

ELK MANAGEMENT IN PENNSYLVANIA A FIVE-YEAR PLAN (2020-2025)



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EXECUTIVE SUMMARY

Prior to European settlement, elk (*Cervus canadensis*) inhabited nearly all of Pennsylvania, with the highest densities occurring in the Allegheny Mountains. Rapid expansion and exploitation by early European immigrants along with habitat changes caused the population to diminish across the Commonwealth and by most accounts elk were extirpated by 1877. In 1913 the Pennsylvania Game Commission began reintroducing elk to the Commonwealth. In total, 177 elk were released between 1913-1926. Following reintroduction, the elk population increased and then declined in a matter of just 20 years. Beginning in the late 1970s through the today, Pennsylvania's elk population has rebounded, presently numbering over 1000 animals. In the past 20 years the Pennsylvania public has embraced the existence of their elk population and elk are valued as a source of recreation by hunters and non-hunters alike.

Pennsylvania's elk population is a valuable public resource available for the enjoyment and benefit of all people. The Pennsylvania Game Commission, as the Commonwealth's wildlife management agency, is legally mandated to manage the elk population as well as the habitat that supports their existence for both current and future generations. Based on this direction, the Game Commission adopted the mission statement - to manage Pennsylvania's elk for population sustainability, habitat health, and social acceptance while maximizing recreational opportunity.

While this mission statement provides general guidance, specific goals must be written for each program area. The elk management goals from 2020 to 2025 are to (1) manage elk for health and sustainability, (2) apply our understanding of elk habitat to influence populations and distribution, (3) manage elk to provide recreational opportunity, (4) manage elk-human conflicts at acceptable levels, and (5) improve the public's knowledge and understanding of elk and the elk management program. These goals are the result of a public involvement process. During development of the Game Commission's 2020-2025 elk management plan, the agency engaged stakeholders to gather input on management goals. Elk affect a diverse group of people in Pennsylvania from hunters to citizens growing crops or gardens to those who drive on Pennsylvania's highways. Individuals representing the interests of sportsmen, agriculture, forestry, environmental conservation, and the Game Commission participated. The group was asked to review and discuss a proposed list of goals and objectives. The group unanimously agreed to the 5 goals listed above.

Game Commission staff use these goals as guidelines when making recommendations about elk management in Pennsylvania. The Game Commission follows an adaptive management approach to elk management. Adaptive management is characterized by establishing clear and measurable objectives, implementing management actions, monitoring those actions and the movement toward, or away from, objectives and then adapting management as necessary. Adaptive management recognizes elk management decisions must be made without the luxury of perfect information. We cannot accurately predict months or years in advance what the elk population will be, what people will want, or what habitat will look like. Consequently, the focus of adaptive management is on monitoring responses to management actions and learning. By managing elk in this way, the Game Commission can effectively adapt its management program as conditions change.

In addition to the management goals and directives detailed in Section I, this management plan provides a comprehensive summary of the historic and current status of elk in Pennsylvania in Sections II-VIII. The appendices at the end include additional information that may be of interest to readers.

Major changes from the previous management plan (2006-2016), include a greater emphasis on maintaining transparency and providing information about Pennsylvania's elk and elk management to an interested public. Over the next five years, this plan will ultimately serve as a guide for ensuring the long-term sustainability of Pennsylvania's elk population. Maintaining a healthy population through effective habitat management and controlled through regulated hunting will minimize conflicts and generate continued public support.

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INTRODUCTION

Elk (*Cervus canadensis*) are a charismatic and important big game species in the United States affecting people in both positive and negative ways. The purpose of the Game Commission's elk management program is to balance Pennsylvania's elk population with the habitat available to them, maximizing recreational opportunities while minimizing elk related conflicts. This dynamic challenge illustrates the need for a comprehensive elk management plan.

REGULATORY AUTHORITY AND RESPONSIBILITIES

The Pennsylvania Constitution states, "The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment.

Pennsylvania's public natural resources are the common property of all people, including future generations. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people" (Pennsylvania Constitution, Article 1, Section 27).

Pennsylvania's Game and Wildlife Code directs the Game Commission to protect, manage, and preserve wildlife and their habitat within the Commonwealth (Title 34, Sections 322 and 2102). The Pennsylvania Game Commission is legally mandated to manage wildlife, including elk, for the benefit of all Pennsylvanians, as well as the habitat that supports their existence.

Based on direction from the State Constitution and Game and Wildlife Code, the Game Commission adopted the mission statement – to manage all wild birds, wild mammals, and their habitats for current and future generations. Additionally, the Code guides the agency to use hunting and trapping to manage wildlife populations and to preserve and promote our special heritage of hunting and furtaking by providing adequate opportunity to hunt and trap the wildlife resources of this Commonwealth (Title 34, Sections 103 and 322).

MANAGEMENT PHILOSOPHY

Elk are a valued part of Pennsylvania's wildlife community that can impact other species, their habitat, and people. The Game Commission must manage elk and elk impacts for all stakeholders. Management decisions cannot focus only on elk related tourism or elk hunting or interests of a specific stakeholder group.

Future implications of any management action must always be considered. Elk management decisions cannot be made to satisfy current values or desires without regard to future impacts on wildlife and habitat resources. Managing elk is an integral part of achieving the Game Commission's mission of safeguarding wildlife resources and habitats for present and future Pennsylvanians.

The Game Commission follows an adaptive management approach to elk management. Adaptive management is characterized by establishing clear and measurable objectives, implementing management actions, monitoring those actions and the movement toward, or away from, objectives and then adapting management as necessary. Adaptive management recognizes elk management decisions may be made without perfect information. We cannot always predict future elk population trends, public desires, or habitat conditions. Consequently, the focus of adaptive management is on monitoring responses to management actions and learning. By

managing elk in this way, the Game Commission can effectively adapt its management program as conditions change.

ORIGIN OF ELK MANAGEMENT GOALS

The elk management goals for 2020 to 2025 are to (1) manage elk for health and sustainability, (2) apply our understanding of elk habitat to influence populations and distribution, (3) manage elk to provide recreational opportunity, (4) manage elk-human conflicts at acceptable levels, and (5) improve the public's knowledge and understanding of elk and the elk management program.

These goals are the result of a public involvement process. During development of the Game Commission's 2020-2025 elk management plan, the agency engaged stakeholders to gather input on management goals. A stakeholder is defined as any person who has an interest in or is impacted by an issue. As noted, elk affect a diverse group of people in Pennsylvania from hunters to citizens growing crops or gardens to those who drive on Pennsylvania's highways. Individuals representing the interests of sportsmen, agriculture, forestry, environmental conservation, and the Game Commission participated.

This group gathered in November 2013 ([Appendix E](#)) and was presented with the history of elk management in Pennsylvania and the associated issues and controversies. The group was asked to review and discuss a proposed list of goals and objectives. The group unanimously agreed to the 5 goals detailed in this plan.

ORGANIZATION OF THE ELK MANAGEMENT PLAN

The elk management plan organizes management, research, and outreach efforts toward specific goals, objectives, and strategies. It also facilitates agency accountability by providing justification and details to an interested public. Program success can be measured through plan implementation and the management plan is revised and updated every 5 years.

The management plan is organized into Sections, each with its own focus. Section I, outlines the Mission of our elk management program, followed by the Goals we've established to meet that Mission. Each Goal is met through specific Objectives and each Objective is completed by accomplishing supporting Strategies. In [Section I](#), additional text is provided under each Strategy as a brief justification. Readers interested in learning how the Game Commission intends to manage Pennsylvania's elk population during the current management cycle (2020-2025) should refer to [Section I](#).

In Sections II–VIII, an overview of Pennsylvania's past management activities is presented with each Section dedicated to a specific topic. Readers interested in a historical summary of Pennsylvania elk and elk management through 2018 should refer to these Sections.

A brief conclusion, literature citations, and a summary of the public comments received during the comment period can be found after [Section VIII](#).

Appendices containing additional information appear at the end of the plan. [Appendix A](#) includes a table summarizing the accomplishments of the previous elk management plan (2006-2016). [Appendix B](#) provides a reference to all Pennsylvania specific elk-related research and

includes a summary of each project. [Appendix C](#) is a table containing all Pennsylvania Game News articles related to elk. [Appendix D](#) is the text of all Pennsylvania Laws pertaining to wild elk, and [Appendix E](#) provides the names of individuals who represented stakeholder groups during the plan development.

SECTION I. MANAGEMENT GOALS, OBJECTIVES, AND STRATEGIES

MISSION STATEMENT

To manage Pennsylvania's elk for population sustainability, habitat health, and social acceptance while maximizing recreational opportunity.

This mission requires continual evaluation of elk populations, health, habitats, and social acceptance, accompanied by regular review, trial, and adaptive application of new initiatives.

The mission statement's principles are directly addressed by the following goals. Each goal is supported by several objectives (major tasks) and associated strategies (how to accomplish tasks).

GOAL 1. MANAGE ELK FOR HEALTH AND SUSTAINABILITY

This Goal focuses on the long-term sustainability of our elk population. The following objectives and related strategies are intended to monitor and/or manipulate parameters related to elk population dynamics, health, and risk of disease infection in support of Goal 1.

Objective 1.1. Maintain a stable or increasing elk population within the elk management area (See Section III for detailed description).

Strategy 1.1.1. Annually estimate the number of elk in the elk management area.

An annual population estimate provides feedback on management actions related to population sustainability and harvest strategies. They also help gauge the success of habitat improvements or elk-human conflict mitigations. Annual elk license allocations rely on the sex and age ratios derived from annual population monitoring. Providing an interested public with an estimate of our elk population demonstrates transparency and builds trust for the Game Commission.

Strategy 1.1.2. Annually monitor age-specific elk survival using radio-collared elk.

Survival estimates are valuable for understanding how a population will vary through time. This strategy directs management effort to continuously maintain a subset of radio-collared elk in the population. These data can then be combined with reproductive data and used to predict variations in the population through time (See [Strategy 1.1.4](#)).

Strategy 1.1.3. By 2023, conduct research to evaluate potential population monitoring techniques within the elk management area.

Estimating wildlife populations is inherently difficult, especially for cryptic animals inhabiting relatively remote areas such as elk. Periodic examination of the methodology used to monitor elk abundance is needed to ensure we are utilizing the most accurate and efficient techniques. As the elk population

expands, new methods will be needed to monitor elk abundance across a larger area. This strategy ensures Game Commission staff are utilizing the most practical and effective techniques for estimating Pennsylvania's elk population.

Strategy 1.1.4. By 2023, develop a model for predicting population trends and potential impacts of management activities.

Combining age-specific survival estimates with reproductive data provides the framework needed to produce a mathematical model to predict the elk population's growth through time (integrated population model). Ideally various hypothetical simulations could then be used to evaluate how the elk population would respond to changes in habitat or harvest regime. To date, these data are not available, and a predictive model is still lacking. This strategy directs management effort toward the development of a model and its application to Goal 1.

Strategy 1.1.5. Review and evaluate boundaries of the elk management area every 5 years, using current data of elk population, distribution, and elk-human conflicts, and recommend changes as needed.

The current boundaries of our elk management area were established to minimize agricultural conflicts, maximize public land, and provide elk with habitat needed to meet their life requirements. Changes in land use and habitats inevitably influence elk distribution and public acceptance of elk varies spatially and temporally. Consequently, the elk management area boundaries should be reviewed every 5 years involving input from local residents and stakeholders.

Strategy 1.1.6. Annually propose hunting seasons and license allocations that encourage natural expansion of elk distribution within the elk management area and discourage movement of elk outside the elk management area.

By design, the elk management area (EMA) is where elk-human conflicts are less likely to occur and where elk are more socially accepted. Encouraging continual expansion within the EMA and reducing the probability of elk travelling outside the EMA is accomplished by changing localized elk populations through regulated harvest. This strategy directs management staff to consider the distribution of elk within and outside the EMA when setting elk hunting seasons and license allocations.

Strategy 1.1.7. Review and evaluate boundaries of the elk hunt zones every 2 years and propose boundary changes as needed.

Elk hunting licenses are allocated by elk gender and hunt zone. The boundaries of elk hunt zones are designed to encompass (1) a sub-population of elk and (2) areas that experience or have the potential for high elk-human conflicts. We define a sub-population as a group of elk that generally remains together within a

specific geographic area throughout the year. However, we recognize these sub-populations are fluid and there is evidence of limited movement between them. Changes in land use and habitats influence the distribution of individual elk resulting in a relatively slow but continuous shift in the distribution of each subpopulation. These shifts require continual monitoring and adaptation of hunt zone boundaries, to ensure harvest strategies are effective in manipulating localized populations. Similarly, delineating hunt zone boundaries to encompass areas that are predisposed to elk-human conflicts provides a simple framework to use regulated harvest to mitigate conflicts. This strategy ensures hunt zone boundaries are regularly evaluated and adjusted to meet their purpose.

Objective 1.2. Maintain a healthy and naturally reproducing elk population.

Strategy 1.2.1. Annually estimate the calf to cow ratio.

An annual estimate of the calf to cow ratio provides feedback on management actions related to population sustainability and harvest strategies. Annual elk license allocations rely on the sex and age ratios derived from annual population monitoring. In Pennsylvania, historical ratios of approximately 40 calves per 100 cows have been maintained. Annual monitoring of cow:calf ratios provide a means of detecting deviations from historical norms that may negatively influence elk population health.

Strategy 1.2.2. Annually propose seasons and license allocations to maintain a post-harvest ratio of at least 25 branched bulls per 100 cows.

Maintaining a bull to cow ratio of at least 25:100 results in a higher proportion of mature bulls (>4 yrs.) being present to maximize conception rates and ensure the annual rut is relatively short and synchronous (Noyes et al. 1996, 2002). Bull to cow ratios typically range from lows of 10 bulls per 100 cows in heavily hunted populations to as high as 50 bulls per 100 cows in protected areas such as national parks. In Pennsylvania the mean bull:cow ratio over the past decade (2008-2018) was 29:100.

Strategy 1.2.3. Annually measure fat accumulation from hunter-harvested elk as a proxy of elk health.

The health of any one animal is the result of a complex interaction between an individual and its environment. The amount of fat an individual animal accumulates is a simple but reliable measure of overall health. Fat accumulation generally indicates that habitat is suitable, and an animal can meet daily nutritional needs while maintaining a reasonable body weight. Body condition can also affect the timing of conception and parturition. Directly measuring fat accumulation depths across the rump is a rapid and reliable method of evaluating

elk health. Collecting these data annually from hunter harvested elk provides an index for monitoring the health and reproductive potential of the elk population.

Strategy 1.2.4. By 2023, estimate elk pregnancy and/or natality rates.

Reproduction must occur for any population to be self-sustaining. Periodically evaluating the elk population's capacity for natural reproduction provides data needed to predict population growth and sustainability given available habitat and harvest management. Estimating elk pregnancy/natality about every 5 years provides a measure of reproduction where changes can be promptly detected.

Strategy 1.2.5. By 2024, evaluate the potential effects of the elk population's genetic diversity and research alternatives for improving genetic diversity.

Low genetic diversity has been linked to harmful effects in wildlife populations, including declines in survival and increased susceptibility to disease. Pennsylvania's elk population has some of the lowest genetic diversity in North America, but the implications of this are unclear. Additional research is needed to identify (1) potentially harmful effects that could be attributed to low genetic diversity and (2) options for improving genetic diversity and the associated cost-benefit.

Strategy 1.2.6. Review new/emerging elk health monitoring techniques and evaluate their application for use, as needed.

New methods and technologies for evaluating wildlife health are continually being developed. This strategy directs elk management staff to periodically review and potentially experiment with new alternatives to ensure use of the most practical and effective tools available to manage Pennsylvania's elk population.

Objective 1.3. Minimize exposure of wild elk to disease.

Strategy 1.3.1. Annually collect samples from hunter-harvested elk for disease testing.

Monitoring hunter-harvested elk for infectious diseases is an effective and efficient step to respond and control disease outbreaks. Hunter-harvested elk provide a relatively representative sample in a short time frame. This strategy mandates management staff regularly collect and test tissues for diseases such as tuberculosis, brucellosis, chronic wasting disease, and others as needed.

Strategy 1.3.2. Collect and test suspect elk for disease, as needed.

To detect and minimize risk of spreading disease, any elk exhibiting symptoms known to be associated with infectious diseases should be promptly euthanized and tested accordingly. This strategy allows for this action on an as needed basis.

Strategy 1.3.3. Collect and test captive deer/elk escapees for disease, as needed.

Any *cervid* originating from a captive facility is considered a high risk to wild elk. Animals that were intentionally released or known to have escaped from a captive facility can carry diseases that could spread to the elk population. As such, any *cervid* known to have originated from a captive facility should be euthanized as soon as possible and tested accordingly.

Strategy 1.3.4. By 2020, develop a response plan to be implemented when chronic wasting disease is detected in Pennsylvania elk.

In 2012, chronic wasting disease (CWD) was detected in wild deer in south-central Pennsylvania. Since then, the disease has continued to spread. Although multiple plans related to deer have been developed, to date, a response plan that includes elk has not been finalized. At present, CWD has not been detected in Pennsylvania elk. A response plan utilizing the best available science should be prepared for implementation before CWD is detected in wild elk.

Strategy 1.3.5. Implement educational programs to discourage activities that facilitate transmission of disease, as needed.

Humans activities, intentional or not, affect wildlife populations and their habitats. This is especially true in the context of disease transmission in wild populations. Artificial feeding, illegal movement of live animals, and movement of carcasses are just a few examples of how humans can facilitate disease transmission. While education does not always lead to changes in human behavior, informing people of how diseases are commonly spread, and the associated risks may discourage actions that ultimately promote transmission in wild populations. Strategy 1.3.5. directs outreach efforts to discourage detrimental human actions/behaviors that facilitate disease transmission.

GOAL 2. APPLY OUR UNDERSTANDING OF ELK HABITAT RELATIONSHIPS TO INFLUENCE ELK POPULATIONS AND DISTRIBUTION USING HABITAT MONITORING, MANIPULATION, AND CONSERVATION WITHIN THE ELK MANAGEMENT AREA

Apart from maintaining a healthy and self-sustaining elk population, elk habitat management is important to the long-term sustainability of Pennsylvania elk. Indeed, health and sustainability of the population is linked to the quality and quantity of habitat. Habitat management for elk in Pennsylvania includes creating and maintaining habitats that are utilized by elk to meet their daily demands in a sustainable manner. Periodic research is required to evaluate specific characteristics of a given habitat that motivate elk use. Monitoring subsequent elk usage of a given habitat provides feedback needed to ensure habitat health and elk populations are in balance with available habitat.

Objective 2.1. directs the Game Commission to manage elk habitat as efficiently and effectively as possible using Pennsylvania-based research to inform management methods. Objective 2.2. is designed to provide feedback on habitat improvement and how elk impact that habitat. Recognizing the scale of Goal 2, Objective 2.3. directs the Game Commission to employ conservation partners, as practical, to maximize our elk habitat management efforts.

Objective 2.1. Annually maintain existing elk habitat acreage and create new elk habitat as practical in the EMA.

Strategy 2.1.1. Create and continually update a database of elk habitat projects.

In the last few decades, the Game Commission and partners have completed habitat projects on thousands of acres within the elk management area. A database of these habitat projects will allow evaluation of maintenance needs and locations for new habitat projects.

Strategy 2.1.2. Annually cooperate with agency foresters and land managers, DCNR, counties, and private landowners to create and maintain an accurate GIS database for the elk management area.

Habitats change through time and maintaining an accurate and complete spatial database is a prerequisite for understanding elk habitat selection in a variable landscape. Annually reviewing and updating this database ensures we are working with accurate and current information related to elk habitat. This strategy directs staff to collaborate with other agencies and individuals in maintaining an accurate GIS database.

Strategy 2.1.3. Annually identify and prioritize areas for potential habitat improvements and seek funding to implement improvements.

A notable limiting factor for Pennsylvania elk is a lack of preferred habitat in the form of open canopy early successional habitats. Capitalizing on all opportunities to enhance or increase the suitability of an area for elk is necessary to support an increasing population. However, funding must be internally available or secured from an outside source to complete most habitat improvement projects. In addition, the location of any habitat improvements must be considered prior to initiation. Improving elk habitat near major roadways or houses increases the potential for elk-human conflicts, while habitat improvements in more remote areas can reduce conflicts by drawing elk away from human-dominated landscapes. These affects must be considered prior to initiating any habitat improvements.

Strategy 2.1.4. Annually review published literature pertaining to elk habitat selection and produce an annotated summary every 5 years.

Wildlife management and more specifically, habitat management, is an adaptive science that evolves with new technologies and information. It's important to continually learn from other researchers and land managers as new studies are completed and published. This strategy directs staff to regularly review and summarize newly published scientific papers to stay up to date with modern techniques and technologies related to elk habitat selection and management.

Strategy 2.1.5. By 2024, conduct research to evaluate season specific elk habitat selection at fine scales within the elk management area.

Relatively little research regarding habitat selection for eastern elk has been conducted. Previous work in Pennsylvania, documented elk selection of coniferous forest and open-canopy herbaceous habitats (Kougher 2009) but these broad observations are difficult to translate into site-specific habitat prescriptions. Evaluating habitat selection at a finer scale, with direct measures of key habitat variables specifically, would improve our ability to manage elk habitat. This strategy calls for a research project investigating elk habitat selection across seasons and scales.

Strategy 2.1.6. By 2024, conduct research to determine characteristics of herbaceous grasslands that correlate to elk usage.

At present, there is little information regarding the mechanisms driving herbaceous habitat selection in Pennsylvania elk. Additional research is needed to evaluate species composition, vegetative structure, and juxtaposition with other habitats. These data would provide support and direction for future habitat improvements.

Strategy 2.1.7. By 2025, using information from published literature and Pennsylvania research, develop an elk habitat manual for public and private landowners.

Information related to optimal elk habitat and how those habitats can be created is still generally lacking. A habitat manual based on research specific to the Pennsylvania landscape would be beneficial to public and private landowners looking to improve their property for elk. This strategy calls for the creation of such a manual.

