the Elk, Moshannon and Sproul State Forests because elk use of these areas continues to increase due, in part, to low or no human conflict.

Creation and Maintenance of Herbaceous Openings

Normal statewide operating guidelines specify that 2-5 percent of state forest and state game lands be maintained as herbaceous openings. Since elk are primarily grazers, special emphasis needs to be given to the management of existing herbaceous openings and enhancing unproductive sites. Within the Elk Management Area, the operating guidelines may need to be higher than statewide guidelines; however, further study is necessary to determine that percentage. Currently, there are 1638 acres (>1%) of state lands actively being managed in herbaceous openings. Additionally, elk will use other types of habitats that are not normally thought of as herbaceous openings such as clearcuts, pipeline and powerline ROWs, and riparian areas. Together, these areas account for about 7% of the state lands.

Based on observation, elk spend the majority of their time foraging in herbaceous openings. In addition, elk movements are influenced by the location, quality and quantity of these areas. Elk tend to use larger openings (eight or

more acres) in summer and early fall. Preferred foods include clovers and trefoils that grow best in warm weather. In early spring and late fall, the preference shifts to areas with orchard grass, timothy and winter wheat. Habitat enhancement work focuses on development of “herbaceous openings,” sometimes referred to as “food plots” or “wildlife openings,” where annual plants, grasses and legumes are the predominant plant species. In addition to elk, turkeys, deer, bear, small mammals, grassland songbirds, grasshoppers, and many other species benefit from these herbaceous openings. These areas are critical components for many native species living in Pennsylvania.

In the Fall of 2001, recognizing the importance of habitat improvements to elk and other species, the PGC, DCNR and the RMEF launched a major partnership effort to raise an additional \$1.2 million over three years to establish and enhance wildlife habitat in the state’s elk range. The goal of the partners was to jumpstart the effort to implement a comprehensive habitat development plan that will nearly double the amount of improved habitat in the 835 square mile elk range from about 1,100 (based on most recent GPS data) acres to over 2,000 acres. This plan provides a blueprint for establishing, improving, and maintaining habitat to benefit a broad spectrum of wildlife in the elk range.

A joint agency habitat committee selected several areas for enhancement from 80 proposed sites. These sites were selected to reduce private landowner conflicts and to encourage the long-term health, growth, and distribution of the herd throughout the range. Additionally, the enhancements seek to manipulate elk distribution and movements across the current range by attracting elk to habitat complexes on public lands. This will allow for better management of conflicts, control elk movements, and determine potential densities across the elk range in the future.

The habitat initiative expanded previous efforts for improving elk habitat that was concentrated in the northwest corner of the elk range. It also developed considerable habitat improvements on the rest of the range on state game lands and state forest lands. At the start of the initiative, there were about 438 acres of habitat improvements within the 212 square mile northwestern corner of the range and 658 acres of habitat improvements in the remaining 600 square miles. Improvements included planting a mixture of legumes (ladino, red, white, dutch and alsike clover, bird's foot trefoil, and alfalfa) and grasses (timothy and orchard grass) using a grain (oats in spring and winter wheat in the fall) as a nurse crop on unreclaimed strip-mine areas, existing pipeline and electric right-of-ways.

One of the plan’s goals is to distribute herbaceous openings throughout the range in “complexes”, which are a series of openings spanning 40-80 acres over an 8 to 12 square mile area. From radio telemetry data collected by the PGC, it is known that 60 to 90 elk will spend most of their time within the boundaries of such complexes, moving from one opening to another to forage for food. The elk the PGC refer to as the Bear Hollow Elk were used to develop this complex approach.

Habitat Improvement Work

The amount of habitat improvement work conducted will always be limited by the amount of available funding. The PGC recognizes that the amount of work needed to improve the Elk Management Area cannot be fully funded by current budget outlays to the food and cover crews. To accommodate the expanding elk herd, additional herbaceous openings will have to be constructed within the proposed enlarged Elk Management Area. Also, it may be necessary to increase the acreages of existing herbaceous openings.

The groundwork is already in place to coordinate a comprehensive wildlife opening program. The PGC intends to continue to utilize the elk habitat committee of BOF employees and RMEF representatives to coordinate the effort for construction and maintenance of food plots. The emphasis for these new food plots will be the eastern portion of the current Elk Management Area. Additional plots would be constructed in close proximity to existing plots to encourage elk movement. These plots would be located utilizing land where the habitat would benefit from additional food plots. The development and construction of new plots would proceed in an easterly fashion.

The PGC will coordinate with BOF personnel on submitting applications for grants for habitat work to conservation organizations such as the RMEF. In the past, the RMEF has provided substantial sums of money for habitat projects to benefit all wildlife. With limited state budgets, funding from private sources and conservation organizations will be the key to how much habitat improvement work occurs.

Reducing Human Disturbance

The PGC and BOF should continue to restrict and enforce laws pertaining to closed road violations. Both agencies should minimize public vehicular access in the area bounded by the West Branch of Hicks Run, Dents Run, Dark Hollow, Belle Draft, and Shaffer Draft Roads. These secluded areas of state forest lands and state game lands provide an area of limited disturbance for elk during periods of escalated human presence. The Dents Run drainage is especially critical to elk, deer, and turkey during severe winter conditions. Between 60 and 100 elk and numerous deer and turkey, have been known to winter in this drainage; therefore the option should be available for the PGC and/or BOF to close this area to vehicles during severe winter conditions to minimize human disturbance for various wildlife species. Also, snowmobiles, by their nature of operating in critical times for wildlife can cause stress to elk. Snowmobiles should not be permitted in elk wintering areas. The PGC and BOF must minimize vehicular traffic within the elk range (i.e. Gilmore Trail, pipelines and electric line right-of ways). All access roads leading to food plot complexes should be gated and closed to vehicular traffic with the option to open these areas to vehicular travel during regular deer seasons.