Strategy 2.1.8. Annually promote and increase the use of prescribed fire for maintaining and enhancing elk habitat.

Maintaining quality elk habitat is generally dependent on some form of disturbance to continually set back natural succession. In the past, the primary method of maintaining herbaceous grasslands in an early successional state was through annual or semi-annual mowing. Prescribed fire is a beneficial and more efficient alternative of successional setback that should be utilized wherever possible. This strategy calls for increased use of prescribed fire to maintain elk habitat in support of Objective 2.1.

Objective 2.2. Evaluate measures of elk impacts on forest and grassland habitats to improve the effectiveness of elk habitat management.

Strategy 2.2.1. By 2023, conduct research in collaboration with DCNR to evaluate elk impacts to forested habitats.

Changes in habitat often occur slowly and can be difficult to detect, making quantifying elk impacts to forested habitats challenging. In Pennsylvania, sympatric deer further complicate this by obscuring our ability to link impacts to a single species. Despite these challenges, options for discerning species-specific impacts are available. This strategy calls for research to understand how elk affect forested environments. This research will be conducted in collaboration with DCNR as they have a vested interest in the outcome.

Strategy 2.2.2. By 2024, using information from published literature and internal research, develop a structured protocol for monitoring elk impacts to herbaceous habitats.

A limitation of our current elk habitat management efforts is a lack of quantitative feedback on the effectiveness of our management efforts. A practical and structured protocol for monitoring how elk impact herbaceous habitats is needed to inform elk population manipulations to ensure long term sustainability and resiliency. This strategy calls for a standardized protocol to monitor elk impacts on herbaceous habitats.

Strategy 2.2.3. By 2025, annually propose seasons and license allocations to mitigate elk impacts to forest and herbaceous habitats.

Maintaining the long-term health of the landscape requires continual monitoring and manipulation of habitat and the populations that depend on and subsequently impact habitat. Balancing the elk population with the habitat that sustains them ensures the elk and their habitats remain healthy. This strategy directs management staff to consider feedback derived from habitat monitoring in recommending elk hunting seasons and license allocations. It should be noted, however, that Strategies 2.2.1 & 2.2.2 are prerequisites to accomplishing Strategy 2.2.3.

Objective 2.3. Maintain and establish partnerships with other organizations and landowners to facilitate habitat improvement, maintenance, and conservation.

Strategy 2.3.1. Actively seek funding from conservation groups to acquire lands for public ownership that benefit elk with an emphasis on access, indentures, in-holdings, and critical or unique habitats as needed.

Permanent land protection through public ownership generally ensures the property will remain undeveloped and available to both wildlife and people.

Depending on the condition and size of a given parcel, funding to purchase property may not be available internally, and alternative sources should be pursued. This strategy calls for continual vigilance for opportunities to acquire land for public ownership that will benefit Pennsylvania elk.

Strategy 2.3.2. Collaborate with public and private organizations / landowners to enhance and secure access to elk habitat as needed.

Improving habitat and habitat management cannot be accomplished by the Game Commission alone. Collaboration with partners and other interested parties is required to maximize the suitability and amount of available elk habitat. This strategy prompts the Game Commission to continually partner with other agencies, organizations and/or individuals in meeting Goal 2.

Strategy 2.3.3. Collaborate with public and private organizations / landowners monitoring the presence of noxious plants that degrade elk habitat.

Coordinating with various Federal, State, and Local government agencies in the monitoring and removal of invasive and noxious plants has long term benefits for Pennsylvania's elk population.

Strategy 2.3.4. Annually collaborate regionally and nationally with elk managers in other jurisdictions.

Annual participation/interaction with elk managers across North America serves as a platform for idea exchange across jurisdictions and ultimately improve elk management in Pennsylvania. These opportunities often include conferences and technical committee meetings such as the Eastern Elk Managers Workshop, the Western Deer and Elk Managers Workshop, and other regional and national initiatives as available.

GOAL 3. MANAGE ELK TO PROVIDE RECREATIONAL OPPORTUNITY

North American wildlife management is based on the concept that wildlife is a public resource. How people value wildlife is complex and highly variable. Subtle and sometimes drastic differences in human beliefs produce a broad spectrum of values related to wildlife. In Pennsylvania, elk are a unique representation of this variation in that they are valued by the general public for numerous reasons, but most include some form of recreational opportunity. Goal 3 was established to provide elk-related recreational opportunities for all residents of and visitors to the Commonwealth.

In Pennsylvania, however, the two most prominent sources of elk-related recreation are elk hunting and elk centered viewing opportunities. These two forms of recreation are specifically distinguished as Objectives 3.1 and 3.2 under Goal 3. Other less prominent sources of elk-related recreation are covered by Objective 3.3.

Objective 3.1. Annually provide sustainable elk hunting opportunities.

Strategy 3.1.1. Annually provide an elk hunting season consistent with population and habitat objectives (Goals 1 and 2).

In Pennsylvania, elk are classified as a big game species (Title 34 Sec 102) and managed through public hunting opportunities (Title 34 Sec 103(b)). Public elk hunting is the most efficient and cost-effective method of balancing the elk population with the habitat available to them and public tolerance for elk-related conflicts. The sheer number of hunters that annually apply to hunt elk demonstrates a passionate interest in pursuing Pennsylvania elk. Since 2001, elk hunting seasons have been established annually. Maintaining this recreational opportunity will ultimately depend on meeting other goals and objectives outlined in this plan such as population sustainability and habitat maintenance. If the population can support a limited harvest, the Game Commission should provide hunting opportunities, for both antlered and antlerless elk, on an annual basis.

Strategy 3.1.2. Annually assess hunter satisfaction with elk hunting in Pennsylvania.

Regular input is required to continually adapt and improve elk hunting opportunities. Feedback from elk hunters is important to quantify elk hunter activities, preferences, and opinions. Currently, after the close of the elk hunting season, all elk hunters are invited to participate in a post-hunt survey. The survey is designed to gauge several aspects of hunter satisfaction and as a check on our efforts to provide high quality elk hunting opportunities.

Strategy 3.1.3. By 2020, research/assess hunter opinions regarding the opportunity to harvest older-aged bulls.

In Pennsylvania, where natural mortality is relatively low, limiting bull hunter harvest generally improves survival to an older age and thus increases antler size. Logically, however, restricting the number of bull licenses issued on an annual basis decreases the odds of an individual hunter drawing a license and potentially increase certain types of elk conflicts. The balance between the odds of drawing a bull license and the opportunity to harvest a large antlered bull has not been investigated. Understanding elk hunters' opinions about bull antler size and hunter opportunity will improve our ability to establish management objectives related to bull age and antler size.

Strategy 3.1.4. By 2022, research/investigate hunter motivations for applying/not applying to hunt Pennsylvania elk.

The factors motivating an individual hunter to apply for a Pennsylvania elk license are poorly understood. Unconfirmed anecdotal evidence suggests the reason most hunters do not apply is they perceive the odds of drawing an elk license as too low to justify the cost of the application. However, there are no data to support or refute this perception. Filling this gap in our knowledge base

will allow for targeted outreach and/or modifications to our license application process.

Strategy 3.1.5. By 2022 research/evaluate the bonus point system and its effect on applicant success probability.

The current structure of our bonus point system rewards individuals that consistently apply over consecutive years by increasing the probability they will be drawn for an elk license. However, long-term effects of this structure are not fully understood. A predictive model needs to be created to evaluate the effect on the probability of drawing a license into the future.

Objective 3.2. Annually provide and promote safe elk viewing opportunities.

Strategy 3.2.1. By 2023, research and develop guidelines to provide safe viewing opportunities while minimizing elk habituation.

Elk viewing opportunities depend almost entirely on elk being visible from locations that are readily accessible to a large number of people. Drawing elk into open and visible areas is subsequently dependent on the presence of preferred habitat. Given sufficient time and funding, preferred elk habitat can be created and maintained almost anywhere. However, human visitors must remain safe and minimize their influence on elk behavior. Elk habituate to human presence when they repeatedly interact with people and do not experience negative consequences, but habituated elk also are more likely to injure people, be struck by vehicles, and conflict with homeowners. Ideally, some minimum distance should be identified and maintained between human visitors and elk to ensure people are not attacked and their effect on elk behavior is minimized. We recommend intuitive guidelines be implemented until enough data can be gathered to evaluate this quantitatively.

Strategy 3.2.2. By 2022, develop and distribute information on responsible elk viewing, emphasizing human-safety and minimizing habituation and trespassing.

Individuals with little or no knowledge of elk behavior are more likely to place themselves in situations where they may be at risk of being attacked. In addition, people seeing elk for the first time often become excited and ignore basic property rights of local residents. Outreach efforts should be designed to inform/educate people on responsible elk viewing, respecting private property and minimizing their effect on elk behavior. Opportunity for improving the audience base and effectiveness of these messages also exist.

Strategy 3.2.3. By 2023, research/assess visitor opinions and satisfaction with elk viewing opportunities.

Feedback on how people visiting the elk management area feel about their experience is generally lacking. No quantitative effort has been made to gauge this since the late 1990s. In order to continually adapt our management efforts some information on visitor opinion/satisfaction is needed. This strategy calls for a research project evaluating visitor opinions related to recreational elk viewing opportunities.

Objective 3.3. Annually promote other elk-related recreational opportunities.

Strategy 3.3.1. Continually encourage conscientious elk shed collection with emphasis on minimizing disturbance and habituation.

Elk typically shed their antlers around the first or second week in March and shed hunting/collection is hugely popular during this time. Depending on how people pursue shed antlers, shed hunting can disturb elk and disrupt natural distributions and seasonal habitat selection. The popularity of this alternative source of recreation, combined with its potential to negatively impact elk, warrants further attention. This strategy directs effort toward educating shed hunters on how to minimize disturbance to elk when collecting shed antlers.

GOAL 4. MANAGE ELK-HUMAN CONFLICTS AT ACCEPTABLE LEVELS

Nearly all wildlife species come into conflict with people. Elk-human conflicts have greater potential to pose significant threat to human safety and property because elk are large and have high nutritional demands. Although management actions cannot eliminate elk-human conflicts, the Game Commission has a responsibility to minimize elk-human conflicts to acceptable levels.

Objective 4.1 directly supports Goal 4 by stating the Game Commission will continually work at reducing elk-human conflicts and adapting our methods as needed. Objective 4.2 indirectly supports Goal 4 in recognizing that habituated elk are a primary source of elk-human conflicts. Under some circumstances and geographic areas, habituation may be inconsequential, but in Pennsylvania habituated elk are more often involved in elk-human conflicts. Intuitively, elk that have lost their instinctual aversion to people are more likely to be involved in conflicts like residential damage, pet attacks, and vehicle collisions. Reducing habituation will ultimately reduce elk-human conflicts. Objective 4.3 provides input and feedback required to accomplish Goal 4. Public involvement in wildlife management decisions builds trust in management agencies and helps maintain transparency. This is particularly true for human-wildlife conflicts where affected individuals have a vested interest in the outcome of management decisions.

Objective 4.1. Annually attempt to minimize elk-human conflicts.

Strategy 4.1.1. Annually compile and review reports of elk-human conflicts.

Currently, any complaint or concern (collectively labeled an incident) reported to the Game Commission is entered into a database and classified by wildlife species and the nature of the incident. Annual reviews of all the elk related incidents will

be conducted to identify areas of high-conflict and trends in elk-human conflicts. Identifying common conflicts and where they occur is a prerequisite to reducing them. This strategy recognizes the importance of these data and directs management staff to continue using them as a tool for reducing elk-human conflicts.

Strategy 4.1.2. Conduct a survey of residents within the elk management area by 2023 and at least once every 5 years thereafter to monitor acceptable elk-human conflict levels.

Acceptable levels of elk-human conflict are defined by the values and tolerances of people experiencing elk-human interactions. A survey of residents will quantitatively monitor acceptable levels of elk-human conflicts.

Strategy 4.1.3. Annually propose seasons and license allocations to reduce populations in areas experiencing unacceptable levels of elk-human conflicts.

Under most circumstances the most practical method of reducing elk-human conflicts is to reduce localized elk populations. The primary tool to reduce populations is legal harvest. The opinions, attitudes, and subsequent tolerance of local residents should be considered in any management actions related to conflicts ([See Strategy 4.3.2](#)). How local residents, who regularly interact with elk, think and feel about elk can have long term effects on elk management. Incorporating data collected through the incident database ([See Strategy 4.1.1](#)) in annual license allocations provides logical and transparent justification for reducing local elk populations in areas experiencing conflict. This strategy requires elk-human conflicts be considered when establishing elk hunting seasons and license allocations.

Strategy 4.1.4. By 2022, develop a Standard Operating Procedure for responding to complaints of elk-human conflict.

To date there is no Standard Operating Procedure for law enforcement or other field staff to reference in responding to elk related complaints/concerns. Developing a hierarchical response procedure would improve consistency and ultimately led to more efficiency in our ability to meet Objective 4.1. A standardized response procedure would improve transparency in our management actions and subsequently build trust in the Game Commission. This strategy mandates development of a standard operating procedure related to elk-human conflicts. However, we acknowledge the variation inherent to any elk-related conflict and will continue to prioritize the discretion of the responding Game Warden in any standardized response procedure.

Strategy 4.1.5. By 2023, evaluate implementing a localized elk damage hunt to reduce populations repeatedly involved in conflicts.

Ancillary or “special” hunting seasons have been effectively used in other States to address localized wildlife conflicts. To date, this style of targeted hunting season has not been examined to determine the potential application to Pennsylvania’s elk. This strategy calls for an evaluation of how additional hunting opportunities could be utilized to reduce populations in areas where elk-human conflicts are unacceptable and tolerance for elk is low.

Strategy 4.1.6. Conduct research to evaluate new/emerging techniques of reducing and/or mitigating elk-human conflicts and their application for use in Pennsylvania as needed.

Mitigating human-wildlife conflicts requires continual adaptation to changes in the environment as well as human and animal behavior. This strategy directs consistent effort be put toward periodically evaluating, and experimenting with, new methods and technologies for safe and ethical mitigation of elk-human conflicts. This Strategy ensures we are utilizing current and effective techniques for meeting Objective 4.1.

Objective 4.2. Continually implement management actions to reduce elk habituation.

Strategy 4.2.1. Annually quantify and monitor elk habituation spatially within the elk management area.

In Pennsylvania variation in elk habituation is apparent with the highest levels of habituation occurring where elk viewing/tourism is common. Monitoring and quantifying habituation is difficult but needed to identify areas of potential elk-human conflict and to ultimately reduce habituation. This strategy directs effort in defining, identifying, and quantifying elk habituation spatially.

Strategy 4.2.2. Actively pursue violations of elk feeding as needed within the elk management area.

Intentional human supplied feeding of elk is illegal (Title 58 § 137.33, Pennsylvania Code) in Pennsylvania. Feeding positively reinforces elk to associate people with food and leads to habituation. This strategy directs law enforcement staff to pursue violations of the law and reduce intentional feeding as much as possible in support of Objective 4.2.

Strategy 4.2.3. Annually propose seasons and license allocations to reduce habituation.

One of the most effective and practical methods of reducing habituation is through legal hunting seasons. Intuitively, elk pursued by hunters identify people or human dominated areas negatively. Elk hunting has been shown to reduce habituation (Bender et al. 1999) and is relatively simple to adapt and apply. This strategy directs management staff to use elk hunting as a means of reducing habituation in support of Objective 4.2.

Strategy 4.2.4. Remove habituated elk from the population as needed.

People regularly perceive habituated elk as domesticated or “tame” creating a false sense of security in proximity to wild elk. Habituated elk are more likely to behave aggressively toward people and attacks are known to occur. People are also more likely to anthropomorphize habituated elk which can and has created contention related to Pennsylvania’s elk hunting season. While every attempt should be made to reduce habituation and change the animal’s behavior prior to euthanasia, in some circumstances euthanasia of habituated elk may be needed to preserve the safety of humans, pets, and property. The decision to euthanize habituated elk falls to the discretion of the local Game Warden under Strategy 4.2.4 in support of Objective 4.2.

Strategy 4.2.5. Conduct research to evaluate new/emerging methods of reducing elk habituation within the elk management area as needed.

Like other Objectives outlined in this plan, reducing elk habituation requires adaptation to changes in the landscape and both human and elk behaviors. Periodic research and experimentation are needed to ensure we are using the most current and effective techniques to accomplish Objective 4.2.

Objective 4.3. Engage residents of the elk management area in efforts to address elk-human conflicts.

Strategy 4.3.1. Establish an Elk Conflict Working Group to develop socially acceptable methods for reducing elk-human conflicts, meeting annually.

Reducing elk-human conflicts is typically a long-term continual process requiring engaged and consistent representation from local residents who regularly interact with elk. Working groups are a common method for involving interested stakeholders. In an effort to increase public involvement and transparency this strategy calls for the creation of an elk conflict working group that will meet annually to develop socially acceptable methods of reducing elk related conflicts.

Strategy 4.3.2. By 2023, conduct a survey of elk management area residents’ opinions, acceptance, and understanding of elk and elk management, and at least once every 5 years thereafter.

Soliciting input from local residents who regularly interact with elk and are subsequently involved in elk-human conflicts ensures we are considering the values and opinions of those most affected by our management decisions. To date a formal survey of how those, living in the elk management area value, view, and think about elk has not been conducted. This information is needed to ensure we are incorporating public opinion in elk management decisions. This strategy directs staff to conduct a random survey of public opinion at least once each

management cycle (5 years). This strategy can be accomplished with the same survey from [Strategy 4.1.2](#).

GOAL 5. IMPROVE PUBLIC KNOWLEDGE AND UNDERSTANDING OF ELK AND THE ELK MANAGEMENT PROGRAM

Pennsylvania's wildlife is a public resource meant for the benefit of all people. The Game Commission is charged with managing wildlife for current and future generations and people have an inherent right to understand management of their wildlife. Moreover, a large proportion of Pennsylvania's residents are fascinated with the natural environment and generally interested in learning about wildlife and their habitats. As the wildlife management agency, it is the Game Commission's duty to provide information about Pennsylvania's elk and elk management to an interested public. Supporting Goal 5, Objective 5.1. provides information to the public related to elk and elk management, and Objective 5.2. is designed to provide feedback on public knowledge of elk and areas to improve our outreach efforts.

Objective 5.1. Provide information and educational materials regarding elk and elk management.

Strategy 5.1.1. Continually cooperate with the Elk Country Visitor Center to promote interest and appreciation of the elk population and the Game Commission's management activities.

The Elk Country Visitor Center is a unique destination that annually attracts hundreds of thousands of visitors. The impact of the Visitor Center on the general public is profound and recognizing this, the Game Commission needs to continually cooperate with the Visitor Center to ensure their outreach messages are consistent with Game Commission elk management activities.

Strategy 5.1.2. Annually provide information and educational materials to the Keystone Elk Country Alliance, the Rocky Mountain Elk Foundation and other partners.

Although the Game Commission is the agency responsible for elk management, achievement of this mission requires partnerships with other conservation entities. Game Commission efforts to provide information and education are greatly expanded by partner organizations. Providing partner organizations with current information on our elk and elk management activities promotes accuracy and consistency in the messaging.

Strategy 5.1.3. Semi-annually review and update elk web pages to ensure timely and relevant information is easily accessible to the public.

Most people, especially younger generations, seek information through the internet. Ensuring the elk-specific information posted on the Game Commission's website is accurate and current, as much as possible, is needed to

ensure public trust and improve transparency. This strategy calls for a thorough review of our elk related webpages at least semi-annually.

Strategy 5.1.4. Continually update and provide presentations on elk natural history and elk management as requested and practical.

Presentations provided by Game Commission staff are an integral part of messaging and outreach (Goal 5). Game Commission staff are often the most knowledgeable regarding elk and elk management and can answer questions promptly and accurately. This strategy directs elk management staff to continually update and present information about elk and elk management to an interested public whenever feasible.

Objective 5.2. Assess public knowledge of elk and elk management.

Strategy 5.2.1. Conduct a survey of Pennsylvania resident's opinions, knowledge, and understanding of elk and elk management by 2025, and at least once every 10 years thereafter.

At present, there is little quantitative data available to understand how Pennsylvania residents' value and feel about the presence of wild elk in Pennsylvania. Responsive Management (Harrisonburg, VA), under contract with the PGC, recently completed a State-wide survey in which some data related to elk was collected. However, additional data on the general knowledge, attitudes, and beliefs of Pennsylvania residents toward wild elk would enable tailoring educational outreach efforts to any identified knowledge shortages.

Strategy 5.2.2. Target educational programs to areas with relatively low knowledge of elk and elk management.

Following completion and outcome of Strategy 5.2.1, areas identified as having a general lack or low knowledge of Pennsylvania elk and the Game Commission's elk management program should be targeted for outreach efforts. Ideally, every Pennsylvania resident should be aware of the public resources that are available for their enjoyment. Strategy 5.2.2. directs outreach efforts to those that are currently uninformed.

SECTION II. A BRIEF REVIEW OF ELK REINTRODUCTION IN PENNSYLVANIA

EARLY EXTIRPATION AND REINTRODUCTION

Prior to the 18th Century, elk inhabited eastern North America from Canada to the coastal plains of the southeastern U.S. and from the Mississippi River to the Atlantic seaboard (Gerstell 1936, Murie 1951, Ranta et al. 1982). By the 18th Century, elk population declines became evident and continued throughout the end of the 1800s due to landscape alterations and unregulated hunting (Gerstell 1936).

Prior to European settlement, elk inhabited nearly all of Pennsylvania, with the highest densities occurring in the Allegheny Mountains (Rhoads 1903, Gerstell 1936, Murie 1951, Williams et al. 1985). Archeological records, summarized by Williams et al. (1985), combined with the relatively large number of localities still bearing the name “Elk” in various combinations ([Figure 1](#)) offer some corroboration to early descriptions of elk distribution. However, like many eastern States, rapid expansion and exploitation by early European immigrants along with habitat changes caused the elk population to diminish across the State. By most accounts elk were extirpated from the State by 1877 (Gerstell 1936, Williams et al. 1985).

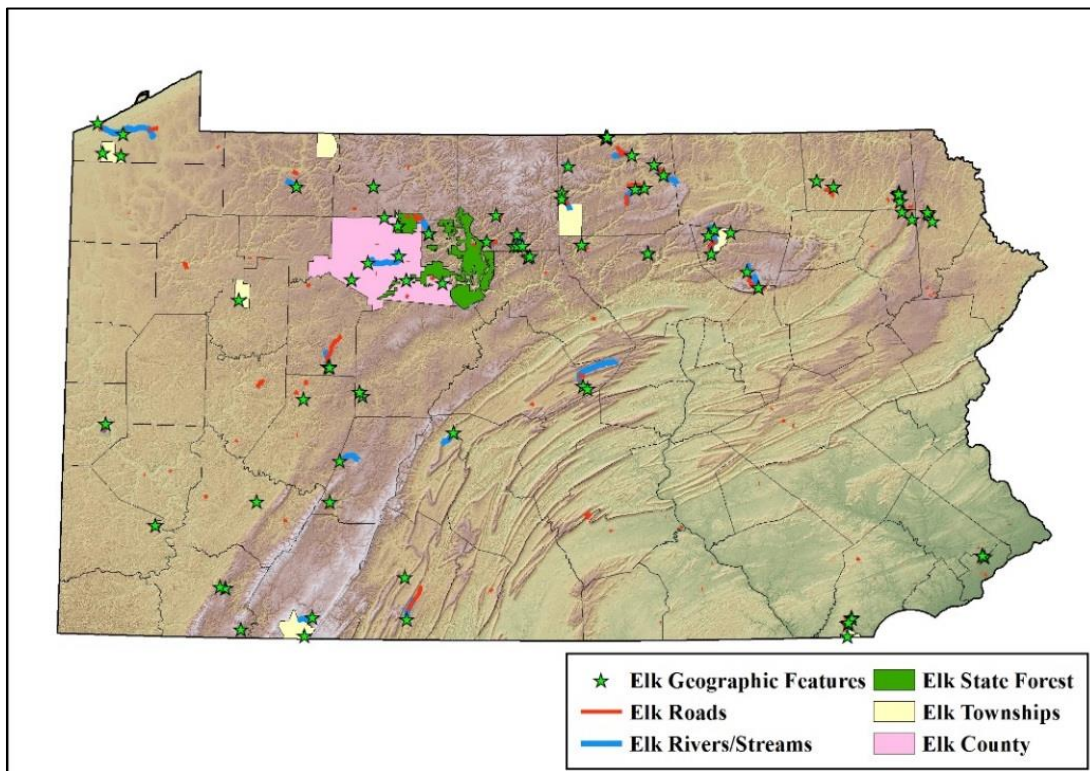


Figure 1. Distribution of roads, waterways, townships, geographic features, Counties, and State Forests containing the word “elk” in Pennsylvania.

In 1913 the Pennsylvania Game Commission began reintroducing elk to the Commonwealth. An initial release of 50 animals, sent by rail from Yellowstone National Park, along with 22 animals from a private reserve in Monroe County, Pennsylvania were released into Clinton, Clearfield, Centre, and Monroe Counties (Table 1, Figure 2). There is little documentation to the survival of these elk, but Gerstell (1936) reports that of the 50 taken from YNP, 14 died shortly after release (likely due to capture myopathy). In 1915 an additional 100 elk were captured in

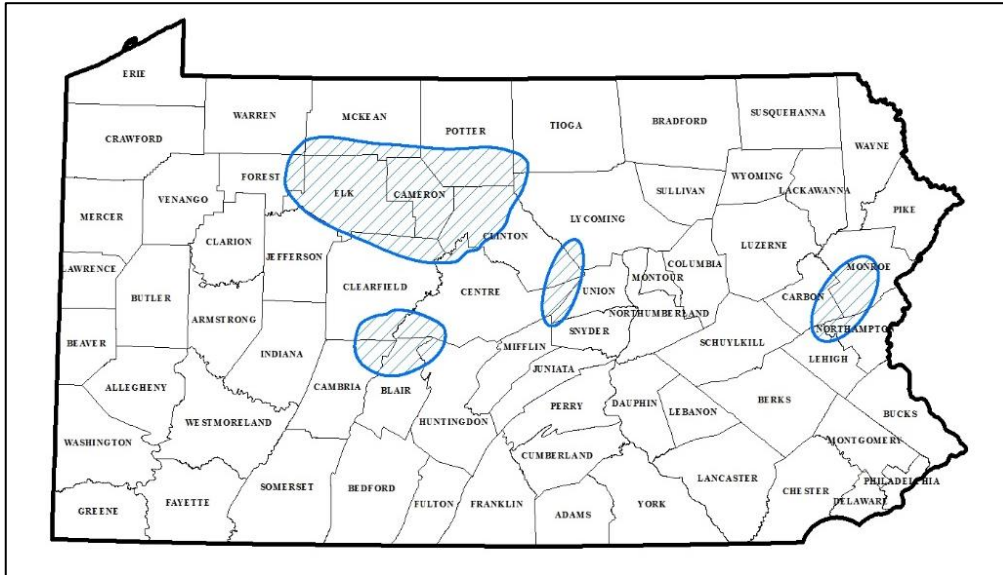


Figure 2. Approximate elk release sites of during the reintroduction from 1913-1926.

Yellowstone National Park and shipped via rail to Pennsylvania, but 5 died in transit leaving 95 to be released in 6 different counties (Table 1, Figure 2). Finally in 1924 and 1926 an additional 6 and 4 bulls, respectively, were purchased from Wind Cave National Park in South Dakota and released in Elk County, Pennsylvania (Gerstell 1936). The 4 bulls translocated in 1926 were the last of Pennsylvania’s reintroduction effort yielding a total of 177 elk released in Pennsylvania between 1913 and 1926.

Historical accounts vary somewhat in their depiction of the elk population post-reintroduction. Much of Pennsylvania was clear-cut by the early 1920’s (Harrison 2013) presumably offering an abundant supply of regenerating browse (Latham 1954) and several authors describe the elk population as thriving between 1913-1923 (Gerstell 1936, Harrison et al. 1994). With an increasing population complaints of crop damage began to rise, and elk were routinely killed for crop depredation.

Table 1. The number of elk released in Pennsylvania by year, source population, and release location during the reintroductions of 1913-1926.

Year	Source	Number of Elk	County of Release	Comments
1913	Yellowstone National Park, WY/MT	50	Clearfield (25) & Clinton (25)	All 50 survived transit

1913	Monroe County, Pennsylvania	22	Monroe (12) & Centre (10)	Private reserve
1915	Yellowstone National Park, WY/MT	95	Potter (24), Cameron (24), Carbon (24), Forest (10), Blair (7), & Monroe (6)	100 captured, 5 lost in transit
1924	Wind Cave National Park, South Dakota	6	Elk County (6)	All bulls
1926	Wind Cave National Park, South Dakota	4	Elk County (4)	All bulls

() indicate the number of elk by County

ORIGINAL HUNTING SEASON (1923-1931)

In 1923 a two-week hunting season was implemented from Dec. 1-15 (except Sundays). Hunters could harvest 1 elk per season via “still-hunting” (driving was unlawful) and only bulls with 4 or more points per antler were legal (Gerstell 1936). In the mid-1920’s it appears the population began to decline as elk were gradually eliminated from most of their original release sites, particularly those with a greater human population and nearby agricultural areas. A 1928 newspaper article stated at that time most, if not all the elk had been eliminated in 8 of the 10 counties where they were originally released. The 9-year gap between the 1915 (95 elk from YNP) and 1924 (6 bulls from SD) translocations, as well as their respective release sites (10 counties versus 1) also suggests that managers recognized the conflicts associated with many of the original release sites.

Table 2. The number of bulls harvested by year during Pennsylvania’s early elk hunting season, 1923-1931.

Year/ Season	Bulls Harvested
1923	23
1924	10*
1925	6
1926	9*
1927	26
1928	6
1929	12
1930	5
1931	1
Total	98

* indicates years of additional reintroductions

While elk hunting continued through the late 1920’s by 1930 it was clear the elk population was declining and the harvest of single bull during the 1931 season ([Table 2](#)) prompted the closure of elk hunting in Pennsylvania. Historical accounts, speculating on the source of the population’s decline, include greater access to wilderness areas along with an overall increase in hunters (Latham 1954), greater competition from an increasing deer population (Latham 1954), poaching (Harrison et al. 1994), an unknown disease (possibly *Parelaphostrongylus tenuis*) (Eveland et al. 1979, Harrison et al. 1994), and changes in available habitat (Latham 1954, Harrison et al. 1994). As with most population declines it was likely a combination of most if not all these factors that ultimately led to the near extirpation of Pennsylvania’s elk for the second time in less than 70 years.

From the late 1930’s to 1971 very little is known about Pennsylvania’s elk population. Scattered records from Pennsylvania Game News articles estimate the population anywhere from a minimum of 14 (Gerstell 1936) to a maximum of 100 (Latham 1954) ([Table 3](#)). Regardless of

the accuracy of these accounts it's clear the elk population was limited in both abundance and distribution during this period. The habitat in the region was probably dominated by mature forest with infrequent or small scale disturbances and losses to poaching and disease were not uncommon (Harrison et al. 1994).

The opinion of Game Commission staff toward the elk population also varied during this time frame. In a 1940 Game News article, Ross Leffler, then the Executive Director of the Game Commission, described the elk reintroduction efforts as an “unwise” importation and waste of money. In contrast, just 14 years later, Roger Latham’s 1954 article claimed a desire to “retain the elk as permanent member of the State’s fauna” and pleaded for cooperation from the public.

Table 3. Pennsylvania Game News articles offering early estimates of the elk population.

Year	Source	Estimated Population	Notes
1936	Gerstell, The Elk in Pennsylvania: its Extermination and Reintroduction.	14	Likely a minimum derived from article figure. Cameron County (8) & Potter County (6).
1940	Leffler, Conservation Mistakes.	24	No distribution specified; article claims "scarcely two dozen wild elk".
1952	PGC Staff, Story Behind the Cover.	<50	Author claims "probably less than 50", no distribution specified.
1954	Latham, Elk Live Here.	50-100	Hicks Run Area, Cameron and Elk Counties.
1965	Erickson, The Last Stand.	35	Big Basin, State Game Lands 14, Cameron and Elk Counties.
1969	Parker, Hunting Pennsylvania's Elk.	40-50	Reprint of an 1896 account by Colonel Parker, PGC staff conclude with a speculation on the current population, no distribution specified.

SECTION III. PENNSYLVANIA’S ELK MANAGEMENT AREA

HISTORY OF CHANGES TO THE ELK MANAGEMENT AREA

Pennsylvania’s elk management area (EMA), sometimes referred to as the elk range, is the geographic area where elk presence is desirable and/or generally tolerated. Traditionally, the EMA was delineated to include large areas of public land where elk-human conflicts are low or negligible. Defining a specific area with clearly identifiable boundaries allows for a more targeted approach to elk management.

Pennsylvania’s first EMA was identified in 1982 (Elk Management Plan 1982-1987) and labeled the “Traditional” elk management area or range. The area was bounded to the north and east by PA-120, to the west by PA-255, and to the south by PA-555 (Figure 3). A total of 205 mi² was encompassed in this area with approximately 36% public land. Much of the elk population at that time occupied habitats within this area.

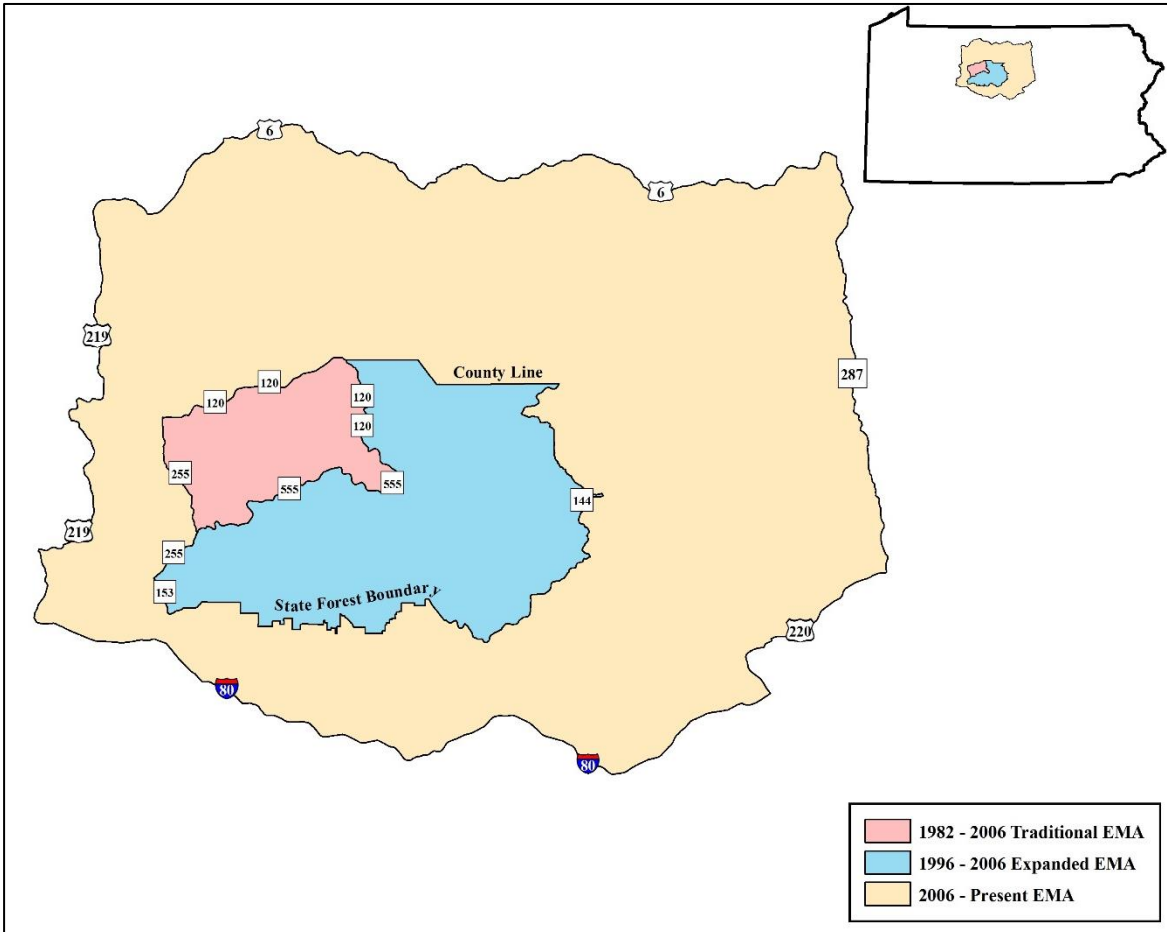


Figure 3. Boundaries of Pennsylvania’s elk management area through time. (1982 – 2018).

In the early 1990’s, elk began naturally dispersing to the south and south-east. Habitat enhancement projects in the Quehanna Wild Area encouraged dispersal and subsequent

occupancy of this area. The 1996-2006 elk management plan delineated an “Expanded” elk management area adjacent to the Traditional EMA. The Expanded EMA included portions of the Moshannon, Elk, and Sproul State Forests, as well as Parker Dam, Sinnemahoning, and Kettle Creek State Parks ([Figure 3](#)). Independent of the Traditional EMA, the expanded EMA was just over 630 square miles and >70% public land. Combined with the Traditional EMA, a total of 835 mi² was designated as the EMA for habitat enhancement and management purposes until 2006.

In response to population growth and expansion the 2006-2016 elk management plan further expanded the EMA ([Figures 3 & 4](#)) to the current boundaries still presently used. Pennsylvania’s current EMA lies within the northcentral portion of the State ([Figure 4](#)). At present, the EMA encompasses all of Cameron County and portions of Elk, Clinton, Potter, Clearfield, Tioga, Jefferson, Lycoming, and McKean Counties. The EMA is bounded to the West by US-219, to

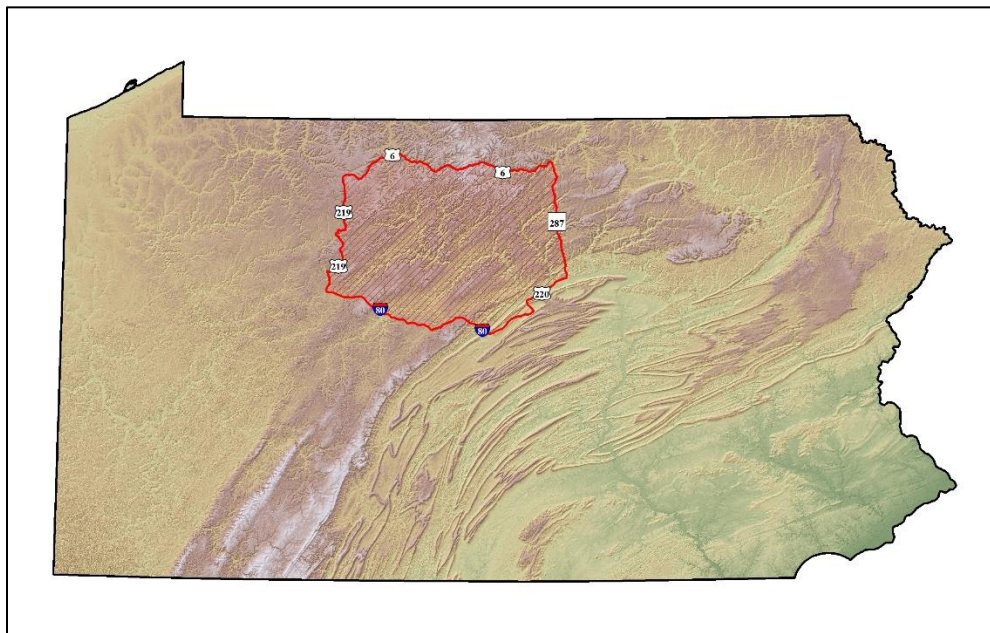


Figure 4. Map showing the boundaries of Pennsylvania’s Elk Management Area, 2006-Present.

the North by US-6, to the East by PA-287 and to the South by US-220 and I-80. The EMA is predominantly public land (74%) in the form of State Forests, State Parks, and State Game Lands. The remaining privately-owned lands (26%) are a mixture of large-scale surface mines, timber holdings, human dwellings, and

businesses typically occurring at lower elevations along the valley bottoms. Overall the area is 3757 mi² (9731 km²).

Relative to entire Commonwealth, the EMA is greater than 70% public land, has a low proportion of agriculture, and a low road density. At the present time, elk consistently occupy approximately ½ of the EMA (western half) allowing for future expansion and growth to the north-east. Given the dynamic nature of elk distribution and the social acceptance of elk presence, [Strategy 1.1.5](#) calls for a review of the EMA boundaries every 5 years. Changes, if needed, can be recommended during these periodic reviews.

On occasion elk can and do disperse to areas outside the EMA. Elk located outside of the EMA are commonly struck by vehicles or legally killed by farmers for crop depredation. Elk located

outside the EMA may be euthanized by State Game Wardens if they are suspected of originating from a captive facility (i.e. an escapee) or potentially interacted with CWD+ deer. At present there is no established protocol/procedure to address wild elk dispersal outside the EMA. As the population continues to increase more elk are likely to disperse and developing a standard operating procedure related to wild elk located outside the EMA will be needed.

LANDSCAPE CHARACTERISTICS OF THE CURRENT ELK MANAGEMENT AREA

The current EMA falls within the Allegheny Plateau Ecoregion (unglaciated) within the northern Appalachian Mountains (locally referred to as the Allegheny Mountains). The landscape is rugged and characterized by forested hills dissected by rivers and creeks (runs) creating narrow meandering valleys with elevations ranging from 266-732 m (874 ft – 2400 ft). The climate of the EMA is characterized by warm wet summers and cool icy winters. Summer temperatures are cooler relative to the rest of the State (July mean temp = 22°C (72°F)) with annual rainfall ranging from 76-110cm (30-44in). Winter temperatures are cooler relative to the rest of the State but variable (January mean temp = -3°C (26°F)) with daytime temperatures regularly above freezing. Winter-time snowfall ranges from 76-150 cm (30-60 in), but rain falling on snow is common throughout the winter months.

The EMA is dominated by mature forest (87%) intermixed with open herbaceous habitats (~8%) consisting of reclaimed surface mines, utility rights-of-way, oil/gas well sites, small farms, wildlife openings, riparian habitats, natural meadows, burned areas, and clear-cuts. The EMA is situated on a transition zone between mixed oak-hickory forest to the south and the Allegheny hardwood forest to the north. Common tree species include, oak (*Quercus* spp.), hickory (*Carya* spp.), maple (*Acer* spp.), American beech (*Fagus grandifolia*), birch (*Betula* spp.), cherry (*Prunus* spp.), ash (*Fraxinus* spp.), cucumber magnolia (*Magnolia accuminata*), eastern hemlock (*Tsuga canadensis*), yellow-poplar (*Liriodendron tulipifera*) and eastern white pine (*Pinus strobus*). Common shrub species include mountain laurel (*Kalmia latifolia*), multiflora rose (*Rosa multiflora*), sweet fern (*Comptonia peregrina*), blueberry (*Vaccinium* spp.), teaberry (*Gaultheria procumbens*), briars (*Rubus* spp.), and autumn olive. Common graminoids include cattails (*Typha* spp.), foxtails (*Alopecurus* spp.), fescue (*Festuca* spp.), deer-tongue grass (*Panicum clandestinum*), orchard grass, and timothy. Common forbs found throughout the EMA include yarrow (*Achillea millefolium*), wild carrot (*Daucus carota*), bedstraws (*Galium* spp.), vetches (*Vicia* spp.), goldenrods, birds-foot trefoil, cinquefoils, and clovers.