Habitat Management on Private Land

Cooperative landowners within the elk range should be contacted and encouraged to enroll in the PGC Forest, Farm or Safety Zone public access programs. The PGC provides technical assistance to cooperating landowners concerning habitat management practices beneficial to elk and other wildlife. The PGC and BOF should assist landowners by providing forest management recommendations and guidelines (preferred species, composition, rotation) for elk. The PGC should encourage landowners to restrict off-road vehicle access to areas heavily used by elk and other wildlife through the use of gates, signs, designated parking areas or other mutually agreeable tactics.

Goals and Objectives

Vision Outline

The PGC recognizes its mandate to manage and protect all Pennsylvania wildlife, including elk, for the benefit of the citizens of the Commonwealth. The Commission shall continue to protect and manage (enhance) habitat and lands within the Elk Management Area. The Commission will maintain a healthy elk population within the Elk Management Area to provide hunting and viewing recreation while carefully monitoring human – elk conflicts. The Commission shall take action deemed necessary to resolve elk – human conflicts occurring on private land. In addition, the Commission will also strive to minimize damage to private property caused by elk.

Goal 1: *Maintain and enhance the elk population in suitable habitat within a defined Elk Management Area.*

Objective 1.1 – Establish an elk management area that is easily recognizable, contains more than 50% public property, and minimizes additional agricultural areas by November 2006.

Recommended Strategies

- 1.1.1 – Enlarge the area where elk will be actively managed from the current 835 square mile area to 3750 square miles by July 1, 2006.
- 1.1.2 - Make use of clearly delineated boundaries such as state highways to define the elk management area by July 1, 2006.
- 1.1.3 - Identify, classify, and categorize the current habitat types within the Elk Management Area using GIS by January 1, 2009.
- 1.1.4 - Establish well-defined elk management units according to habitat availability within the Elk Management Area by July 1, 2007.
- 1.1.5 – Utilize the designated elk management units to establish elk hunting zones by January 1, 2007.

Objective 1.2 – Develop a habitat use model of elk in Pennsylvania by January 1, 2011 for management of habitat within the Elk Management Area.

Recommended Strategies

1.2.1 – By January 1, 2009 develop a 3-year habitat use study of elk in cooperation with Indiana University using radio telemetry and GIS.

1.2.2 – Annually maintain existing wildlife openings within the Elk Management Area.

1.2.3 – Annually (depending on condition of food plot) plant vegetation in wildlife openings emphasizing species preferred by elk.

1.2.4 – By January 1, 2016 have completed extensive habitat enhancement projects allowing naturally migrating elk to find adequate habitat for development of sub-populations.

Objective 1.3 – By 2016, provide necessary elk life requirements throughout the Elk Management Area by implementing sound wildlife management practices.

Recommended Strategies

1.3.1 – By January 1, 2011 have data available to evaluate elk habitat use to determine the importance and use of habitat types.

1.3.2 – By 2016 establish strategically located wildlife openings that will benefit elk.

1.3.3 – Annually acquire land for public ownership that is critical for elk use with an emphasis on riparian areas.

1.3.4 - Annually evaluate abandoned mine areas which may be converted to suitable elk habitat if restored to natural conditions.

1.3.5 – Annually attend meetings of federal, state, and local government agencies monitoring the presence of noxious plants, particularly in riparian areas that degrade elk habitat.

1.3.6 – Annually evaluate closing of roads to certain habitat areas frequented by elk.

1.3.7 – Annually coordinate forestry management practices and operations that enhance elk habitat.

Goal 2: Maintain a self-sustaining elk population that will provide recreational opportunities such as hunting and viewing.

Objective 2.1 –Monitor the elk population within the Elk Management Area.

Recommended Strategies

2.1.1 – Annually determine elk population size and distributions by elk management units.

2.1.2 – Continue a calf survival study started in 2005.

2.1.3 – Utilize radio tracking devices and other state of the art equipment to assist with research on the elk population.

- 2.1.4 – Maintain records of elk locations and monitor movements for herd dispersal to establish sub populations beginning in 2006.
- 2.1.5 – Develop a research study to gather data on elk diets and food preferences in cooperation with Indiana University.
- 2.1.6 – Continue to utilize an elk population survey using ground-based techniques to determine population trends and density.

Objective 2.2 - Establish an annual elk hunting season.

Recommended Strategies

- 2.2.1 - Annually evaluate the status of the herd to determine the viability of conducting an elk hunt.
- 2.2.2 - Assess elk telemetry locations within the elk management units to establish hunt zones.
- 2.2.3 - Assign harvest recommendations to established hunt zones.

Objective 2.3 – Continue to utilize the Elk Check Station for collection of harvest, age structure, and presence of diseases.

Recommended Strategies

- 2.3.1 – Annually coordinate with the Bureau of Forestry for use of the Quehanna Ranger Station as the location of check station.
- 2.3.2 – Annually gather biological information such as sex, age, and DNA samples of each animal brought to the check station.
- 2.3.3 – Annually coordinate with staff veterinarian to collect sample for testing of tuberculosis, brucellosis, chronic wasting disease, and other diseases determined to be in need of testing.

Objective 2.4 - By July 1, 2008 provide quality recreational opportunities for elk viewing.

Recommended Strategies

- 2.4.1 – Annually evaluate habitat enhancement activities where viewable wildlife activities can take place.
- 2.4.2 – Annually monitor and address tourism related activity problem situations that arise which may invoke safety issues.

Goal 3: Improve the public's knowledge about elk and the elk management program.

Objective 3.1 – Beginning in January 1, 2007 have programs in place allowing for the dispersal of information to assist in educating the public about elk.

Recommended Strategies

- 3.1.1 – Present elk programs at the viewing area on Winslow Hill throughout the year.
- 3.1.2 – Provide public outreach programs throughout the year.

- 3.1.3 – Present elk programs when requested by media organizations.
- 3.1.4 – Provide an elk display when requested and practical at fairs, conventions, and trade shows, etc.
- 3.1.5 – Semiannually prepare elk status reports and develop news releases throughout the year for distribution to the public.
- 3.1.6- Beginning January 1, 2007 provide a power point program for distribution to qualified and knowledgeable personnel for use in conducting programs for the public.
- 3.1.7- Beginning January 1, 2007 utilize the internet for periodic updates and information about the elk management program.
- 3.1.8 – Beginning January 1, 2007 provide assistance and information to DCNR and other organizations at various facilities throughout the Commonwealth when requested.
- 3.1.9 – Annually conduct a teacher workshop for the purpose of providing information to classroom teachers to be used later in their classroom instruction.
- 3.1.10 – Participate in field trips throughout the year highlighting work being conducted in the Elk Management Area.
- 3.1.11 - Continue to be a partner in the “PA Wilds” program and attend scheduled meetings.

Goal 4: Reduce Elk/Human Conflicts to levels considered safe and acceptable by the Citizens of the Commonwealth.

Objective 4.1 – By 2016 have an elk herd that is not causing irreparable damage to habitat and is not damaging private property.

Recommended Strategies

- 4.1.1 – Annually identify problem areas by assessing conflict reports within the Elk Management Area.
- 4.1.2 – Annually utilize hunting as a technique to eliminate or reduce elk/human conflicts within established elk management units.
- 4.1.3 – Actively pursue violations of the ban on feeding elk on an as needed basis.
- 4.1.4 – Annually evaluate the need for fencing to resolve damage complaints to private property.
- 4.1.5 – On a daily basis prioritize law enforcement activities to address damage complaints and problem situations.

TABLES and FIGURES

Table 1. Number of age/sex class per 100 cows calculated from winter population surveys from 1988-2003.

	89	91-92	92-93	93-94	94-95	96-97	98-99	99-00	00-01	02-03	Mean
Calves	23	31	30	47	29	27	36	42	42	34	34.1
Spikes	14	10	18	9	18	11	13	18	18	7	13.6
Branch Antlered Bulls	38	27	32	36	32	39	28	34	34	26	32.6

TABLE 2. Calf production for translocated radio collared elk in Northcentral Pennsylvania, 1998-99.

	Bitumen Release		Hevner Run Release
	1998	1999	1999
Cows	9	8	6
Calves produced	8	6	4
Calving rate*	<u>89%</u>	<u>75%</u>	<u>67%</u>

*Traditional Range (1991-1997): 67%

Table 3. Causes of known non-harvest elk mortalities in Cameron, Clearfield, Clinton, Elk, Jefferson, and Potter Counties, Pennsylvania, 1975-2005.

Year	Crop Damage	Illegal	Highway	Brainworm	Winter Mortality	Accidental	Train	Disease	Other	Birthing Complications	Dogs	Unknown	TOTAL
1975	2	3	1	3								3	12
1976	5	2		2								1	10
1977	2	4	1										7
1978	1	7		5								2	15
1979		2		1								2	5
1980	4	4		2				2				1	13
1981	6	1	2					1					10
1982	11	15		2	5						2		35
1983	5	5		2								3	15
1984	2	4										1	7
1985	4	4			1			1				1	11
1986	3	2		1									6
1987	8	1		1								2	12
1988	2	3	1	1				1				5	13
1989	2	8						1				1	12
1990	10	2	1			1							14
1991	9	4	3	5								3	24
1992	1	3		3		1			2			2	12
1993	1	3	2		5	2	1					2	16
1994	1	4		3		3	1	1	1	2		2	18
1995	2	6	1	2	1	4	1			1		3	21
1996		2	6	3	1	1	2	1	1			3	20
1997	2	3	6	2		5						4	22
1998	3	5	4	1		2	3		1			8	27
1999	13	6	11	2	1	1	8					5	47
2000	4	6	12	1		3	6		2			16	50
2001	5	6	8	2		3	1					13	38
2002	17	8	11	1		2	5					6	50
2003	12	2	8			2	1					4	29
2004	6	4	7	2	1	2	1	1				6	30
2005	6	5	12	5		3						4	35
TOTAL	149	134	97	45	14	35	30	8	7	3	2	103	627
%	23.8	21.4	15.5	7.2	2.2	5.6	4.8	1.3	1.1	0.5	0.3	16.4	100
MEAN	5.07	4.31	4.88	2.14	2.33	2.31	2.90	1.14	1.40	1.50	2.00	3.88	20.0

Table 4. Calculated MCP home ranges for radio collared elk during 2004-2005 in Pennsylvania.