SECTION IV. ELK HEALTH AND POPULATION MANAGEMENT

EARLY POPULATION ESTIMATES (1970-1992)

In 1970, interest in the remaining elk herd began to rise. The Pennsylvania State University (PSU) began the first research study with help from the Game Commission, the Department of Forests and Waters (presently the Department of Conservation and Natural Resources [DCNR]) and the Northcentral Pennsylvania Economic Development District. The research was designed to evaluate ecology, population dynamics, and movements of the Pennsylvania elk herd (Eveland et al. 1979). PSU graduate student John Eveland, under the guidance of John L. George, spent the autumn months counting and re-counting elk from vehicle and foot, ultimately estimating an overall population of 65 (± 3) elk (Eveland et al. 1979). From 1972-1974 PSU graduate students continued conducting ground based autumn counts documenting a steadily declining population (Eveland et al. 1979). With the PSU research project ending in 1974, biologists from the PGC and the Bureau of Forestry (DCNR) completed a ground based survey in autumn 1975 and estimated the population at 28-33 elk, the lowest number ever documented (Hassinger 1975). In January 1976 the PGC and BOF adopted an annual aerial survey method, using a combination of pre-survey ground reconnaissance followed by observations recorded via helicopter (Hassinger 1981). Under this structure, pre-survey work (usually 2 weeks prior to aerial counts) consisted of ground crews systematically searching designated areas noting the presence of elk or sign (tracks/scat). These pre-survey observations provided the focus for the helicopter crew. The actual aerial count was completed in 1-2 days, with helicopter crews systematically flying each survey unit and communicating with ground crews via radio.

In late winter 1981, the PGC began marking elk with radio collars to assist in the annual survey. Although no complete records exist a small portion of the elk population has been collared since then. Somewhat accurate records can be deduced from annual reports or survey data and range from 16-87 collared animals (3-20% of annual population) annually with an average of 50 (10% of annual population). At present (2019) 54 (~5% of the population) elk are fitted with active radio collars.

Specific survey units were only loosely defined prior to 1987. In 1987, the traditional elk management area (as delineated by the 1982-1987 elk management plan) was separated into 25 individual units ([Figure 5](#)). Each unit was small enough that it could be surveyed rapidly ideally preventing double counting. The annual elk survey, occurring in late January or early February, continued under this methodology from 1976-1990, apart from the 1989 survey when no air support was available, and the survey was completed using ground-based observations. During this time frame (1976-1990) no effort was dedicated toward developing any form of sightability measure and all data collected during these years should be considered a minimum number of living elk.

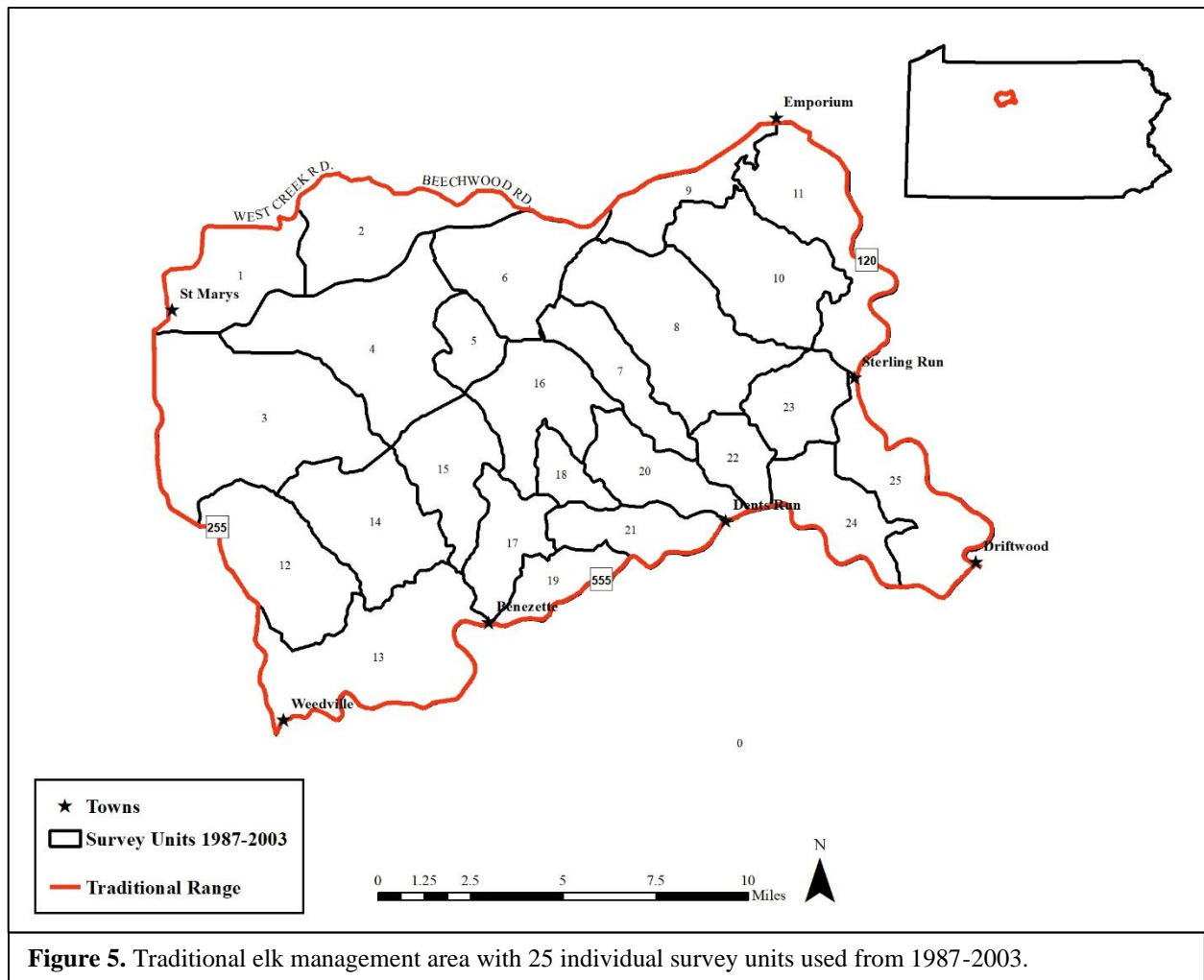


Figure 5. Traditional elk management area with 25 individual survey units used from 1987-2003.

MARK-RESIGHT ESTIMATES (1992-2008)

In January 1992 the PGC began estimating the elk population using Chapman’s mark-recapture formulas described by Pollock et al. (1990). Under this methodology the entire area was surveyed via helicopter flying transects spaced approximately 1320ft apart, at a ground speed of 60-70 mph and an elevation of ~300ft (Cogan 1992). Helicopter observations were recorded and broken down into 1 of 5 classifications (branched bulls, spikes, calves, cows, unknown). These observations were then compared to the known locations of the radio collared animals (recorded previously from a fixed wing aircraft) to calculate a mark-recapture estimate. The overall number of radio-collared elk (n_1), along with the number of marked elk observed from the helicopter (m_2) and the total number of animals observed during the survey (n_2) were then used in Chapman’s mark-recapture formula to estimate the elk population (Pollock et al. 1990).

As the population continued to increase through the 1990’s a simultaneous expansion in distribution occurred. In 1996, an “expanded” range was delineated to the southeast of the traditional range and included in the annual aerial survey, but only as a minimum count (Figure 6). The 25 survey units of the traditional management area continued to be surveyed by

helicopter yielding an estimate via Chapman’s estimator. While the expanded range was likewise surveyed via helicopter, only the minimum number of animals was noted and simply added to estimate population. In 2003 concerns over the cost of an annual aerial survey combined with an continual increase in the number of elk residing in the expanded management area prompted the PGC to experiment with a ground based mark-recapture estimate developed

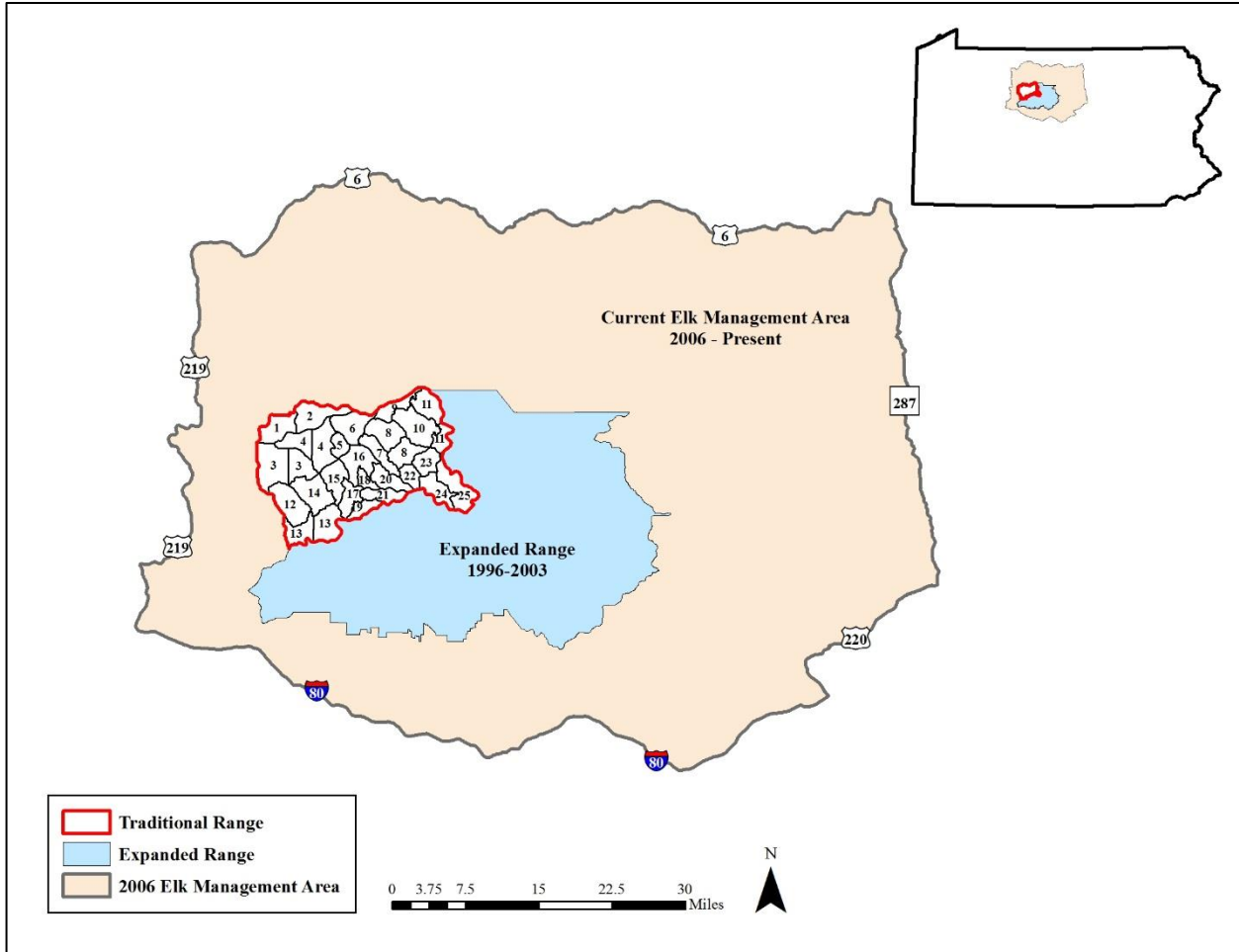


Figure 6. Map of the current elk management area (2006-Present) shown with the traditional (1982-2003) and expanded ranges (1996-2003).

by Bowden and Kufeld (1995). In its most basic form, Bowden and Kufeld’s population estimator is an unbiased variant of the traditional Petersen population estimator (Seber 1982) where the total number of observations is divided by the average number of sightings of marked animals. The PGC used Bowden and Kufeld’s (1995) estimator from 2003-2008. Marked elk were uniquely identifiable via yellow placards affixed to radio collars. Every autumn, predesignated routes were assigned to various PGC personnel, and repeatedly run by vehicle over a 30-day period (usually 15 Sept.-17 Oct.) noting all observations of elk (marked and unmarked). Achieving nominal confidence intervals using this method is highly dependent on the assumption that each marked animal is sighted at least 1 time during the survey period. From 2003-2008 sightability of marked animals was highly variable and the aforementioned assumption was violated on several occasions. As a result, the confidence intervals in several years were over-inflated making the final estimates difficult to interpret. In 2008 Bowden and

Kufeld's estimator was abandoned as a population estimate and replaced with a simple minimum number alive survey.

MINIMUM NUMBER ALIVE (2008–2018)

Since 2008, the Pennsylvania Game Commission has used a minimum count to annually evaluate the elk population. The minimum count is completed during the months of January and February when snow cover is maximized and elk are more likely to congregate in larger groups. We focus primarily on marked elk (radio-collared elk), which are used to locate groups. Each individual observed is then counted and classified into 1 of 4 categories (cows, calves, branched bulls, and spikes). While moving between and locating radio-collared individuals we will opportunistically count groups that don't include marked elk. To maximize the probability of opportunistically observing unmarked groups we generally restrict our survey times to the crepuscular periods when elk are most active. In an effort to minimize double counting we concentrate our searches in an area for several days and count the same groups on several different occasions.

Each year we calculated the percentage of adult cows, calves, adult bulls, and yearling bulls (spikes) within the population. In addition, we calculated the number of branched bulls (adult) per 100 cows by dividing the total number of bulls by the total number of cows, multiplied by 100 ($(\# \text{ bulls} / \# \text{ cows}) * 100$). Similarly, we calculated the number of calves per 100 cows by dividing the total number of calves by the total number of cows, multiplied by 100 ($(\# \text{ calves} / \# \text{ cows}) * 100$). Since 2008, the population has shown an increasing trend with some between year variations ([Figure 7](#)).

Pennsylvania Elk Population (1971-2018)

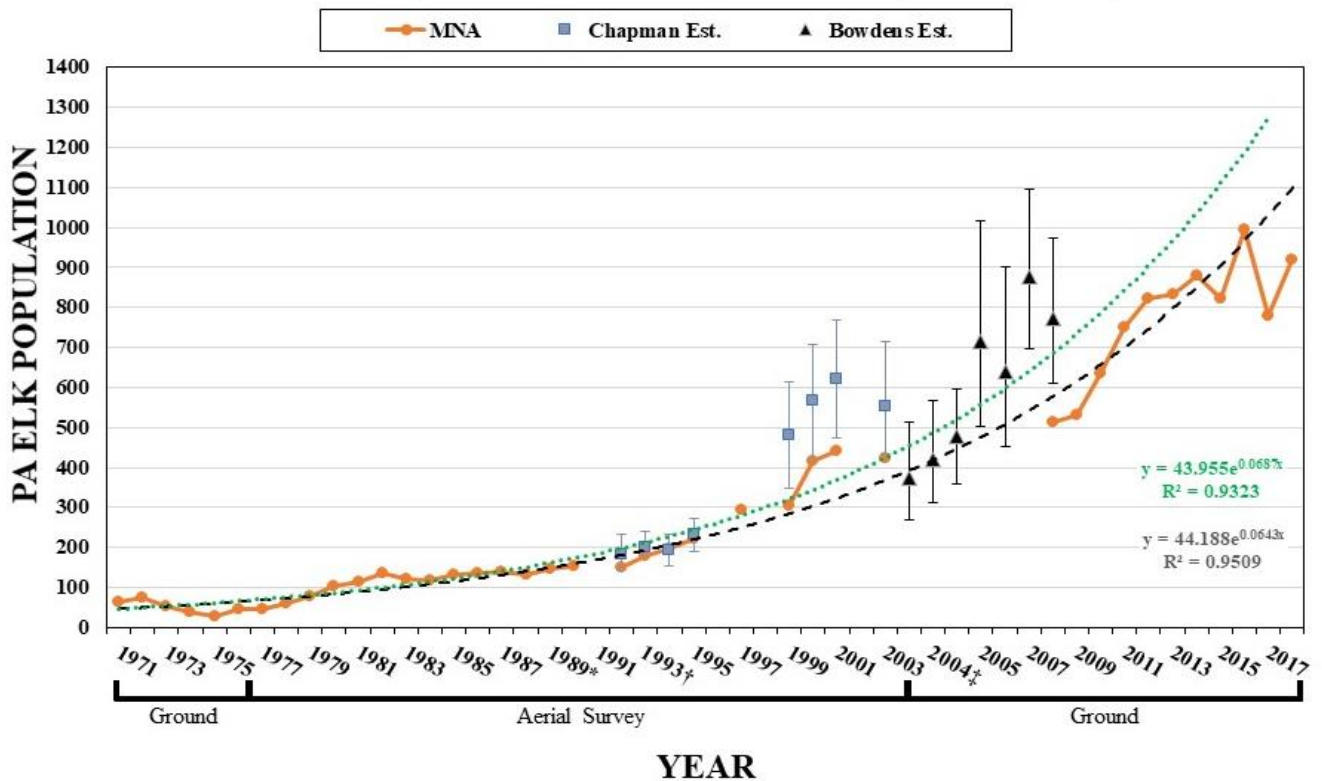


Figure 7. Estimates of Pennsylvania’s elk population by year and survey method. Exponential equations and trend lines are shown for all data points (Green) and only minimum number alive data points (Black).

* No air support was available for the 1989 survey and only ground based observations were collected.

† Aerial survey conducted twice in 1993 & 1994.

‡ Bowden’s estimator survey conducted twice, spring & fall 2004.

FUTURE POPULATION EVALUATION

While our current minimum number alive method clearly underestimates the overall population, it offers a conservative benchmark for annual tag allocations and provides a useful index of the population. Given the current goals of Pennsylvania’s elk management program, the annual minimum number alive survey provides basic, albeit conservative, data needed for management decisions. Some method of annual population evaluation is mandated under [Strategy 1.1.1](#). However, as new technologies become available, we anticipate more accurate, reliable, and cost-effective options will replace current methodologies. [Strategy 1.1.3](#) mandates continual research and evaluation of new or alternative methods.

PRODUCTION ESTIMATES

Apart from the annual survey little effort was directed toward population demographics until 1991. Beginning that year adult cows fitted with radio collars were intensely monitored from mid-May through the end of August. The proportion of cows that produced calves (confirmed by observing a nursing calf and defined as *production*) was determined annually from 1991-1997 ([Table 4](#)). Over the 7-year study, 161 monitored cows produced 109 calves, for a mean

production of 68%. Interestingly twins were observed on 3 different occasions during this study, with 1 set still born (both females) and 2 sets presumably surviving.

Table 4. The number of cows producing calves from annual observations from 1991-1997 and 2005-2010, Pennsylvania.

Year	Cows Monitored	Cows with Calf	% Reproducing
1991	17	11	64.7 %
1992	21	15	71.4 %
1993	29	22	75.9 %
1994	26	17	65.4 %
1995	26	14	53.8 %
1996	25	15	60.0 %
1997	17	15	88.2 %
Total/Mean	161	109	68.5 %
2005	30	24	80.0 %
2006	32	21	65.6 %
2007	47	30	63.8 %
2008	43	24	55.8 %
2009	41	21	51.2 %
2010	35	20	57.1 %
Total/Mean	228	140	61.4 %
Overall	389	249	64.0 %

From 2005-2010 an identical study was conducted using radio collared cows. During the calving season (May-August) cows were monitored for the presence of a calf. Over this 6-year period 228 cows were monitored, and 140 calves were observed yielding a mean production of 62% (Table 4). Pooling data from both studies (1991-1997 & 2005-2010) resulted in an overall average production of 64% (Table 4).

Table 5. Percentage of cows 3-12 years old testing positive for pregnancy specific protein B (pregnant) from 2013-2018.

	2013	2014	2015	2016	2017	2018	Total/Mean
Pregnant	77.3%	66.7%	43.8%	53.2%	47.2%	49.0%	56.2%
# Cows Tested	22	30	32	47	53	51	235

It should be noted that these data represent a minimum estimate of adult cow production. Calf survival from birth to the time of first detection/observation was not estimated or accounted for. Still-born calves are not uncommon in Western populations and detection of still-born calves was only reported on one occasion during the early production study. It's likely that some additional portion of adult cows produced calves that died soon after birth or were still-born and therefore undetected. However, more recent data collected from hunter harvested elk suggests the results of these early studies are representative of the population. Beginning in 2013 Pennsylvania elk hunters who successfully harvested an elk were asked to collect a blood sample while field dressing. Samples from female elk were later analyzed for pregnancy via pregnancy

specific protein B (Table 5). From 2013-2018 an average of 56.2% of cows ages 3-12 were pregnant at the time of harvest (early November). Although there is variability between years the average pregnancy rate across the past 5 years (52.0%) is slightly lower than the combined cow production studies (64.0%). Again however, the reader should exercise caution in interpreting these values as conceptions occurring after October 1 are likely not detected. In addition, at present no data on intrauterine mortality has been collected. Previous research from western populations shows the nutritional condition of the cow influences the potential for intrauterine mortality (Cook et al. 2004a;b), with animals in poor condition being more likely to reabsorb or abort the fetus. Additional data will be needed before any population level conclusions can be made but pregnancy rates and production estimates for Pennsylvania elk appear suspiciously low compared to other populations. Indeed, a 2002 review of western elk populations concluded that pregnancy rates <80% should be considered low and warrant further investigation (Raedeke et al. 2002).

CALF SURVIVAL

Two elk calf survival studies have been conducted in Pennsylvania. The first occurred from 1993-1996. PGC staff captured elk calves <10 days old and fit them with expandable radio collars. Calves were then monitored daily and mortalities investigated within 24 hours of detection. During the 3-year study, 30 calves (15 male, 15 female) were collared and monitored (Table 6). Annual survival was calculated as the proportion of calves surviving to 1 year of age and averaged 77% over the 3-year study, with most deaths occurring within 65 days of birth (Cogan 1998).

Table 6. The number of elk calves captured and surviving to 1 year of age from 1993-1996.

Year	Captured	Survived	% Survival
1993	2	1	50 %
1994	9	6	67 %
1995	8	7	88 %
1996	11	9	82 %
Total/Mean	30	23	77 %

Table 7. Cause specific mortality for elk calves captured and monitored between 1993-1996.