Sex	Age	Collar #	Miles²
F	ADULT	7	4.51
F	ADULT	1	9.42
F	ADULT	8	8.35
F	<i>ADULT</i>	<i>No Number</i>	4.90
F	ADULT	16	6.28
F	ADULT	26	6.97
F	ADULT	11	7.78
F	<i>ADULT</i>	<i>No Number</i>	33.67
F	<i>ADULT</i>	23	23.95
F	<i>ADULT</i>	<i>No Number</i>	16.65
F	ADULT	10	9.99
F	<i>ADULT</i>	<i>No Number</i>	33.67
F	<i>ADULT</i>	<i>No Number</i>	17.25
F	<i>ADULT</i>	<i>No Number</i>	17.85
F	<i>ADULT</i>	<i>No Number</i>	19.80
F	<i>ADULT</i>	<i>No Number</i>	27.90
F	<i>ADULT</i>	4	12.37
F	ADULT	12	24.69
F	ADULT	2	16.87
F	<i>ADULT</i>	49	11.54
F	<i>ADULT</i>	46	37.97
F	ADULT	32	7.06
M	ADULT	5	4.78
M	ADULT	21	23.71
M	ADULT	24	23.43
M	ADULT	64	18.24
Mean	F=16.34	M=17.54	

***Bold italics** indicates home range is predominantly outside of northwest corner of elk range.

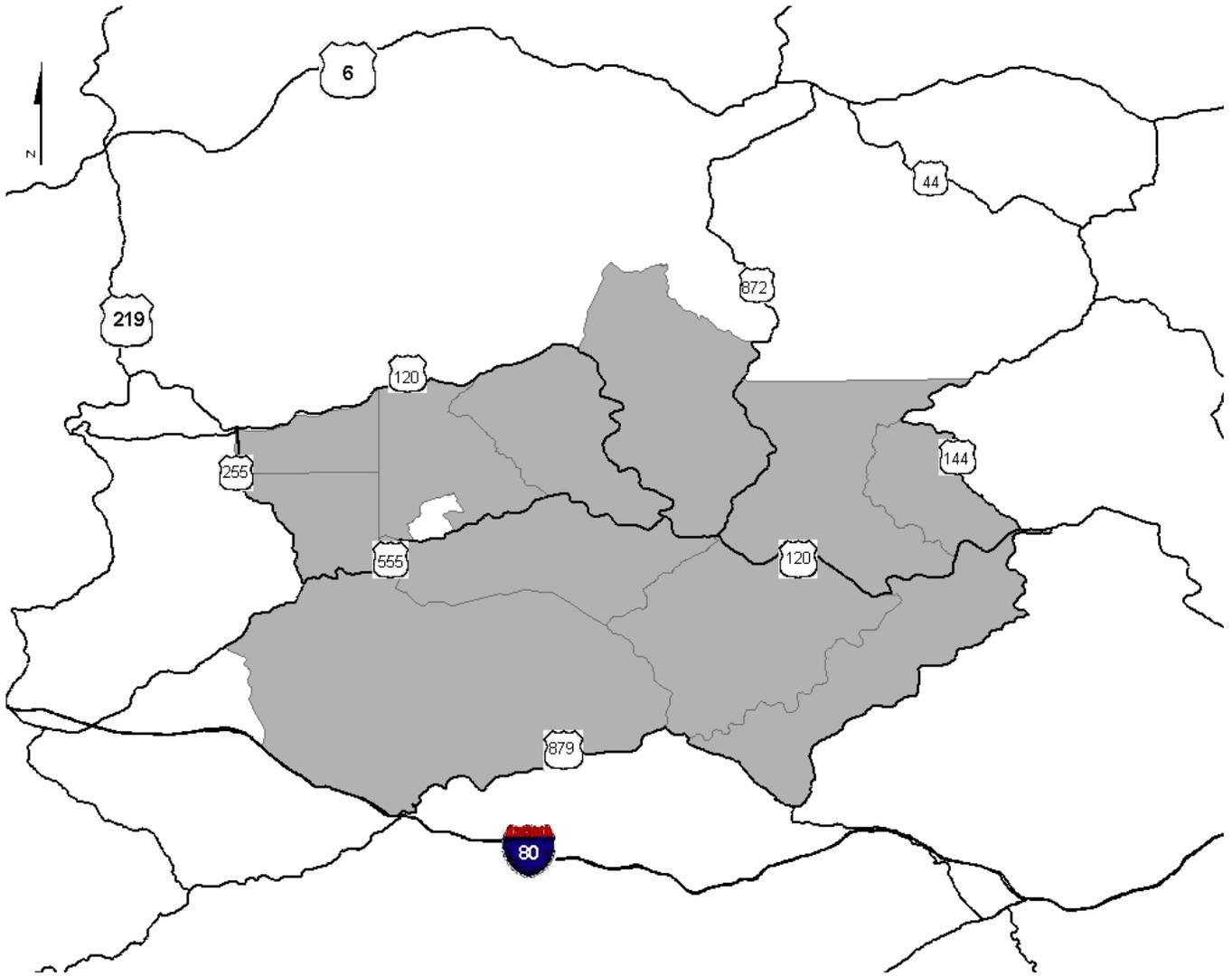


Figure 1. Elk Management Area (gray shaded area) in 2005.