Cause of Mortality	Calves
Bacterial Infection (Clostridium spp.)	2
Meningeal Worm (P. tenuis/brainworm)	1
Drowning	1
Predation (Black Bear)	1
Unknown (Presumed Malnutrition Winter)	1
Poaching	1
Total	7

A second elk calf survival study was completed in 2009 (DeVivo et al. 2011). Similar to the previous study elk calves captured from 2005-2008 (May-August) were fit with expandable radio collars (Table 8). Calves were monitored daily from capture through July 31 and then weekly for the remainder of the study (June 2, 2009) and mortalities investigated with 24 hours of detection. Researchers used the Kaplan-Meier product-limit procedure modified for staggered entry (Kaplan and Meier 1958, Pollock et al. 1990) to estimate calf survival in summer (birth – October 31), winter, (November 1 – April 1) and annually (DeVivo et al. 2011). During the 3-year study 93 calves were collared and monitored, with most (58%) being born to previously radio-collared cows. Annual survival ranged from 0.79 (2007-2008) to 0.93 (2006) yielding an overall estimate of 0.82 across both sexes and all years. Cause specific mortality included a variety of factors including poaching and vehicle collisions among other factors (Table 9; See Appendix B for additional details).

Table 8. Gender specific number of elk calves captured and monitored from 2005-2008.

Year	♂ Calves	♀ Calves	Total
2005	10	12	22
2006	7	8	15
2007	13	15	28
2008	13	15	28
Total	43	50	93

Table 9. Cause specific mortality for elk calves monitored from 2005-2009.

Cause of Mortality	Calves
Poaching	3
Legal Harvest	2
Roadkill	2
Pneumonia	1
Rumen Acidosis	1
Undetermined *	6
Total	15

* Predation eliminated based on all 6 carcasses being intact with no visible signs of trauma.

ADULT SURVIVAL

In late 2009, PSU graduate students Andrew S. Norton and David P. Stainbrook under the direction of Dr. Duane R. Diefenbach completed a brief survival analysis of Pennsylvania’s adult elk population based on data from 199 radio-collared individuals between 1991 and 2008 (Norton et al. 2009). The group used the staggered entry Kaplan Meier estimator (Kaplan and Meier 1958, Pollock et al. 1990) to calculate non-harvest survival as well as overall survival (including harvest). Adult elk in Pennsylvania exhibit relatively high survival rates. Annual non-harvest survival ranged from 0.97 in 1995 to 0.63 in 2008, with an annual mean of 0.86 across both sexes. Pooling data across years yielded an overall non-harvest survival rate of 0.87 with 0.82 for males and 0.90 for females.

Overall survival rates (including harvest) were slightly lower and the authors were openly skeptical of the 2008 estimates speculating that elk hunters may have been selecting collared elk, thereby biasing survival estimates. Limiting our summary to years 2001-2007 (2001 was the first elk hunting season) overall survival rates ranged from 0.84 in 2004 to 0.63 in 2006 with an annual mean of 0.76. Pooling data across years yielded an overall survival rate post-hunting of 0.81 with 0.76 for males and 0.84 for females.

ANNUAL MORTALITY INDEX

Since 1975 a record of known elk mortalities and their causes has been documented and summarized annually ([Table 10](#)). It should be noted that these data do not represent the *actual* number of annual elk mortalities and cannot be utilized in survival estimates; they serve only as an annual index of known cause specific non-harvest related elk mortality. Consistent and leading causes of mortality include animals killed by farmers for crop damage, illegal poaching, and elk-vehicle collisions. It should be noted however that elk-vehicle collisions have exceeded both crop damage and illegal kills over the past decade. Indeed, outside of legal harvest elk-vehicle collisions are the single greatest cause of mortality in Pennsylvania.

Table 10. Cause specific sources of known elk mortality in Pennsylvania by year from 1975-2018.

Year	Crop Damage	Illegal	Highway	Meningeal Worm	Winter Mortality	Accidental	Train	Disease	Other	Birthing Complications	Dogs	Unk	Total
1975	2	3	1	3	0	0	0	0	0	0	0	3	12
1976	5	2	0	2	0	0	0	0	0	0	0	1	10
1977	2	4	1	0	0	0	0	0	0	0	0	0	7
1978	1	7	0	5	0	0	0	0	0	0	0	2	15
1979	0	2	0	1	0	0	0	0	0	0	0	2	5
1980	4	4	0	2	0	0	0	2	0	0	0	1	13
1981	6	1	2	0	0	0	0	1	0	0	0	0	10
1982	11	15	0	2	5	0	0	0	0	0	2	0	35
1983	5	5	0	2	0	0	0	0	0	0	0	3	15
1984	2	4	0	0	0	0	0	0	0	0	0	1	7
1985	4	4	0	0	1	0	0	1	0	0	0	1	11
1986	3	2	0	1	0	0	0	0	0	0	0	0	6
1987	8	1	0	1	0	0	0	0	0	0	0	2	12
1988	2	3	1	1	0	0	0	1	0	0	0	5	13
1989	2	8	0	0	0	0	0	1	0	0	0	1	12
1990	10	2	1	0	0	1	0	0	0	0	0	0	14
1991	9	4	3	5	0	0	0	0	0	0	0	3	24
1992	1	3	0	3	0	1	0	0	2	0	0	2	12
1993	1	3	2	0	5	2	1	0	0	0	0	2	16
1994	1	4	0	3	0	3	1	1	1	2	0	2	18
1995	2	6	1	2	1	4	1	0	0	1	0	3	21
1996	0	2	6	3	1	1	2	1	1	0	0	3	20
1997	2	3	6	2	0	5	0	0	0	0	0	4	22
1998	3	5	4	1	0	2	3	0	1	0	0	8	27
1999	13	6	11	2	1	1	8	0	0	0	0	5	47
2000	4	6	12	1	0	3	6	0	2	0	0	16	50
2001	7	7	12	3	0	2	1	0	0	0	0	10	42

2002	17	7	9	1	0	2	5	0	2	0	0	9	52
2003	11	3	5	1	0	5	1	0	0	0	0	2	28
2004	7	4	5	3	0	4	1	0	2	0	0	6	32
2005	7	5	13	5	0	2	0	0	2	0	0	3	37
2006	6	6	17	8	0	3	0	0	0	0	0	6	46
2007	4	4	6	1	0	5	0	0	1	0	0	10	31
2008	13	3	15	1	0	3	0	0	1	0	0	9	45
2009	2	3	8	3	0	2	0	0	3	0	0	16	37
2010	2	1	11	1	0	1	0	0	4	0	0	9	29
2011	6	2	14	4	0	3	1	0	8	0	0	15	53
2012	5	0	19	0	0	5	0	0	0	0	0	5	34
2013	3	4	20	2	0	1	0	0	2	0	0	9	41
2014	4	5	13	0	0	1	1	0	5	0	0	32*	61
2015	0	6	19	6	0	1	0	0	6	0	0	12	50
2016	4	3	13	7	0	3	0	0	1	0	0	9	40
2017	9	6	23	5	0	4	0	0	11	0	0	7	65
2018	8	6	20	3	0	1	1	0	8	0	0	16	63
Total	218	184	293	96	14	71	33	8	63	3	2	255	1240

* Includes 5, 9-month old calves that were found decomposed on SGL-311, potentially winter mortality, but too decomposed to determine.

POPULATION RATIOS

The two primary ratios of interest for Pennsylvania elk are the calves per 100 cows and branched bulls per 100 cows. Over the past eleven years these ratios have only exhibited mild variations ([Table 11](#)). The ratio of calves per 100 cows has ranged from 32 to 51 with a long term mean of 38. A calf ratio at this level, while not uncommon in many Western populations, is slightly low

Table 11. Population ratios (calves and branched bulls per 100 cows) by year from 2008-2018.

Year	Calves:Cow	Branched Bulls:Cow
2008	33	28
2009	44	28
2010	36	31
2011	37	31
2012	32	30
2013	37	32
2014	37	32
2015	46	20
2016	45	28
2017	37	30
2018	51	29
Mean	39	29

given Pennsylvania's low neonatal predation (DeVivo et. al. 2011). This relatively low ratio is likely rooted in the suspiciously low pregnancy rates previously discussed. The ratio of branched bulls per 100 cows is more consistent ranging from 20 to 32 with a long term mean of 29. This ratio is expected given the relatively conservative nature of the PGC's harvest management on bull elk.

Maintaining a ratio of 25:100 is a stated goal of Pennsylvania's elk management program ([Strategy 1.2.2](#)).

CHRONIC WASTING DISEASE

In 2012, Pennsylvania documented its first occurrences of chronic wasting disease (CWD) in both wild and captive white-tailed deer. Under the guidelines of the existing CWD response plan, disease management areas (DMA) were established around each positive animal (Pennsylvania Game Commission 2016). In 2014, several more positive white-tailed deer were confirmed from a captive

facility in Jefferson County and a third DMA was established ([Figure 8](#)). Additional regulations designed to monitor and limit the spread of the disease (Pennsylvania Game Commission 2016) are applied within the DMAs. Every legally harvested elk combined with dead animals found opportunistically (or via radio collars) is tested for CWD. To date no elk have tested positive for CWD. Unfortunately, Chronic Wasting Disease will eventually be found in Pennsylvania elk. The timing of that event is nearly impossible to predict but the number of cases found in wild deer increases annually and Pennsylvania has over 3000 captive facilities (PA Department of Agriculture, pers. comm) spread throughout the State. These facts combined suggest that Pennsylvania elk are likely to be exposed to CWD positive animals sometime in the next 10-20 years. Monitoring and attempting to reduce the spread of this disease are part of the PGC's response plan. Under [Strategy 1.3.4](#), an elk-specific section is included in the response plan. While much of the management responses will mirror those already accepted for white-tailed deer, this section includes information on establishing an elk specific DMA and options for reducing disease transmission.

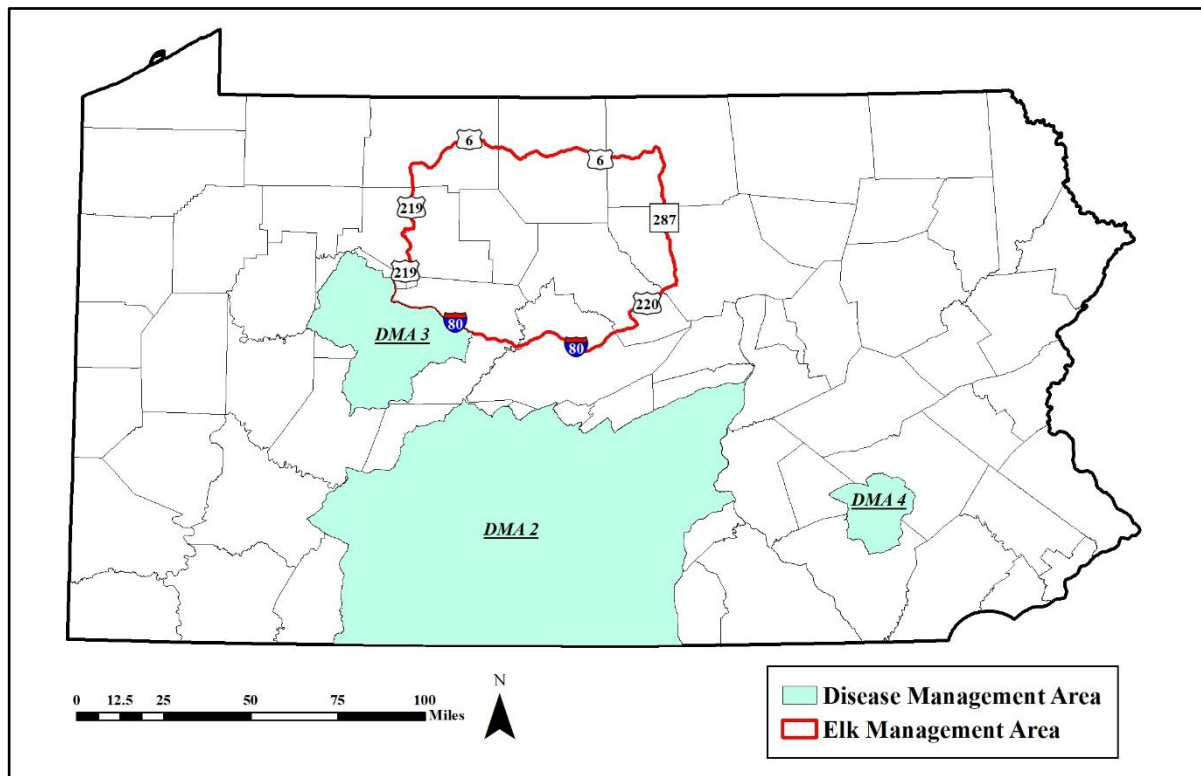


Figure 8. Map of the elk management area shown with the current disease management areas encompassing CWD positive animals, Pennsylvania.

OTHER DISEASE MONITORING

In addition to CWD testing, all hunter harvested elk along with some elk killed through non-harvest related processes are tested for bovine tuberculosis and brucellosis. Bovine tuberculosis is a bacterial disease that typically affects the lungs and can lead to mortality in elk. It has become endemic in wild deer in northern Michigan and is occasionally found in elk as well. Pennsylvania elk are tested for tuberculosis because they could be infected through movement of live animals by the captive cervid industry. Brucellosis, caused by *Brucella abortus*, is known to infect cattle and people worldwide. Brucellosis has been found in bison and elk in the Greater Yellowstone Area of Wyoming, Montana, and Idaho. Abortion is the most common symptom of brucellosis and typically occurs in the latter half of pregnancy (generally late Feb – Mar). At present brucellosis is not found in free ranging elk outside the Greater Yellowstone Area. However, like tuberculosis, there is potential for elk or bison harboring the disease to be transported into Pennsylvania through the movement of animals by the captive cervid industry. This potential risk warrants that all hunter harvested elk in Pennsylvania be tested for brucellosis. Since 2001, with the inception of Pennsylvania’s elk hunting season, the Game Commission has tested >800 elk for bovine tuberculosis and brucellosis with no animals testing positive for either disease. [Strategy 1.3.1](#) mandates that we continue to test all hunter harvested elk for these diseases.

GENETIC DIVERSITY

The history of elk in Pennsylvania from the early reintroduction efforts to the present is a near perfect description of a population bottleneck. The relatively small reintroduction effort led to

an apparent increase through the 1920's followed by a decline in the 1930's with the population remaining low until the mid-1970's when it began steadily increasing to the present. The length of this bottleneck (45-50 years) combined with a matriarchal social structure and polygynous mating system make Pennsylvania's elk highly susceptible to a loss of genetic diversity (Williams et al. 2002). In 2002, Williams et al. (2002) compared the genetic diversity of Pennsylvania elk to that of its source populations (Yellowstone National Park and South Dakota). Multi-locus heterozygosity of PA elk (0.222) was >60% less than that of its source populations (YNP=0.57 & SD=0.589). Williams et al. (2002) further speculated that it was unlikely that PA had more than 10 effective breeding pairs prior to 1971. Overall, Williams et al. (2002) concluded their findings "provide indisputable empirical data" that Pennsylvania's elk population experienced a genetic bottleneck.

The consequences of poor genetic diversity are ambiguous. To date there is no record of Pennsylvania elk ever having physical abnormalities and body condition scores collected during routine captures indicate the population is generally healthy. However, Pennsylvania elk have and continue to exhibit suspiciously low productivity; a symptom that might be related to poor genetic diversity. Additional research will be needed to determine effects (if any) of low genetic diversity as well as the costs and benefits of attempting to address these effects through management.

SECTION V. ELK HABITAT MANAGEMENT

HISTORY OF ELK HABITAT MANAGEMENT

It's not entirely clear when Pennsylvania's land management agencies began actively managing elk habitat. There is some evidence that herbaceous habitats were being maintained specifically for elk as early as 1965 (Erickson 1965), but most accounts point to the 1970's as the start of dedicated elk habitat management. In 1977, as part of Penn State's initial elk research, some logging access roads and landings were disked and seeded with herbaceous species (Devlin and George 1979, Hunter et al. 1979). Around that same time Harrison (1994) describes careful planning of timber removals to encourage woody regeneration providing browse and in 1980 several old fields and failed clear-cuts were disked, limed, fertilized, and planted with a mixture of grasses (Harrison et al. 1994). The 1982 cooperative elk management plan included goals related to maintenance and creation of herbaceous habitat and early successional forests on public lands. Similar goals were outlined in the 1989-1995 elk management plan and the 1996 management plan called for an expansion of the current elk range through habitat enhancement, land acquisition, and assisted dispersal (trap and transfer). All these plans resulted in a continual increase in the number of acres being managed as herbaceous habitat through the 1980's and 90's. During this same period many of the public land timber removals were fenced, at great expense, to prevent over browsing. Through the 1990's fencing timber removals became more common as perceived deer impacts increased reducing the overall availability of browse. By 2000, the Pennsylvania Game Commission and the Bureau of Forestry were actively managing ~ 1100 acres of herbaceous habitat within the elk management area (at that time 835-square miles; Pennsylvania Game Commission et al. 2006).

ELK HABITAT CHALLENGE INITIATIVE

In 2001, a partnership between the PGC, the DCNR-BOF and the Rocky Mountain Elk Foundation launched the "Elk Habitat Challenge Initiative". The initiative's goal was to raise \$1.2 million in public and private funds over a 3-year period for improving elk habitat (Pennsylvania Game Commission et al. 2006). The three-year effort included funding from over 12 different private organizations/companies as well as RMEF and the 2 State Agencies. Over \$830,000 was raised for habitat development resulting in creation of 593 acres of herbaceous habitat as well as improvement (addition of lime and fertilizer) of nearly all the existing herbaceous openings. In addition, equipment for habitat maintenance was purchased and several small private acreages were improved. Since 2006, the PGC has continued to increase the acres of herbaceous habitats on public lands, mainly through mine reclamation projects (mining occurred prior to PGC acquisition).

PRESENT DAY ELK HABITAT MANAGEMENT

At present, Pennsylvania's elk management area (EMA) is ~3750 square miles with over 70% of that area in public land ownership. On public lands, the PGC in collaboration with the DCNR-BOF actively manages just over 2100 acres of herbaceous habitat distributed primarily in the western half (currently occupied portion) of the EMA. Three PGC habitat crews (2-3 people per crew) as well as DCNR-BOF maintenance staff from several State Forests work in conjunction to maintain herbaceous openings. On average, each opening is mowed at least once per year during the growing season and top-dressed with lime and fertilizer on a 3-5-year rotation. Approximately every 5-7 years individual openings are replanted with a no-till seeder/drill. In

some circumstances specific openings may be mowed more frequently (2-3 times per year) depending on the desired forage (i.e. clover *spp.* vs. cool season grasses).

Forage classes commonly found or planted in herbaceous openings include cool season grasses, warm season grasses, forbs, and legumes. Specific species common to these habitats include orchard grass (*Dactylis*), timothy (*Phleum pratense*), little blue stem (*Schizachyrium scoparium*), birds foot trefoil (*Lotus corniculatus*), clover species (*Trifolium spp.*), and aster species (*Aster spp.*).

Timber removals generate low-level woody browse providing an abundant source of food for elk. Over the past 5 years the DCNR-BOF has removed >5000 acres of timber in areas currently occupied by elk. While site conditions influence overall regeneration, these timber removals generally result in large expanses of early successional habitat offering cover and browse for elk and other wildlife. Depending on location and regeneration in the years following a timber removal some fencing may still occur. However, the overall number of fenced acres is declining, and Foresters are encouraged to plan larger scale harvests in an effort to prevent overbrowsing.

Conifer stands make up ~8% of the EMA and have been documented as a source of cover in Pennsylvania (Kougher 2009). These stands, generally of lower timber value, are conserved for wildlife (including elk) under most circumstances.

Mast producing stands are managed on a sustainable rotation ensuring the annual availability of acorns. Acorns are an important component in the seasonal diets of elk in Pennsylvania (Heffernan 2009) and other Eastern populations (Schneider et al. 2006, Lupardus et al. 2011).

Less is known about private land habitat management and in most circumstances it's likely that little if any active management occurs exclusively for elk. However, some of the largest sub-populations predominantly occupy private lands, and locational data from radio collared elk indicate that most, if not all, Pennsylvania elk seasonally utilize private land. Like other Appalachian States, Pennsylvania's landscape has been significantly altered by surface mining operations. Reclaimed surface mines create open herbaceous habitat in a mostly forested landscape that is highly attractive to elk and these private land areas are utilized almost year-round.

FUTURE ELK HABITAT MANAGEMENT

Over the next decade leading into the future the PGC plans to add to the current practice of maintaining hard-edged herbaceous openings through high input annual mowing to include a more natural disturbance regime. In addition to creating young forests, practices will include converting some closed canopy stands into oak woodlands. These stands, along with failed clear-cuts, can be disked and seeded with a blend of native grasses, forbs, and soft mast producing shrubs that can be managed by fire. Prescribed fire is an efficient method of successional setback, commonly utilized in many Western and Southeastern States. Up into the late-1800's periodic fires acted as the primary source of disturbance in Northern Pennsylvania affording vast acres of early successional habitats for elk and other wildlife (Brose et al. 2013). Fire increases the overall amount of edge, creates diverse uneven-aged habitats, improves soil health, and increases nutritional quality of vegetation.

The growth and expansion of Pennsylvania's elk population is intimately linked with abundant high-quality habitat. While the PGC will continue to create and maintain an increasing number of herbaceous acres, it is time consuming and costly. If population growth is to become reality, additional effort to create high quality habitat that doesn't require high input annual maintenance (mowing, fertilizer, fuel, time, etc.) must occur. This does not suggest abandonment of our current habitat maintenance strategies, only that over time movement toward an additional low-input method of successional setback will be necessary to maintain/create the mosaic of diverse aged habitats selected by elk.

SECTION VI. ELK HARVEST MANAGEMENT

ELK HUNTING SEASON (2001 – 2018)

With the closure of elk hunting after the 1931 season, Pennsylvania's elk population remained un-hunted for the next 70 years. As the population increased through the 1980's and 1990's, concern over elk-human conflicts and habitat degradation grew. In 1996, the PGC's Board of Commissioners asked Game Commission staff to evaluate the feasibility of elk hunting by 1998. In June 1997, wildlife management staff released a report examining the different aspects and effects of reinstating an elk hunting season. Ultimately the report concluded that, because legislative action was required to initiate a hunt and the Commission had little information about the attitudes and perceptions of stakeholders, an elk hunt was not advisable by 1998. However, the report conceded that elk hunting could be possible in the "near future" and recommended the Game Commission begin an aggressive educational campaign to gain public consent for an elk hunting season. Over the next few years (1998-2000) several public presentations were conducted across the State. In late 2000, the Pennsylvania Legislature approved Senate Bill 612 granting authority to the Game Commission to develop regulations for a limited elk hunting season and establish an application process for the issuance and sale of elk licenses. The following year (April 2001) the Board of Commissioners approved the first elk hunting season since 1931. In the inaugural season, a total of 30 licenses were issued via lottery. Licenses were designated as either antlered or antlerless and restricted to a specific geographic area or elk hunt zone. Over 50,000 potential elk hunters paid a non-refundable fee (\$10.00) applying to hunt elk during the 6-day season, which was held from Nov. 12-17. Successful hunters were required to take their elk to a check station within 24 hours of harvest. Check station staff collected biometrics and samples for disease testing and evaluating reproduction. Pennsylvania's elk hunting season has continued with generally the same structure through 2018 with a few noteworthy exceptions.

SEPTEMBER SEASONS (2006-2008)

For three consecutive years (2006-2008) the Game Commission authorized an early (September/October) elk season in addition to the traditional November season. This season specifically targeted areas of high agricultural conflict. In each year a total of 10 tags (2 either-sex + 8 antlerless) were issued via lottery for hunt zones that had a history of agricultural damage due to elk. However, only 2 antlerless elk were taken annually during this season (DeBerti 2008) and this limited success prompted the Game Commission to abandon it after 2008.

ARCHERY AND LATE ANTLERLESS SEASONS (2019-PRESENT)

In April 2019, the Board of Commissioners approved an archery elk season for the latter part of September (Sept. 14-28, 2019) in addition to the traditional general season held in early November (Nov. 4-9, 2019). Likewise, a late antlerless only season was approved for early January (Jan. 4-11, 2020), increasing the number of hunting days from 6 with the traditional general season to 26 with the early archery and late seasons. The main motivation for these additional seasons was to decrease over-crowding by elk hunters during the general season, increase flexibility in managing the inevitable CWD infection, and reduce habituation.

BONUS POINTS (2003-PRESENT)

In 2003, a bonus point system was established where applicants gain 1 point for each year they are unsuccessful. Points are then applied in subsequent drawings as a multiplier increasing the applicant's probability of being drawn. Bonus points are only lost if/when an applicant is successfully drawn, but the applicant must apply in the current license year for his/her points to take effect. If an applicant is drawn for an antlered permit, they must wait five years before they can apply again, but applicants drawn for an antlerless permit may begin applying the following year.

SPECIAL CONSERVATION LICENSES (2009-PRESENT)

In October 2008, House Bill 747 was passed granting the Game Commission authority to auction a single elk license in contract with a "wildlife conservation organization". The contracted organization was permitted to keep up to 20% of the proceeds for administrative costs and return the remaining 80% for the Commonwealth's elk management program. This license, referred to as the special conservation elk license, generated \$28,000 in its inaugural year (2009) and more than \$169,000 over its 5-year life span. The original legislation authorizing the bill included a sunset clause of July 2013. Fortunately, House Bill 2169 passed in July 2014, reauthorizing the original special conservation license as well as a second conservation license that could be auctioned or raffled at the discretion of the contracted conservation organization. In 2014, one special conservation license was auctioned and the second was raffled raising a combined total of over \$200,000 for Pennsylvania's elk management program ([Table 12](#)). Since then these licenses have been annually auctioned or raffled.

Table 12. Summary of Pennsylvania's annual special conservation elk licenses including cost, participating organization, and funding method from 2009-2019.

Year	Conservation Organization Contracted	Cost	Fund Raising Method
2009	National Wild Turkey Federation	\$ 28,000	Auction
2010	Rocky Mountain Elk Foundation	\$ 35,000	Auction
2011	Safari Club International	\$ 29,000	Auction
2012	Eastern Chapter of the Wild Sheep Foundation	\$ 37,500	Auction
2013	Rocky Mountain Elk Foundation	\$ 40,000	Auction
2014	Rocky Mountain Elk Foundation	\$ 41,000	Auction
2014	Keystone Elk Country Alliance	\$ 163,175	Raffle
2015	Rocky Mountain Elk Foundation	\$ 52,500	Auction
2015	Keystone Elk Country Alliance	\$ 157,150	Raffle
2016	Rocky Mountain Elk Foundation	\$ 85,000	Auction
2016	Keystone Elk Country Alliance	\$ 190,325	Raffle
2017	Rocky Mountain Elk Foundation	\$ 85,000	Auction
2017	Keystone Elk Country Alliance	\$ 195,350	Raffle
2018	Rocky Mountain Elk Foundation	\$ 105,000	Auction
2018	Keystone Elk Country Alliance	\$ 180,650	Raffle
2019	Rocky Mountain Elk Foundation	\$ 105,000	Auction
2019	Keystone Elk Country Alliance	\$ 183,500	Raffle

ELK HUNT ZONES

The current elk management area encompasses 14 individual elk hunt zones. Hunt zone boundaries are delineated and designed to encompass an individual sub-population (defined as a group of elk that remain together throughout the calendar year), and any areas of potential elk-human conflict. Prior to the annual elk hunting season, each hunt zone is allocated a set number of antlered and antlerless licenses except hunt zone 1. Hunt zone 1 is open to any elk hunter with a valid unused elk license. Hunt zone 1 includes large portions of land along the elk management area boundary and is designed to reduce the probability of elk migrating out of the elk management area. The remaining hunt zones vary in size, but each zone maintains a self-sustaining elk sub-population.

APPLICATION PROCESS AND SEASON DATES

In Pennsylvania, hunting licenses are usually available for purchase by mid-June of each year. Hunters interested in hunting Pennsylvania elk must apply between the onset of license sales (~mid-June) and July 31 of each year. Applicants are charged a non-refundable fee of \$11.90. Applicants may apply for one, two, or all three seasons and may select from one of four optional license types, bull-only, cow-only, either-sex, or point only. The point-only option simply provides an applicant with an additional preference point without entering them in the drawing. Applicants may also select a preferred hunt zone with no impact on their probability of being drawn. For example, if the preferred zone is unfilled at the time the applicant is drawn, they are automatically assigned to that zone. However, if the preferred zone is already filled, the applicant is randomly assigned to any remaining unfilled zone. Both residents and non-residents may apply with an equal probability of being drawn, however, if drawn resident elk licenses cost \$25.00 while non-resident elk licenses cost \$250.00. The number of applicants has varied from over 50,000 in 2001 to over 60,000 in 2019 ([Figure 9](#)). The source of this variation is unclear but likely related to the annual number of elk licenses as well as larger economic trends. Most of the applicants are Pennsylvania residents (~93%), with most non-resident applicants being from neighboring States.

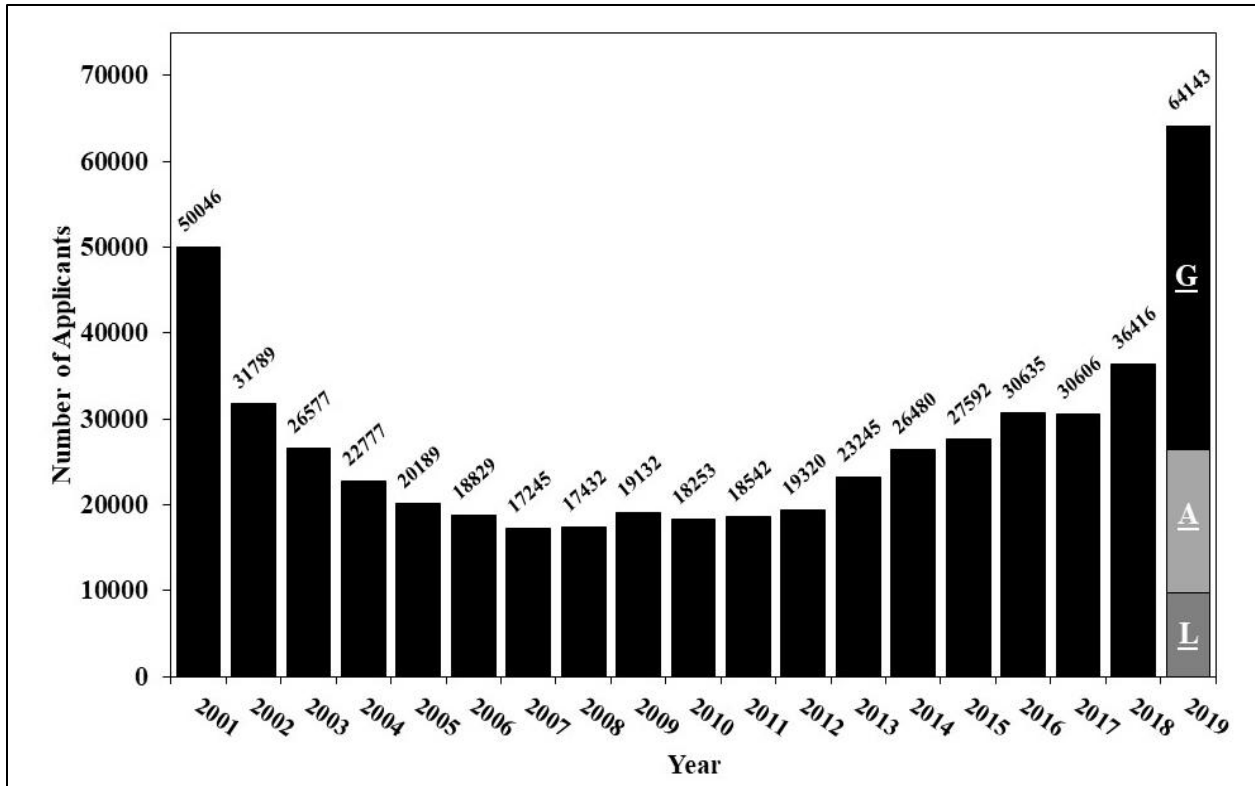


Figure 9. The number of applicants for Pennsylvania’s annual elk hunting season by year. For the 2019 season, applicants are categorized proportionally by season type; G – General, A – Archery, and L – Late.

Since 2001, Pennsylvania’s regular elk hunting season has never exceeded six days in length. From 2001 – 2007, the elk hunting season was generally held the second full week of November. Beginning in 2008 to the present, the season was held during the first full week of November. In 2010, an extended elk season was offered during the week (except Sundays) following the regular season in areas outside the elk management area. Open to any elk hunters with an unused tag, the goal of the extended season was to eliminate animals that had migrated out of the elk management area. To date no elk have been harvested during the extended season.

HARVEST SUCCESS

Harvest success for antlered elk has been consistently >90%, with a long-term average of 97% (Table 13). Most antlered elk hunters (>85%) coordinate and hire an outfitter to assist in locating, field dressing, and moving elk from the field. Harvest success for antlerless elk hunters has been variable ranging from 61% to 89%, with a long-term average of 77%. Overall success for all elk hunters averages 83% (Table 13) and traditionally >55% of hunters hire an outfitter/guide.

Table 13. The number of Pennsylvania elk hunting licenses, hunter harvested elk, and hunter success rates by year from 2001-2018.

Year	Licenses Issued			Hunter Harvest			Harvest Success (%)		
	Antlered	Antlerless	Total	Antlered	Antlerless	Total	Antlered	Antlerless	Overall

2001	15	15	30	14	13	27	93%	87%	90%
2002	36	34	70	32	29	61	89%	85%	87%
2003	20	80	100	19	49	68	95%	61%	68%
2004	12	28	40	12	22	34	100%	79%	85%
2005	10	30	40	10	25	35	100%	83%	88%
2006[†]	15	25	40	14	19	33	93%	76%	83%
2007[†]	15	25	40	14	19	33	93%	76%	83%
2008[†]	17	28	45	17	23	40	100%	82%	89%
2009*	20	39	59	20	24	44	100%	62%	75%
2010*	17	33	50	17	23	40	100%	70%	80%
2011*	18	38	56	18	34	52	100%	89%	93%
2012*	19	46	65	19	33	52	100%	72%	80%
2013*	26	60	86	25	47	72	96%	78%	84%
2014**	27	81	108	25	63	88	93%	78%	81%
2015**	21	95	116	20	65	85	95%	68%	73%
2016**	25	99	124	25	79	104	100%	80%	84%
2017**	25	93	118	25	79	104	100%	86%	89%
2018**	26	99	125	25	74	99	96%	75%	79%
Overall	364	948	1312	351	720	1071	97%	77%	83%

[†] Does not include data from the September season that resulted in the additional harvest of 2 antlerless elk each year.

* Does not include the special conservation license that resulted in the additional harvest of 1 antlered elk each year.

** Does not include the special conservation licenses that resulted in the additional harvest of 2 antlered elk each year.

SECTION VII. CULTURAL VALUE OF PENNSYLVANIA'S ELK

PUBLIC INTEREST AND CULTURAL VALUE

Over the past 40 years public sentiment toward Pennsylvania's elk has changed dramatically. In the late 1970's and early 1980's, elk were seen as little more than a nuisance to local landowners and crop depredation was a major source of mortality (Eveland et al. 1979, Cogan 1996). However, notable changes in the cultural value of elk began in the late 1980's, as an increasing number of people were visiting the area to see them (Shafer et al. 1993). This *elk-viewing* tourism, primarily occurring during the autumn rut, was initially unwelcome by many local residents (Cogan 1996). However, as the seasonal tourism became more consistent and regular, local residents began opening a variety of service-oriented businesses to capitalize on the surge of people visiting the area. Shafer et al. (1993) estimated that in 1987 the number of recreational visitor days was 7,200. Ten years later, Lord et al. (2001) reported an annual visitation of ~53,000 people in 1997 that increased to ~64,000 by 2000.

In fall 2010, after several years of fund raising, the *Elk Country Visitor Center* was opened to the public. The Visitor Center, owned by the DCNR and operated by the Keystone Elk Country Alliance (KECA), is an 8400sq ft building designed to educate the public about elk biology and habitat. During the first four months the Visitor Center was open it had over 51,000 people come through its doors. In fall 2015, the estimated number of visitors was ~350,000.

In addition to elk-focused eco-tourism, the 2001 return of elk hunting created a coveted opportunity to harvest a Pennsylvania elk ultimately improving their value amongst sportsmen. The first elk season (2001) attracted over 50,000 applicants interested in hunting Pennsylvania elk. The number of applicants declined in the years following but has recently begun to increase with over 60,000 applicants for the 2019 elk season.

Although there's notable variation in the source of their value, it's clear that many Pennsylvania residents presently see their elk population as a treasured resource. However, a distinction between non-resident visitors to the elk management area and local residents is also apparent. Most non-resident visitors have very positive opinions of the elk population, while resident opinions are more varied depending on their interaction/encounters with elk directly and their economic connection to elk-driven tourism. Despite this disparity, the previous perception of elk as a nuisance to be destroyed has been, in large part, replaced by acceptance and appreciation.

CONTINUED PUBLIC SUPPORT

At present, public outlook toward Pennsylvania's elk is generally supportive. A positive shift in public opinion has substantially reduced many of the social challenges that were endured in the 1980's and 90's. While some proportion of the public will always disapprove of elk in Pennsylvania, an increasing fraction is excited and even passionate about elk. Maintaining or ideally increasing public support for elk has been and will continue to be a primary goal of Pennsylvania's elk management program. Approval, or at least acceptance of elk by many provides the conduit for continual habitat improvement and population growth. Maintaining public support will require consistent education on elk biology and management (See [Goal 5](#)), a continual increase in transparency of management actions, and sincere and dedicated efforts at mitigating human-elk conflicts (See [Goal 4](#)). In addition, safe and educational opportunities for public involvement should be utilized. In most circumstances, offering opportunities for public involvement in wildlife management will strengthen public trust in natural resources agencies and the justification for science-based management.

SECTION VIII. ELK-HUMAN CONFLICTS

HISTORY OF ELK-HUMAN CONFLICTS

Historically, agricultural damage was the primary source of elk-human conflicts in Pennsylvania. Early accounts from the decades following their initial reintroduction note that elk were regularly killed for crop depredation which likely led to their extirpation from many of their original release sites. The remaining sub-population in Elk County probably persevered because of their relatively low overlap with agricultural areas and relatively low human density. It wasn't until the late 1980s and early 1990s as the elk population began to recover that complaints of agricultural damage began to increase. The majority of these complaints originated from areas surrounding the elk management area (mostly outside St. Mary's, PA). Pennsylvania law allows farmers to kill elk (and other wildlife) for agricultural damage (34 PA Code §2121). If an elk is killed for crop depredation, the PGC must be notified within 24 hours and the head and hide will be collected. Any edible portions of the elk may be retained by the farmer as long as the animal was killed on property open to public hunting and outside of any deterrent fencing that was provided by the PGC. See [Appendix D](#) for specific text of this law. Records of known elk mortalities through the late 1970's and early 80's reflect a consistent removal of animals for crop damage ([Table 10](#)) and these figures only represent the number of reported crop kills. The actual number of elk killed for crop damage was probably 50-100% greater. Farmer's legal rights to kill wildlife for crop damage combined with the relatively small elk population during that time frame motivated a concerted effort to reduce elk-agricultural conflicts. In 1982, an "elk committee" was initiated and provided a biannual forum for farmers to share their grievances with representatives of the PGC and the DCNR. This committee continued to meet to discuss remedies for elk-human conflicts into the mid-2000s. An additional measure aimed at mitigating elk-human conflicts was habitat improvement on public lands and, in some instances, land acquisition. Through the late 1980s, herbaceous habitat was continually created or enhanced on public lands bordering agricultural areas (mainly near St. Mary's). In 1990 the PGC partnered with the Rocky Mountain Elk Foundation to purchase a large tract of previously surfaced mined land near the agricultural areas. This parcel later became State Game Lands 311.

DETERRENT FENCING

In 1993, the PGC again partnered with the Rocky Mountain Elk Foundation and developed an elk deterrent fencing program. Under this program the cost of material and construction was shared between the PGC and the RMEF and fences were erected on several farms at no cost to the landowner. This program continued for several years and eventually ended due to a lack of funding. Nevertheless, numerous farms that were traditionally experiencing elk damage were fenced and many of those fences are still in place to date.

PRE-HUNT POPULATION CONTROLS (TRAP AND TRANSFER)

Open communication, land acquisition, habitat improvement on public lands, and the deterrent fencing program clearly aided in alleviating some of the agricultural conflicts but also promoted population growth and expansion. In 1997, with no methods to control the increasing elk population, persistent agricultural conflicts, and suitable but currently unoccupied habitat, the PGC initiated an Elk Trap and Transfer Program. The goal of this 3-year program was to reduce elk densities in high conflict areas and expedite dispersal to unoccupied but suitable habitat (Cogan 1996).

During the winters of 1998, 1999, and 2000, sixty-eight elk were captured and held in one of three enclosures located on public land (Bitumen, Hevner Run, State Game Lands 321) to the south and east of the traditional elk management area (Figure 10). In the spring following each winter capture, elk were released into their new environments. The success of the trap and transfer program varied between release sites. In the first years of the Bitumen release site, 9 elk were shot for crop depredation and another 4 were killed illegally. The Hevner Run release had similar results and was only used for 1 year. In contrast, the release site on State

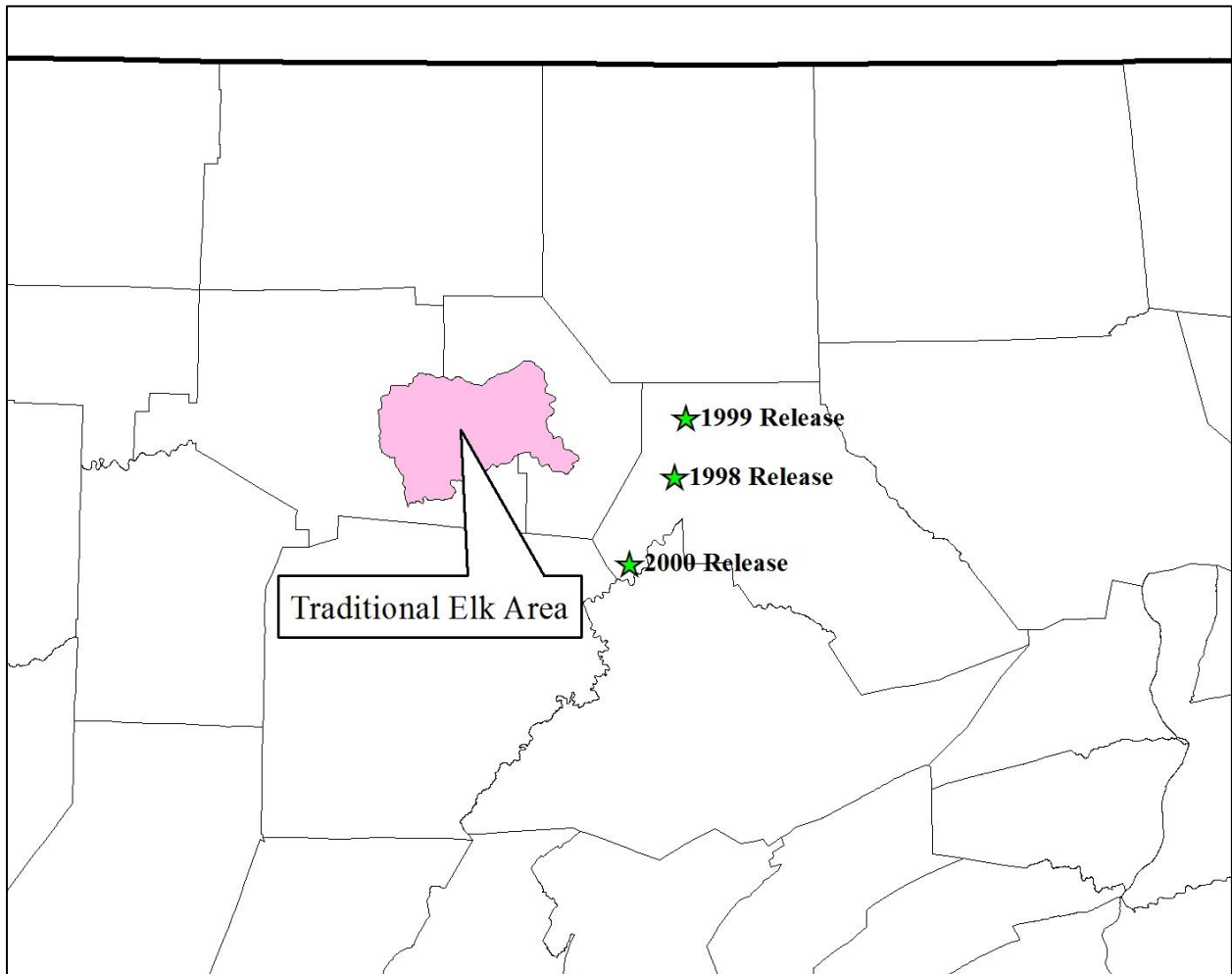


Figure 10. Approximate location of elk release sites of during the Pennsylvania elk trap and transfer program from 1998-2000.