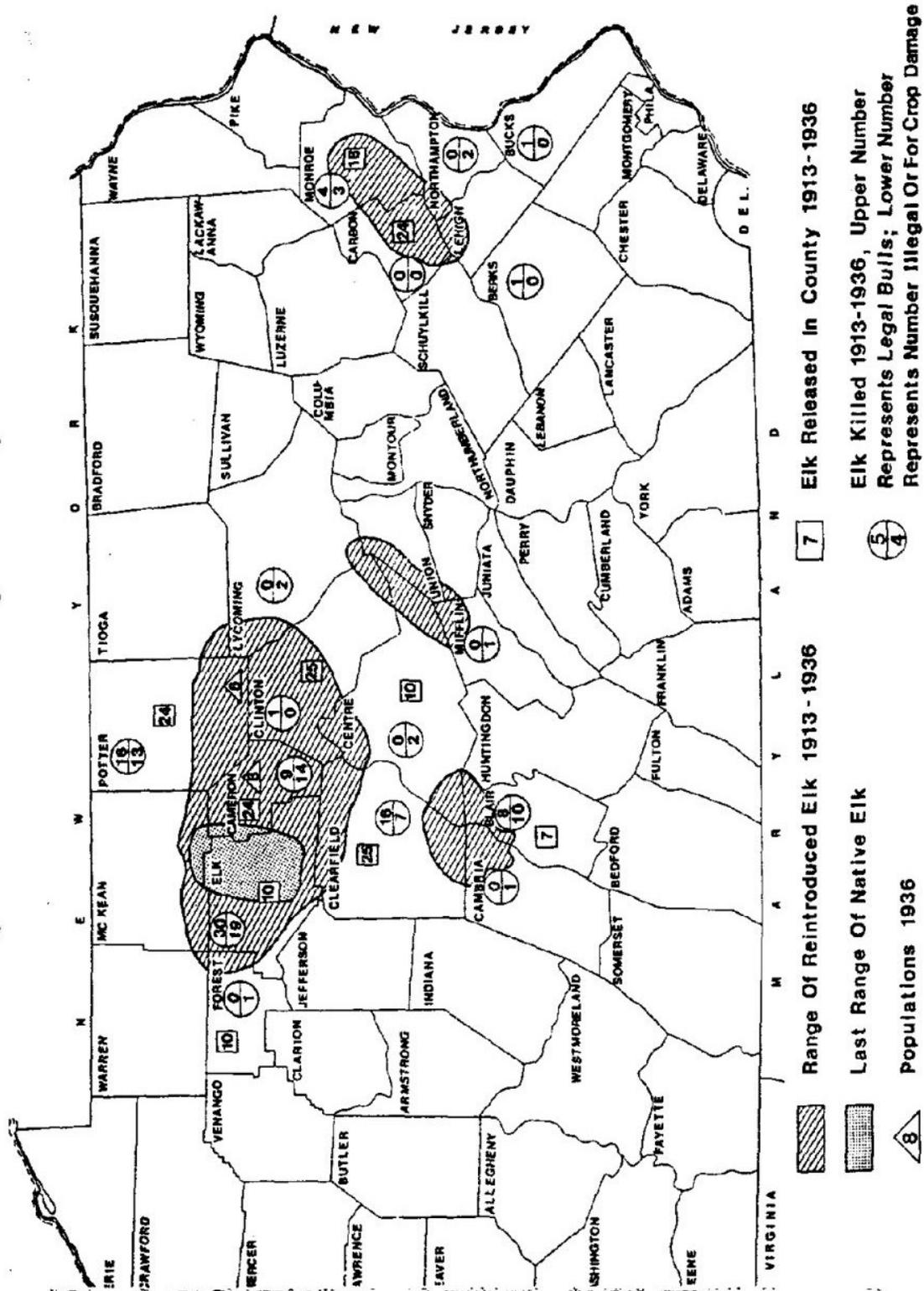


Figure 2. Range and numbers of reintroduced elk in Pennsylvania, 1913-1926.