Game Lands 321 flourished from 18 elk to >200 as of the 2017 winter survey. Overall, the trap and transfer program did succeed in expanding elk distribution and increased utilization of suitable but previously unoccupied habitat and likely contributed to a reduction in human-elk conflicts via localized population reduction.

ELK HUNTING

In 2001, Pennsylvania held its first elk hunting season in almost 70 years. The planning process and the legislation that ultimately allowed for elk hunting is summarized in Section VI, Elk Harvest Management. Here we briefly review Pennsylvania's elk hunting season in the context of elk-human conflicts. Regulated hunting is the traditional means by which most State wildlife agencies manage populations and Pennsylvania elk are no exception. Each year since 2001, the PGC has allocated a specific number of male and female elk licenses that are awarded to hunters via lottery. The occupied portion of the elk management area is currently separated into 14 hunt zones. Individual hunt zone boundaries are delineated considering elk distribution and areas of traditional or potential elk-human conflict. Zones encompassing areas of high elk-human conflict receive a disproportionately greater number of elk hunting licenses with the goal of reducing populations in these areas. This method of license allocation has successfully, albeit slowly, reduced populations in areas of high elk-human conflict. In 2011, the PGC began documenting all wildlife related contacts from the public. The number of elk related contacts has varied annually from a high of 88 in 2013 to a low of 77 in 2015. Negative contacts including those related to elk-vehicle collisions, elk damage, or complaints of nuisance are summarized annually and considered during zone specific tag allocations (See [Strategy 4.1.3](#)).

HABITUATION AND ILLEGAL FEEDING

During the past 10-15 years as the population has increased, agricultural conflicts, although still an annual occurrence, have become reduced in prevalence compared to residential complaints and elk-vehicle collision conflicts. Residential complaints commonly include incidents of elk damaging back-yard gardens or elk behaving aggressively toward people or pets. Conflicts of this nature are common in areas where elk have become habituated to humans. Habituation results from repeated actions that are not associated with a negative stimulus (Thompson and Henderson 1998). In Pennsylvania, year-round elk viewing results in localized pockets of habituated elk. In residential areas, habituation is exacerbated by supplemental feeding (usually in winter). Feeding and/or causing elk to congregate is prohibited by statute in Pennsylvania, but still occurs annually (See [Appendix D](#) for specific text). Habituated elk frequenting back yards, parks, or other human dominated landscapes are the most common source of residential complaints. Similarly, the comfort and tranquility exhibited by these animals in human dominated areas makes them more likely to be involved in elk-vehicle collisions. Reducing habituation requires repeated and consistent aversive conditioning and rarely yields long term effects. Over the past 20 years, the PGC has experimented with a variety of aversive conditioning methods, including hazing with rubber buckshot, cracker shells, paintballs, and border collies. To date none have resulted in a long-lasting effect that was safe and efficient to implement. In addition to altering elk behavior, the PGC has conducted annual educational campaigns highlighting the negative consequences of supplemental feeding ([Figure 11](#)). These efforts appear to be at least somewhat effective as the number of citations for feeding elk has decreased in recent years. [Objective 4.2](#), and the associated Strategies are aimed at reducing elk habituation over the next management cycle.



Figure 11. Billboard message purchased by the Pennsylvania Game Commission and displayed near a residential area with a history of feeding elk.

CONCLUSION

The history of Pennsylvania's elk from their initial extirpation in the late 1800s through reintroduction in the early 1900s to the present population numbering over 1000, is truly remarkable. Over the past century, the elk population has survived persecution from local landowners, a severe population bottleneck, and dramatic shifts in the landscape and available habitat. Over the past 20 years, the Pennsylvania public has embraced the existence of their elk population. At present, there are more elk inhabiting more places than there have been in the past 100 years.

Accomplishing the Objectives and their associated Strategies will help us meet the Goals outlined in this plan. Maintaining a healthy population through effective habitat management and controlled through regulated hunting will minimize conflicts and generate continued public support, ultimately ensuring the long-term sustainability of Pennsylvania's elk population for current and future generations.

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SUMMARY OF PUBLIC COMMENT

A draft version of this management plan was made available for public comment from January 20, 2020 to February 21, 2020 (30-day comment period). A news release, posting on the Game Commission’s web page, and several social media postings announced the public comment period. The document was available electronically through the Game Commission’s web page, or in printed format by request. Comments could be submitted through a dedicated e-mail, or in writing to the agency’s Harrisburg Office.

Twenty correspondences were received. Two were identical duplicates of comments previously submitted by the same individuals and therefore excluded from further analyses. One completely blank email was sent to email account dedicated to elk plan comments. The remaining 17 correspondences were categorized according to their reference to a specific Goal, Objective, or Strategy. Comments that did not reference a specific Goal, Objective, or Strategy were tabulated under “General Comments”.

Copies of comments are available upon request.

GOAL 1. MANAGE ELK FOR HEALTH AND SUSTAINABILITY

Objective 1.1. Maintain a stable or increasing elk population within the elk management area.

Strategy 1.1.5. Review and evaluate boundaries of the elk management area every 5 years, using current data of elk population, distribution, and elk-human conflicts, and recommend changes as needed.

Comment Topic/Summary	# Comments
Evaluation of elk management area boundaries and recommends including a timeline for when the next evaluation should take place.	1

Strategy 1.1.6. Annually propose seasons and license allocations to encourage natural expansion of elk distribution within the elk management area and discourage movement of elk outside the elk management area.

Comment Topic/Summary	# Comments
Interest/requests to promote and/or allow the elk population to spread across a greater area of the State, specifically outside the current elk management area.	5
Suggests additional language that identifies areas where natural expansion of elk distribution would be supported by the PGC	1

Objective 1.2. Maintain a healthy and naturally reproducing elk population.

Strategy 1.2.1. Annually estimate the calf to cow ratio.

Comment Topic/Summary	# Comments
Recommends PGC identify proposed calf-cow ratios based on achieving future population goals, and not based on historic, observed ratios.	1

Strategy 1.2.3. Annually measure fat accumulation from hunter-harvested elk as a proxy of elk health.

Comment Topic/Summary	# Comments
Recommends consideration of recent research in assessing elk health through fat accumulation of harvested animals.	1

Strategy 1.2.5. By 2024, evaluate the potential effects of the elk population's genetic diversity and research alternatives for improving genetic diversity.

Comment Topic/Summary	# Comments
Increase the genetic diversity of the elk population.	1

Objective 1.3. Minimize exposure of wild elk to disease.

Strategy 1.3.4. By 2020, develop a response plan to be implemented when chronic wasting disease is detected in Pennsylvania elk.

Comment Topic/Summary	# Comments
Preemptively reduce elk populations in an effort to reduce the inevitable CWD infection/spread	1

GOAL 2. APPLY OUR UNDERSTANDING OF ELK HABITAT RELATIONSHIPS TO INFLUENCE ELK POPULATIONS AND DISTRIBUTION USING HABITAT MONITORING, MANIPULATION, AND CONSERVATION WITHIN THE ELK MANAGEMENT AREA

Objective 2.1. Annually maintain existing elk habitat acreage and create new elk habitat as practical.

Strategy 2.1.3. Annually identify and prioritize areas for potential habitat improvements and seek funding to implement improvements.

Comment Topic/Summary	# Comments
The strategy identifies areas where habitat enhancement activities may be avoided (e.g., near roadways), but should also indicate priority areas to improve elk habitat.	1

Strategy 2.1.7. Annually promote and increase the use of prescribed fire for maintaining and enhancing elk habitat.

Comment Topic/Summary	# Comments
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Comments related to benefits of controlled burning for habitat enhancement/maintenance.	1
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GOAL 3. MANAGE ELK TO PROVIDE RECREATIONAL OPPORTUNITY

Objective 3.1. Annually provide sustainable elk hunting opportunities.

Strategy 3.1.1. Annually provide an elk hunting season consistent with population and habitat objectives.

Comment Topic/Summary	# Comments
Requests/interest in limiting or discontinuing non-residents elk hunting opportunities.	2
Requests/interest in increasing non-resident application and/or license fees.	4
Provide 2 one-week archery seasons versus 1 two-week season.	1

General Comments Related to Elk Hunting Seasons/Lottery

Comment Topic/Summary	# Comments
Archery hunters should be required to pass a proficiency test prior to hunting.	1
Reduce the annual tag allocation to increase the population and provide additional future opportunities.	1
Eliminate antlerless hunting to allow the elk population to increase and provide additional future opportunities.	1
Continue the bonus point system for the elk license lottery. Concern over discontinuation of this process.	1
Increase law enforcement of outfitters/guides during the elk hunting season.	1

GOAL 4. MANAGE ELK-HUMAN CONFLICTS AT ACCEPTABLE LEVELS

Objective 4.1. Annually attempt to minimize elk-human conflicts.

Strategy 4.1.2. Conduct a survey of residents within the elk management area by 2023 and at least once every 5 years thereafter to monitor acceptable elk-human conflict levels.

Comment Topic/Summary	# Comments
Local residents concerned their opinions and values being ignored.	1

Strategy 4.1.3. Annually propose seasons and license allocations to reduce populations in areas experiencing unacceptable levels of elk-human conflicts.

Comment Topic/Summary	# Comments
Local residents perceiving an overabundance of elk.	3
Local residents concerned that elk are negatively impacting deer habitat/competing for resources.	1

Strategy 4.1.5. By 2023, evaluate implementing a localized elk damage hunt to reduce populations repeatedly involved in conflicts.

Comment Topic/Summary	# Comments
Local residents concerned about elk as a hazard to motorists and roadways.	2

APPENDICES

APPENDIX A. STATUS AND ACCOMPLISHMENTS OF 2006-2016 ELK MANAGEMENT PLAN

The 2006-2016 elk management plan replaced a 1996-2006 management plan which had followed a 1989-1995 plan and the original 1982-1987 plan. The following table provides a summary of the progress made in achieving the goals, objectives, and strategies of the 2006-2016 elk management plan.

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.

Strategy	Status	Comments
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.	Completed	See Section III
1.1.2 - Make use of clearly delineated boundaries such as State highways to define the elk management area by July 1, 2006.	Completed	See Section III
1.1.3 - Identify, classify, and categorize the current habitat types within the Elk Management Area using GIS by January 1, 2009.	Ongoing	Multiple classification structures are available for the EMA, but this will need to be updated to be considered complete.
1.1.4 - Establish well-defined elk management units according to habitat availability within the Elk Management Area by July 1, 2007.	Completed	See Section VI, Elk Hunt Zones
1.1.5 - Utilize the designated elk management units to establish elk hunting zones by January 1, 2007.	Completed	See Section VI, Elk Hunt Zones

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.

Strategy	Status	Comments
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.	Completed	See Appendix A for a review
1.2.2 – Annually maintain existing wildlife openings within the Elk Management Area.	Ongoing	See Section V
1.2.3 – Annually (depending on condition of food plot) plant vegetation in wildlife openings emphasizing species preferred by elk.	Ongoing	See Section V
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.	Ongoing/Not Complete	Various habitat enhancement projects have been completed but this strategy is ambiguous regarding a specific number of projects.

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

Strategy	Status	Comments
1.3.1 – By January 1, 2011 have data available to evaluate elk habitat use to determine the importance and use of habitat types.	Ongoing/Not Complete	Several research projects have been completed but additional data is needed to fully complete this strategy.
1.3.2 – By 2016 establish strategically located wildlife openings that will benefit elk.	Ongoing/Not Complete	Various habitat enhancement projects have been completed but this strategy is ambiguous.
1.3.3 – Annually acquire land for public ownership that is critical for elk use with an emphasis on riparian areas.	Ongoing	This strategy is considered continuous and is still ongoing.
1.3.4 - Annually evaluate abandoned mine areas which may be converted to suitable elk habitat if restored to natural conditions.	Ongoing	This strategy is considered continuous and is still ongoing.

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.	Ongoing	This strategy is considered continuous and is still ongoing.
1.3.6 – Annually evaluate closing of roads to certain habitat areas frequented by elk.	Not Complete	There is no evidence this strategy was attempted or achieved.
1.3.7 – Annually coordinate forestry management practices and operations that enhance elk habitat.	Ongoing	This strategy is considered continuous and is still ongoing.

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.

Strategy	Status	Comments
2.1.1 – Annually determine elk population size and distribution by elk management units.	Ongoing	This strategy is considered continuous and is still ongoing.
2.1.2 – Continue a calf survival study started in 2005.	Complete	See Section IV, and Appendix A for a review
2.1.3 – Utilize radio tracking devices and other state of the art equipment to assist with research on the elk population	Ongoing	This strategy is considered continuous and is still ongoing.
2.1.4 – Maintain records of elk locations and monitor movements for herd dispersal to establish sub populations beginning in 2006.	Complete/Ongoing	Sub-populations have been delineated but require regular evaluation/updates
2.1.5 – Develop a research study to gather data on elk diets and food preferences in cooperation with Indiana University.	Complete	See Appendix A for a review
2.1.6 – Continue to utilize an elk population survey using ground-based techniques to	Ongoing	This strategy is considered continuous and is still ongoing.

determine population trends and density.		
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Objective 2.2 - Establish an annual elk hunting season.

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

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

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

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

Strategy	Status	Comments
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2.4.1 – Annually evaluate habitat enhancement activities where viewable wildlife activities can take place.	Complete	This strategy was met by construction of the Elk Country Visitor Center.
2.4.2 – Annually monitor and address tourism related activity problem situations that arise which may invoke safety issues.	Ongoing	See Section VIII

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.

Strategy	Status	Comments
3.1.1 – Present elk programs at the viewing area on Winslow Hill throughout the year.	Ongoing	This strategy is considered continuous and is still ongoing.
3.1.2 – Provide public outreach programs throughout the year.	Ongoing	This strategy is considered continuous and is still ongoing.
3.1.3 – Present elk programs when requested by media organizations.	Ongoing	This strategy is considered continuous and is still ongoing.
3.1.4 – Provide an elk display when requested and practical at fairs, conventions, and trade shows, etc.	Complete	Elk display is in use and still available for public opportunities.
3.1.5 – Semiannually prepare elk status reports and develop news releases throughout the year for distribution to the public.	Ongoing	This strategy is considered continuous and is still ongoing.
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.	Complete	An annual power point program is available to all PGC staff for use in public presentations.

3.1.7- Beginning January 1, 2007 utilize the internet for periodic updates and information about the elk management program.	Complete	The PGC webpage is updated annually with elk related information.
3.1.8 – Beginning January 1, 2007 provide assistance and information to DCNR and other organizations at various facilities throughout the Commonwealth when requested.	Ongoing	This strategy is considered continuous and is still ongoing.
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.	Ongoing	Teacher workshops are conducted annually and hosted jointly between the PGC and the KECA.
3.1.10 – Participate in field trips throughout the year highlighting work being conducted in the Elk Management Area.	Ongoing	This strategy is considered continuous and is still ongoing.
3.1.11 - Continue to be a partner in the “PA Wilds” program and attend scheduled meetings.	Complete	This strategy was related primarily to the elk scenic drive which was completed in 2015.

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.

Strategy	Status	Comments
4.1.1 – Annually identify problem areas by assessing conflict reports within the Elk Management Area.	Ongoing	This strategy is considered continuous and is still ongoing. See Section VIII.
4.1.2 – Annually utilize hunting as a technique to eliminate or reduce elk/human conflicts within established elk management units.	Ongoing	This strategy is considered continuous and is still ongoing. See Section VI.

4.1.3 – Actively pursue violations of the ban on feeding elk on an as needed basis.	Ongoing	This strategy is considered continuous and is still ongoing.
4.1.4 – Annually evaluate the need for fencing to resolve damage complaints to private property.	Not Complete	Our primary source of funding for elk exclusion fences is no longer available.
4.1.5 – On a daily basis prioritize law enforcement activities to address damage complaints and problem situations.	Ongoing	This strategy is considered continuous and is still ongoing.

APPENDIX B. SUMMARY OF PENNSYLVANIA SPECIFIC ELK-RELATED RESEARCH PROJECTS

While many of the research projects specific to Pennsylvania elk have been noted and/or cited in the elk management plan, here we provide a comprehensive list and a brief summary of each project. Published works are grouped and listed first in chronological order followed by unpublished works also listed chronologically. Following these summaries, we include a concise listing of Pennsylvania Game News articles related to Pennsylvania elk.

PUBLISHED WORKS

Devlin, D., and J. George. 1979. Forage utilization by elk and white-tailed deer on two clearcuts in Elk County, Pennsylvania. Pg. 98 in M. Boyce, and L. Hayden-Wing, editors. North American elk: ecology, behavior and management. The University of Wyoming, Laramie, Wyoming.

Objectives were to determine biomass utilization of food plots by deer and elk during the growing season as well as volunteer vegetation (<2.5cm in diameter) in a clear-cut, and individual plant species <2.5cm in diameter.

Authors note that second growth aspen (trembling and big-tooth) and hardwood associates predominate the area. 2 clear-cuts, Little Bear was 40 ha and cut in 1969-70, the second, Dark Hollow, was 13 ha and cut in 1976. Access and logging roads for both cuts were disked, seeded, limed and fertilized and hence forth called food plots, Little Bear food plots = 1.62 ha and Dark Hollow food plots = 0.81 ha. Plots were seeded with winter wheat, birds foot trefoil, ladino clover, orchard grass and KY bluegrass. Steel cages (1X1X0.5m) were distributed randomly around the study area. 30 cages on Little Bear (10 on food plots and 20 on volunteer vegetation) and 25 on Dark Hollow (10 on food plots and 15 on volunteer).

Samples were taken within each cage and in the square meter next to each one resulting a paired sample design (control in cage, treatment outside of cage), vegetation was air dried for 2 weeks before massing. Empty bag weight was accounted for by subtraction. Food plot sampling was done ~ every 2 weeks and began 24 Mar 1977 and went through 11 Nov 1977. Volunteer vegetation was sampled 3 times May, Aug, Oct. Cages were reassigned randomly after each sampling. Density, stems per m² was used to evaluate species utilization. ANOVA and contingency tables were used to compare differences/ utilization.

Food plot utilization was greatest in early to mid-spring and late summer to mid-fall. Significant differences were detected for periods 2, 3, 7 and 9. Period 8 deviated because it occurred during the rut. ANOVA was significant for volunteer vegetation in summer, but not spring or fall. This was mostly due to deer and elk use of blackberry. The only 2 species differences detected using Mann-Whitney, were blackberry and "woody stems" which included all woody species, no individual species were identified. Authors speculate that this indicates deer and elk could have significant effects on woody regeneration. Authors conclude that the succulence was more important than biomass production, and recommended mowing food plots during the growing season to induce succulent regrowth. They also suggest blackberries as a food species and Hunter et al. (1979) recommended providing abundant blackberry browse could prevent over-browsing of more desirable regenerating tree species.

Eveland, J., J. George, N. Hunter, D. Forney, and R. Harrison. 1979. A preliminary evaluation of the ecology of the elk in Pennsylvania. Pages 145-151 in M. Boyce, and L. Hayden-Wing, editors. North American elk: Ecology, behavior, and management. The University of Wyoming, Laramie, Wyoming.

This was the early PA elk ecology study. Objectives were to look at behavior, population dynamics, herd size and distribution, and basic biological characteristics. Describes the early elk range in Elk and Cameron counties and makes distinction between bull and cow areas. Describes vegetation at the time as 2nd growth, red maple, red and white oak, beech, cucumber tree, black cherry and quaking and big tooth aspen. Drainages were comprised of hemlock, willow, alder, hornbeam and witch hazel. Study occurred continuously from July 1971 – April 1974. The elk herd mainly consisted in a 110 sq. mi. area including, Dent's, Hicks, and Trout Run. Bulls tended to occupy agricultural areas outside St. Mary's whereas the cows remained primarily around the clearcut areas of lower Dents and Hicks Run. Authors broke behavior into 7 distinct periods: summer, breeding, late breeding, fall, winter (reports elk concentrated on 5, 100-acre clearcuts of aspen and red maple), spring and parturition and describe each in detail, mostly documenting movements.

Authors describe the population from 1971 (65), 1972 (77), 1973 (53) to 1974 (38), as fluctuating and cite *P. tenuis* as the primary source of mortality. Authors also report that local foresters have observed similar trends since the early restoration. Humans affect the elk through illegal kills during the Dec. deer season and by farmer killed elk. This is primarily the bulls that are affected at they occupy agricultural areas. Authors claim that in 1972, farmers shot about 40% of the mature bulls. Authors also cite that the herd staying small and cyclical has resulted in little internal pressure on the herd to expand in distribution.

Hunter, N. B., J. L. George, and D. A. Devlin. 1979. Herbivore-woody plant relationships on a Pennsylvania clearcut. Pages 105-111 in M. Boyce, and L. Hayden Wing, editors. North American elk: ecology, behavior and management. The University of Wyoming, Laramie, Wyoming.