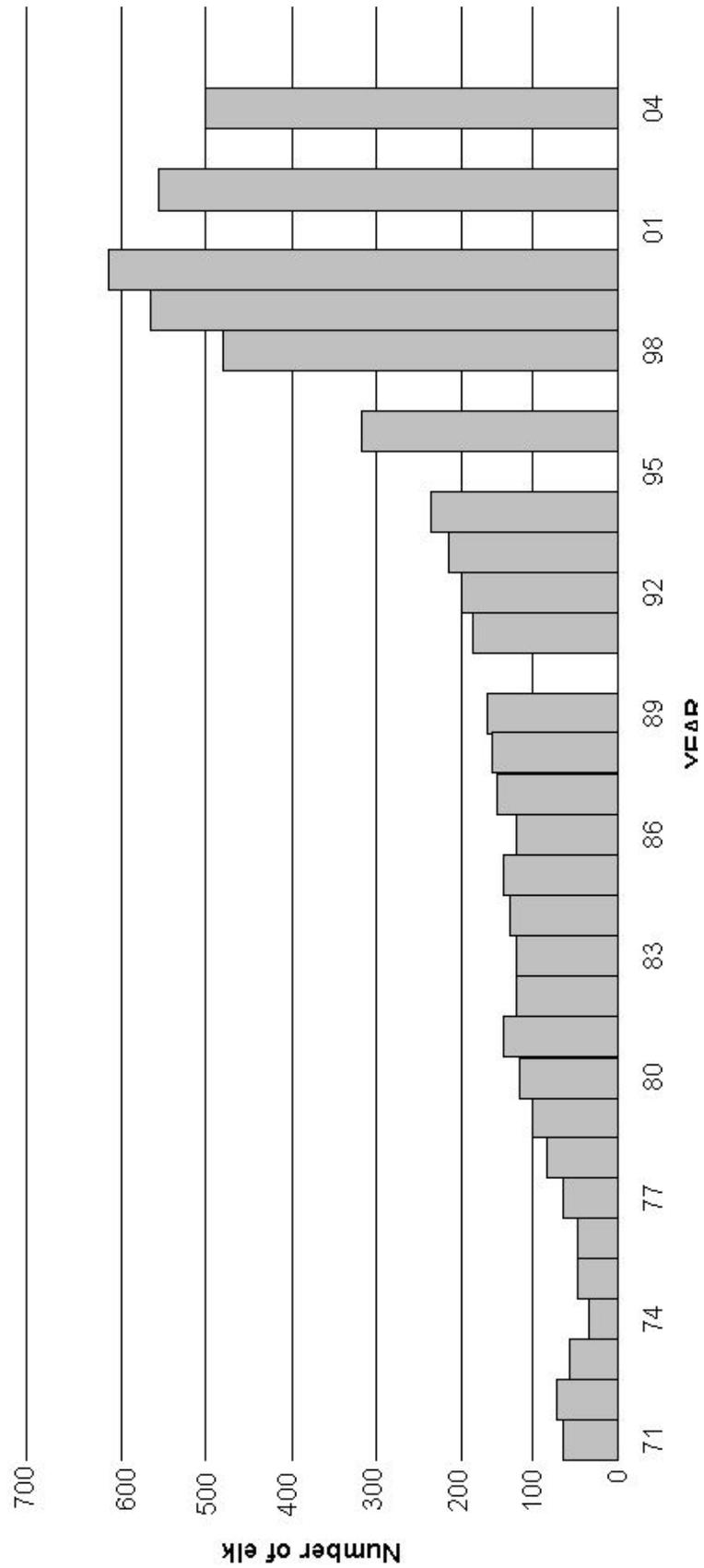


Figure 3. Elk population estimates 1971-2004.

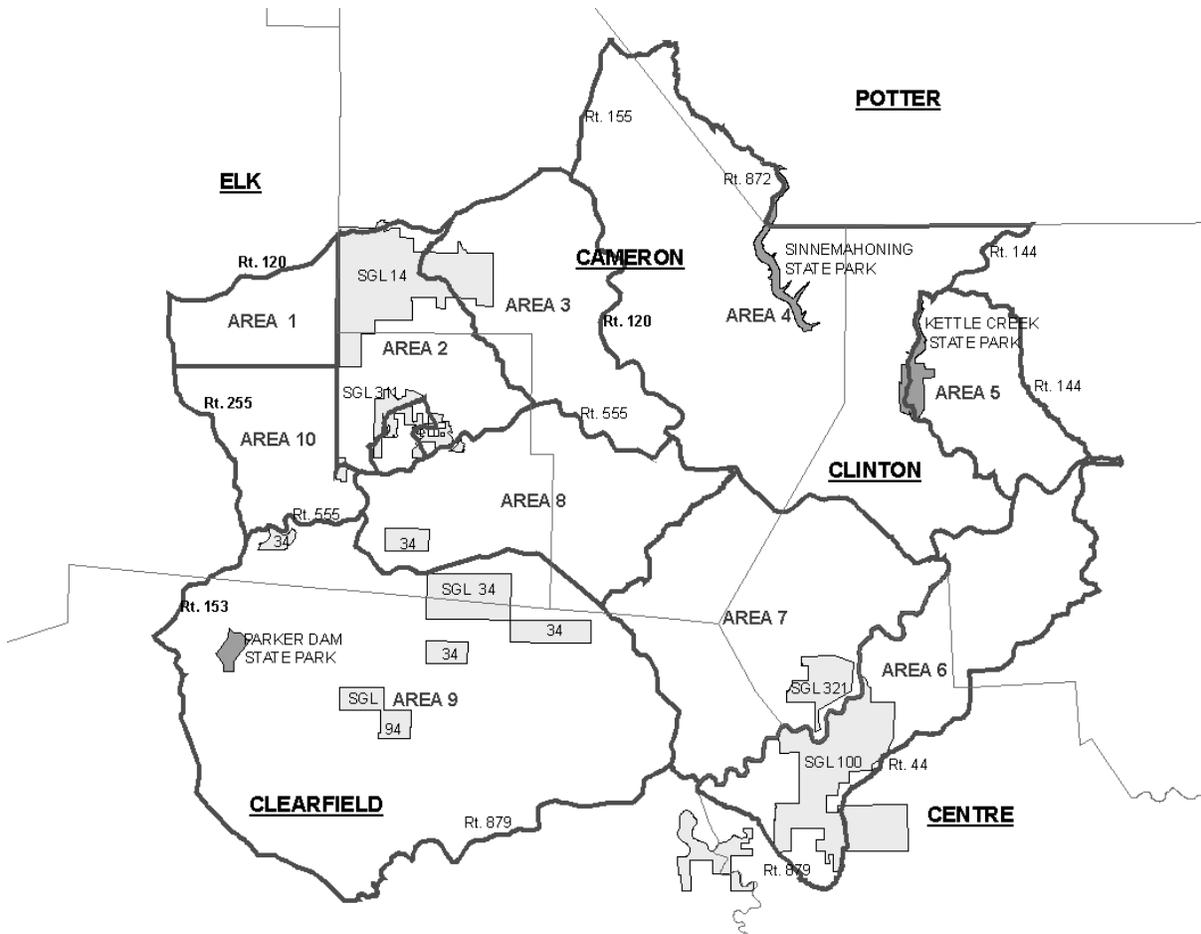


Figure 4. Current Elk Management Area in Pennsylvania.

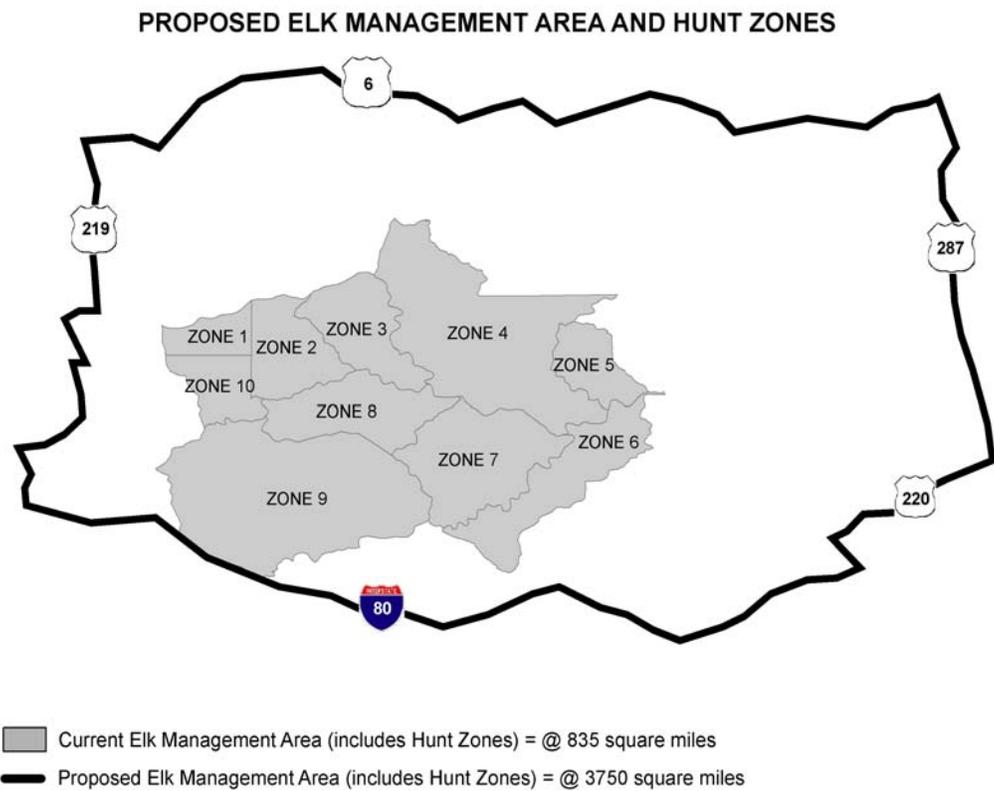


Figure 5. Proposed Elk Management Area.

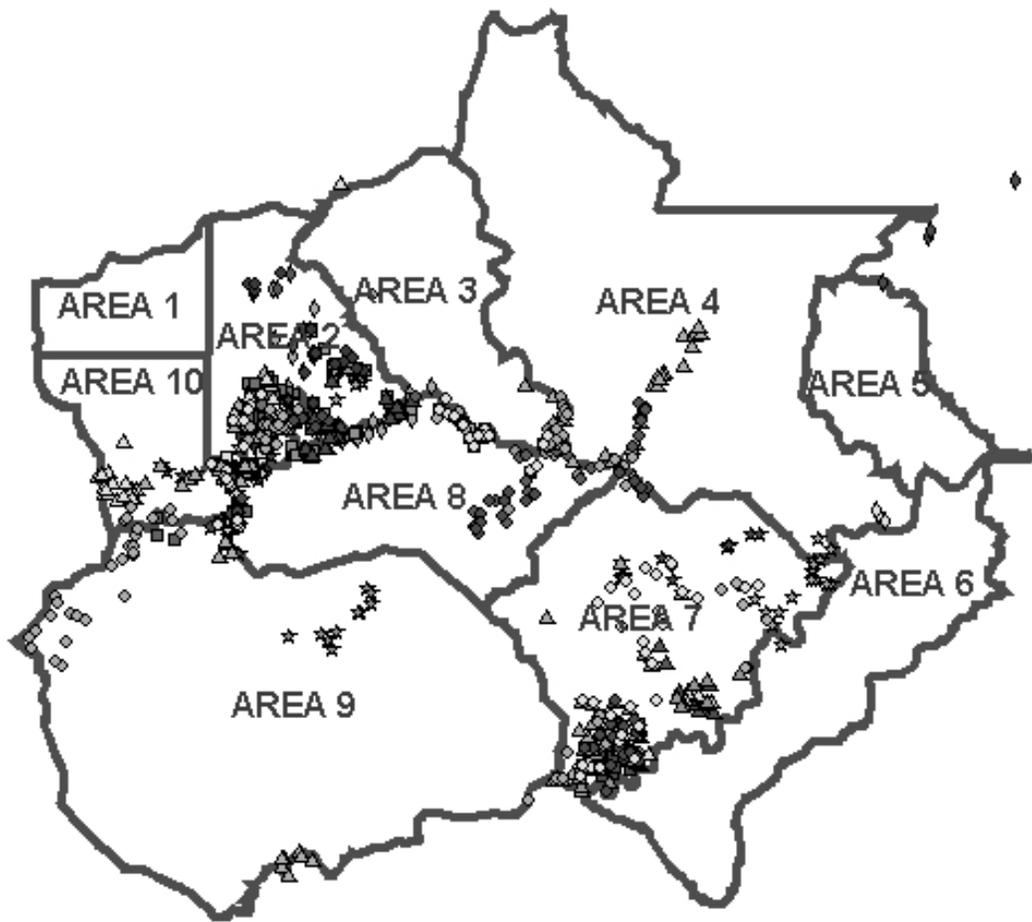


Figure 6. Telemetry locations of radio-collared elk in Elk Management Area.

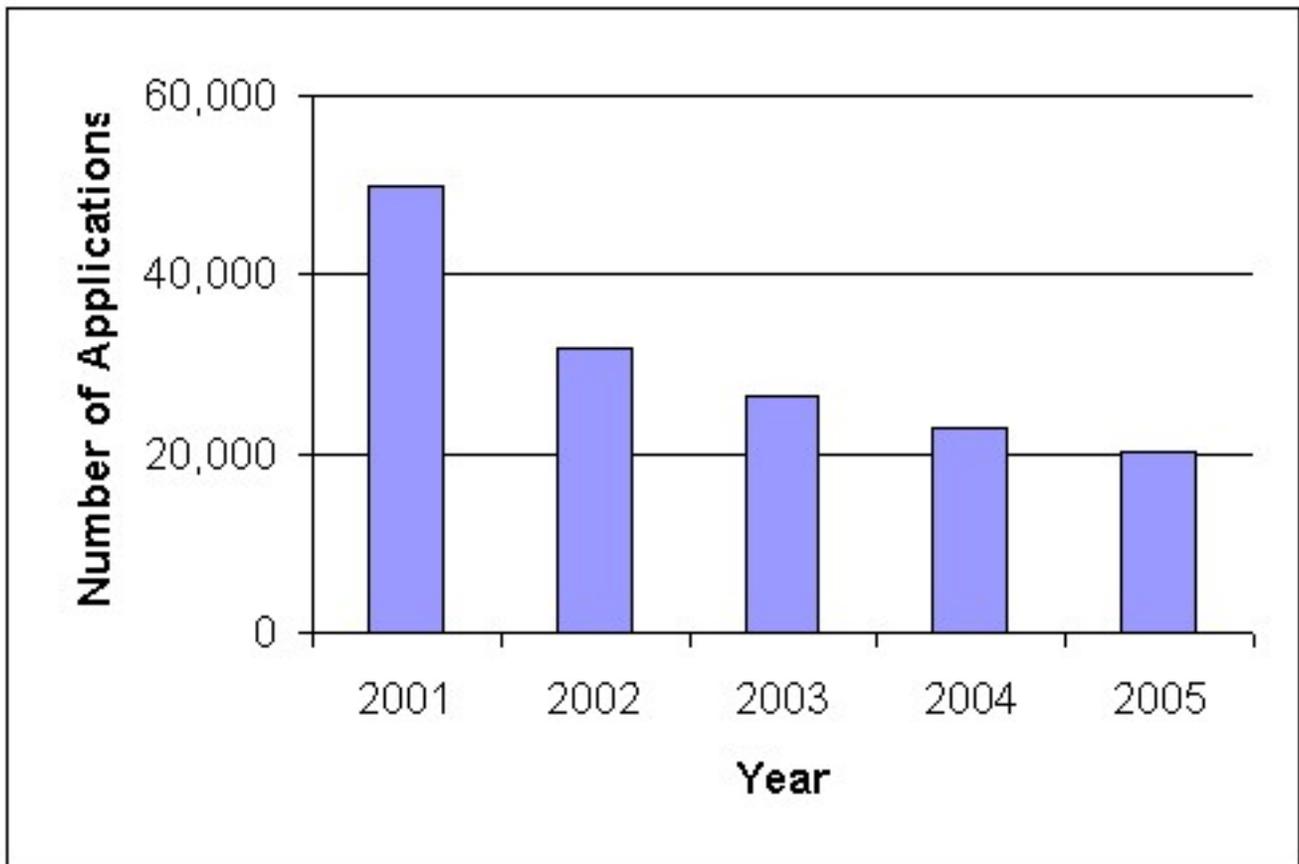


Figure 7. Number of elk license applications 2001-2005.

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