Objective of this study was to evaluate utilization of woody vegetation by elk, deer and small mammals and evaluate the effects of elk, deer, and small mammals on plant vigor, density, distribution, and species composition in clearcut areas. 40 ha area was clearcut between summers of 1969-1970. This study occurred in summers of 1973 and 1974, and identified 3 cover types, shrub-herb opening, sapling-shrub-herb opening, and aspen sapling stand. 10 sets of exclosures were set up throughout the clearcut with each set having 4 treatments, 16m² unfenced plot, 64m² fence to exclude elk (only 0.61m in height to allow deer over the top), 16m² plot to exclude deer and elk, and a 16m² plot to exclude deer, elk and small mammals. Data collected for the 40 plots included plant height in classes, plant vigor in classes, browsed and un-browsed twigs in 2 different height classes, bark stripping and plants broken by elk.

Field observations of elk and elk sign showed elk were present in the area ~9 months out of the year and indicated elk fed heavily on aspen, red maple, fire cherry, and blackberry. In the 2 open cover types, aspen, black cherry, fire cherry, red maple, sassafras and white oak were browsed

significantly (>75%) in the <1.5 m height class and aspen and red maple stump sprouts were the only species in the 1.5-2.8 m height class, and both were browsed heavily >80%. Interestingly in the sapling cover type, aspen browsing was less (23% in <1.5m) but red maples stump sprouts were still browsed almost completely 98-99% in both height classes. The low utilization of aspen in the sapling cover type was attributed to low palatability (due to natural pruning, vigorous tree growth and browse were sparse), low availability and/or stand density (and dense stands may deter use from elk, physically or psychologically). Authors conclude by reiterating that elk and deer can have a significant effect on regeneration, but many species responded well to herbivore exclusion. Aspen and red maple are major components of winter elk diet, but elk prefer more open stands and dense sapling sized stands were of little value to elk.

Witmer, G. 1990. Re-introduction of elk in the United States. Journal of the Pennsylvania Academy of Science 64:131-135.

This paper discusses early elk reintroductions in the United States and offers considerations for future reintroductions. The author notes that most of the early attempts to reintroduce elk to the Eastern US failed due to inadequate habitat or over-harvest from crop depredation. The author proposes that prior to any elk reintroduction consideration should be given to 1) the size of the release site/area and 2) the number of animals to be released, related to minimum viable population size and genetic diversity. The author also advocates that any management agency considering an elk reintroduction should complete a feasibility study considering, historic range, habitat requirements, predation, and potential human-elk conflicts. In addition, a well-orchestrated public relations plan with public involvement should be carried-out. This is one of the first publications examining the success and failure of elk reintroductions. Numerous studies have been completed since this paper was originally published and follow a similar framework.

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

This study was conducted in the context of aerial surveys and the challenges associated with accurately counting elk in differing group sizes and under variable canopy cover. The objective of this study was to determine the error in counting elk groups, determine the effect of undercounting and the ideal variables used to develop an accurate sightability model. A sample of elk were radio-collared and 6 aerial surveys were completed via helicopter across 4 winters (1992-1995). The number of elk in each group, their behavior, percent canopy cover, and a 10-category vegetation class were noted during the surveys. Prior to each helo survey, a fixed-wing aircraft located and recorded the location of each radio collared elk. Authors used multiple linear regression with actual group size as the dependent variable and observed group size and percent canopy cover as independent variables. They also calculated a sightability estimate using logistic regression, and the most parsimonious model was selected using AIC. A Lincoln-Petersen estimate and a minimum number alive (MNA) count were conducted as well. These 3 population estimates were then compared qualitatively. Thirty to 43 radio-collared elk were available during the 6 surveys. Sightability estimates developed from helicopter observations consistently underestimated group sizes resulting in lower overall estimates than the MNA counts. Lincoln-Petersen estimates average slightly higher than the MNA counts. In general, the authors appear skeptical about the application of the sightability model as it requires a correction

for undercounting as well. They discuss several methods for estimating variance and confidence intervals but conclude with cautionary comments on the use of this sightability model.

DeVivo, M. T., W. O. Cottrell, J. M. DeBerti, J. E. Duchamp, L. M. Heffernan, J. D. Kouger, and J. L. Larkin. 2011. Survival and cause-specific mortality of elk (*Cervus canadensis*) calves in a predator rich environment. *Wildlife Biology* 17:156-165.

The objective of this study was to evaluate elk calf survival and cause specific mortality for summer, winter, and annually in Pennsylvania. A secondary objective was to examine the influence of birth weight and date on elk calf survival. Given the relatively high abundance of coyotes and black bears and previous research documenting these as major predators of elk calves in other locales the researchers predicted calf survival would be low due to predation. Calves were captured from mid-May to late August 2005-2008 and fit with expandable radio collars. Animals were then monitored daily until July 31 and then weekly until the end of the study in June 2009. Mortalities were investigated within 24 hours and the carcasses transported to the animal diagnostics lab at the Pennsylvania State University for necropsy. Researchers used Kaplan-Meier product limit procedure with staggered entry to estimate summer (birth – 31 Oct), winter (1 Nov – 1 Apr) and annual survival of elk calves. 93 calves were captured and fit with collars (50 female, 43 male). Summer survival was 0.92, winter survival was 0.90 and annual survival was 0.82. Of 15 calves that died in the first year of life, the average age at death was 123 days. Causes of mortality included poaching (3), legal harvest (2), road kills (2), pneumonia (1), and rumen acidosis (1) with the remaining 6 causes undetermined. Survival rates in Pennsylvania were similar to other Eastern States (except Great Smoky Mountain National Park) but generally higher than most Western populations. Calves born with lower birth weights as well as late-born calves did not appear to have greater mortality rates. The authors conclude noting the unexpected finding that no calves were lost to predation.

UNPUBLISHED WORKS

Cordes, R. C. 2003. Habitat use by elk translocated in northcentral Pennsylvania. Frostburg State University. Master's Thesis.

A copy of this work could not be obtained and no review was conducted. Additional attempts to obtain a copy will be made during the current management cycle.

Heffernan, L.M. 2009. Effects of age, sex, and landscape composition on seasonal diets of elk in Pennsylvania. Indiana University of Pennsylvania. Master's Thesis.

The primary objective of this study was to characterize the plant composition of elk diets in Pennsylvania and determine which plant communities were consumed more or less than available. A secondary objective was to compare elk food habits between seasons, and by age and gender. Fecal samples were collected via direct observation and pick-up and from November 2006 to January 2008. Forage availability was estimated by sampling 1 km transects, with percent cover of graminoids, forbs, ferns, and mosses within a 1x1m square every 100 m along each transect. Woody browse was identified to species and summarized as percent cover within a 5 m radius circle (at the quadrat center). Differences in forage classes among sex/age

classes was tested for using MANOVA. Seasonal forage selection was evaluated using Ivlev's electivity index. Overall, 75 different forage species were consumed by Pennsylvania elk. Graminoids were the most dominant forage class consumed across all seasons, but woody browse was also evident in all seasons. Species commonly selected by elk included graminoids, blueberry, teaberry, autumn-olive, aspen, willow, dogwood and oaks. Authors note the broad suite of forage species utilized in elk diets and suggest land managers preserve forage diversity and increase the abundance of woody browse.

Kougher, J. D. 2009. Multi-scale Resource Selection of Elk (*Cervus Elaphus*) in Northcentral Pennsylvania. Indiana University of Pennsylvania. Master's Thesis.

This study was focused on elk habitat selection at both the 2nd (home range) and 3rd order scales (within home range). A secondary objective was to compare habitat selection between males and females. VHF collared elk were monitored from July 2003 to Oct. 2008. A total of 63 animals (38F, 25M) were monitored across all seasons, winter (Dec 1 – Mar 31), spring (Apr 1 – May 31), summer (Jun 1 – Aug 31), fall (Sep 1 – Nov 30). Author produced 50% and 85% home ranges for each animal (fixed kernel). Took Landsat data and reclassified and corrected it using ortho-imagery aerial photos. Used a 5.8km buffer MCP around all locations to define 2nd order availability. Authors used MANOVA to test for use of cover types in proportion to availability.

2nd order selection results did not differ between males and females, so data were pooled. Elk were closer than expected to openings, conifer and developed areas, but farther than expected from deciduous forest.

3rd order selection results indicated a similar trend with elk being closer than expected to openings, conifer, and developed areas and farther from deciduous forest than expected. The relative proportion of cover types within an 85% fixed kernel home range was 80.5% deciduous forest, 9.9% coniferous forest, 8.6% herbaceous openings, and 1% developed. The relative proportion of cover types within a 50% fixed kernel home range was 76.3% deciduous forest, 10.6% coniferous forest, 11.9% herbaceous openings, and 1.2% developed.

Authors affirm the importance of open herbaceous areas and cite additional eastern and western examples and note the most of these environments in KY and PA are in the form of reclaimed surface mines. Authors note the selection of residential areas is likely due to lawns and highly managed and manicured grass that was available in low elevation areas. This is further complicated by routine (illegal) winter feeding of elk. Coniferous forests were highly selected, presumably for cover but there is also some potential for browse originating in coniferous forests and the authors also note that coniferous forests were commonly associated with open herbaceous habitats, in mine lands for example, and thus the preference for this cover type might be partially attributed to correlation.

Authors note the apparent avoidance of deciduous forests but site that other studies have found deciduous forests to be highly selected. Selection for this cover type may have occurred at a scale below this study or may be seasonally important. This study did not account for seasonal changes in elk habitat selection. Overall authors recommend a mosaic of early successional

young forest, coniferous forests, and herbaceous openings, in an irregular pattern, maximizing edge and interspersed of habitat types and ages. Authors also caution planting non-native species and recommend highly preferred native species such as willow and aspen. Finally, authors acknowledge the importance of deciduous forest and recommend additional studies.

Norton, A. S., D. P. Stainbrook, and D. R. Diefenbach. 2009. Survival of adult elk in Pennsylvania. State College, Pennsylvania. Internal report completed for the Pennsylvania Game Commission.

Objective of the study was to evaluate 1) pre-hunt survival of PA elk 2) post hunt survival of PA elk and 3) non-harvest related survival as well as survival during the trap and transfer (1998-2000). Authors used Kaplan-Meier with staggered entry design and evaluated the effect of year (temporal) and subpopulation (spatial) variability. Models were compared using AICc (corrected for small sample size) in program MARK. Used 199 (88 male, 111 female) radio collared elk to estimate overall and non-harvest survival.

Authors acknowledged small sample sizes and potential bias by hunters selecting collared animals. No evidence of differences in survival between trap and transferred elk and non-trapped elk. Some spatial and sexual variability was apparent in non-harvest survival estimates. Adult males had slightly lower survival than females. No differences in annual non-harvest survival were apparent. Also, no detection of a difference in non-harvest survival between pre-and-post hunt time frames suggesting that harvest is additive. Non-harvest survival estimates were 86.9% (combined), 82.3% (male) and 89.6% (female). No spatial differences in overall survival (both hunting and non-hunting) were detected. Overall survival estimates were 81.2% (overall), 75.8% (male) and 84.3% (female).

APPENDIX C. TABLE OF ELK-RELATED PENNSYLVANIA GAME NEWS ARTICLES

Pennsylvania Game News is the official publication of the Pennsylvania Game Commission. The first publication of the Pennsylvania Game News was released in the early 1930’s and has continued monthly to the present. Although not considered scientific publications, early articles contain invaluable historical information on elk in Pennsylvania. As such we’ve included a complete listing of Pennsylvania Game News articles related to Pennsylvania elk (Table 14). Electronic copies are available upon request.

Table 14. Pennsylvania Game News articles related to elk by year.

Year	Author	Title
1936	Richard Gerstell	The Elk in Pennsylvania: Its Extermination and Reintroduction
1940	Ross L. Leffler	Conservation Mistakes
1952	Unknown	The Story Behind the Cover
1954	Roger Latham	Elk Live Here
1955	William Boyd	Hunting in Pioneer Days
1965	Norman L. Erickson	The Last Stand
1969	Colonel Parker	Hunting Pennsylvania's Elk
1982	Bob Mitchell	Pennsylvania's Elk Herd
1983	Bob Mitchell	Managing Pennsylvania's Elk
1987	Rawland D. Cogan	On the Trail of Pennsylvania's Elk
1992	Rawland D. Cogan	A Different Approach
1998	Rawland D. Cogan	Elk Reproduction
1998	Rawland D. Cogan	Elk Calf Survival
2001	Rawland D. Cogan	Elk Habitat Benefits Other Wildlife, Too
2001	Rawland D. Cogan	Modern-Day Elk Hunt Approved
2001	Rawland D. Cogan, Robert Cordes and Jon DeBerti	Pennsylvania's Elk Trap and Transfer Project
2002	Bob D-Angelo	Elk Hunt 2001
2007	Unknown	PA Elk Receiving Space Signals
2007	Dale McElheny	Perseverance Pays Off: Big Time
2007	Lori D. Richardson	Elk Calf Survival
2013	Joe Kosack	One Hundred Years Later - Part 1
2013	Joe Kosack	One Hundred Years Later - Part 2
2013	Jeremy Banfield	January Elk Count - Research Note
2014	Unknown	Camera to Provide Elk's Point of View
2014	Jeremy Banfield	Armstrong County Elk - Research Note
2018	Game News Staff	Elk Live Here, Make No Mistake, Confusion Still Occurs
2018	Joe Kosack	Fall Magic, On the Trail of Elk in the Alleghenies
2018	Joe Kosack	2018 Elk Forecast, Big Bulls Abound
2018	Cindy Ross	Bagging a Bull Elk in a Wheelchair

APPENDIX D. PENNSYLVANIA STATE REGULATIONS RELATED TO WILD ELK

TITLE 58 PENNSYLVANIA CODE

CHAPTER 137. WILDLIFE

§ 137.33. Feeding of certain wildlife prohibited.

It is unlawful to, except for normal or accepted farming, habitat management practices, oil and gas drilling, mining, forest management activities or other legitimate commercial or industrial practices, intentionally lay or place food, fruit, hay, grain, chemical, salt or other minerals anywhere in this Commonwealth for the purpose of feeding bear or elk, or to intentionally lay or place food, fruit, hay, grain, chemical, salt or other minerals that may cause bear or elk to congregate or habituate an area. If otherwise lawful feeding is attracting bear or elk, the Commission may provide written notice prohibiting the activity.

CHAPTER 143. HUNTING AND FUR TAKER LICENSES SUBCHAPTER K. ELK LICENSES

§ 143.201. Purpose and scope.

If the Commission approves an elk hunting season, this subchapter establishes methods of applying for elk licenses. The Commission will set the number of licenses to be issued, establishing a quantity of tags for antlered and/or antlerless elk.

§ 143.202. Application.

Completed applications shall be submitted as determined by the Director. For the purpose of having a unique identifier assigned to each individual in the database, permitting a crosscheck for duplicates, applicants shall provide their Social Security number or hunter ID number on the application. A nonrefundable \$10 application fee shall accompany the application.

§ 143.203. Drawing.

(a) The Executive Director will set the date and location for the random drawing of applications for the issuance of elk licenses. Incomplete, illegible or duplicate applications will not be included in the drawing.

(b) Applications from current applicants who have applied in the 2003-2004 license year and subsequent years will be included in the drawing until the applicant is successfully drawn and issued a license.

(c) Applicants issued a license entitling them to take an antlered elk are not permitted to apply for an elk license for 5 license years.

(d) Qualified applicants and alternates drawn for an elk license shall be required to obtain a regular hunting license and complete an orientation program as prescribed by the Director.

(e) Qualified applicants drawn for an elk license whose military obligation prevents them from hunting the current elk season shall be eligible to hunt in the next available elk season.

(f) The number of licenses shall be limited to a number set by the Commission.

§ 143.203a. Special elk conservation license auction.

(a) Each year the Commission may contract with an eligible wildlife conservation organization to conduct an auction sale of one special elk conservation license in accordance with the mandates under section 2706.2 of the act (relating to elk hunting licenses).

(b) Upon conclusion of the auction, the wildlife conservation organization shall issue the winning bidder a license voucher which may be redeemed for a special elk conservation license under section 2712 of the act (relating to vouchers for licenses and permits).

§ 143.204. [Reserved].

§ 143.205. [Reserved].

§ 143.206. Validity of license.

(a) *Elk hunt zones.* Except as provided in subsection (c), an elk license is valid for taking elk only in the elk hunt zones designated on the elk license.

(b) *Elk gender.* Except as provided in subsection (c), an elk license is valid for taking only an antlerless, antlered or either sex elk as designated on the elk license.

(c) *Exception.* Any unfilled antlered or antlerless elk license for any designated elk hunt zones is additionally valid for taking either an antlered or antlerless elk anywhere within this Commonwealth outside of the elk management area during any designated extended elk season following the regular elk season.

§ 143.207. Unlawful acts.

It is unlawful for a person to:

(1) Submit more than one application for an elk license for any elk season, during any hunting license year.

(2) Apply for or to receive a license contrary to the act or this part.

(3) Hunt for elk in an elk hunt zone other than the elk hunt zone designated on the elk license.

(4) Hunt or take an elk other than the antlered or antlerless elk designated on the elk license.

§ 143.208. Penalties.

A person violating this subchapter shall, upon conviction, be sentenced to pay the fine prescribed in the act.

TITLE 34 GAME AND WILDLIFE CODE

CHAPTER 21: GAME OR WILDLIFE PROTECTION

SUBCHAPTER B. DESTRUCTION FOR AGRICULTURAL PROTECTION

§ 2121. Killing game or wildlife to protect property.

(a) General rule.--Subject to any limitations in this subchapter, nothing in this title shall be construed to prohibit any person from killing any game or wildlife:

(1) which the person may witness actually engaged in the material destruction of cultivated crops, fruit trees, vegetables, livestock, poultry or beehives;

(2) anywhere on the property under the person's control, including detached lands being cultivated for the same or similar purposes, immediately following such destruction; or

(3) where the presence of the game or wildlife on any cultivated lands or fruit orchards is just cause for reasonable apprehension of additional imminent destruction. Lands divided by a public highway shall not be construed as detached lands. Any person who wounds any game or wildlife shall immediately make a reasonable effort to find and kill the game or wildlife. Every person shall comply with all other regulations in this subchapter pertaining to the method and manner of killing, reporting the killing and the disposition of game or wildlife and their skins and carcasses.

(b) Protected game or wildlife.--Before any game or wildlife, which may be designated by regulation of the commission, or any bird or animal classified as threatened or endangered may be killed, every reasonable effort shall be made to live trap and transfer such game or wildlife. The trapping and transfer shall be done in cooperation with a representative of the commission.

(c) Definition.--As used in this subchapter the word "person" shall be limited to any person cultivating, as a primary means of gaining a livelihood, any lands for general or specialized crop purposes, truck farming or fruit orchard or nursery being regularly maintained, as either the owner, lessee or a member of the family of the owner or lessee assisting with the cultivation of the land, or a domiciled member of the household of the owner or lessee or an employee of the owner or lessee, regularly and continuously assisting in the cultivation of the land **or other person as authorized by commission permit.**

§ 2122. Report to commission officer.

Any person who kills any game or wildlife, other than raccoons, under the provisions of this subchapter shall, within 24 hours, report, orally or in writing, the killing to an officer of the commission. The report shall set forth the date, time and place of the killing, the number of species killed and the sex of the species.

§ 2123. Safekeeping edible carcass pending disposition.

Unless otherwise directed by an officer of the commission, the entire carcass intact, less entrails, of each edible bird or animal killed under the provisions of this subchapter shall be held in a place of safekeeping pending final disposition pursuant to this chapter.

§ 2124. Retention of edible carcass for food.

(a) General rule.--Except as otherwise provided in subsection (b), the carcass of one deer, bear or elk killed under the provisions of section 2121 (relating to killing game or wildlife to protect property) may be retained for food. All portions of the carcass generally considered edible shall be consumed only within the household of a person having authority to kill and possess the game or wildlife. No additional animals may be retained for food until the entire carcass of the animal previously retained has been entirely consumed. The head and hide of each deer, bear or elk killed and retained for food shall be properly salted, placed in safekeeping and turned over to a commission officer.

(b) Exceptions.--No carcass, or any part or parts thereof, of any deer, bear or elk shall be retained for food, by any person, if the animal was killed upon:

- (1) Land located within a game or wildlife deterrent fence provided by the commission.
- (2) Land, or any part thereof, on which access for hunting purposes is denied at any time.

§ 2125. Surrender of carcass to commission officer.

Except as otherwise provided in this subchapter, the entire carcass, including the head and hide, of all big game animals and the entire carcass of any other game or wildlife, other than raccoons, shall be made available, unless otherwise directed by an officer of the commission, intact, less entrails, to any commission officer calling for them.

§ 2126. Unlawful activities.

(a) General rule.--It is unlawful for any person while acting under the provisions of this subchapter to:

- (1) Place any salt, bait or food of any kind or quantity or use any artificial means for the purpose of attracting or luring any game or wildlife upon any lands.
- (2) Use any method not approved by the commission except that traps may be used to take furbearers and groundhogs.
- (3) Use any firearm except a center fire propelling a single all-lead, lead alloy or expanding bullet or ball to kill or attempt to kill any big game animal.
- (4) Fail or neglect to report the killing of any game or wildlife other than raccoons.
- (5) Fail or neglect to care for the carcass, or any part thereof, of any game or wildlife other than raccoons.
- (6) Refuse to answer, without evasion, upon request of any representative of the commission, any pertinent question pertaining to the killing or wounding of any game or wildlife killed or wounded, or the disposition of the entire carcass or any part thereof.
- (7) Fail to produce satisfactory evidence that material damage was done within the preceding 15 days and that there was just cause for reasonable apprehension of additional imminent destruction.
- (8) Fail to relinquish to any officer the entire carcass, less the entrails, of any game or wildlife, other than raccoons, killed to which the person killing the game or wildlife is not legally entitled thereto.
- (9) Fail to comply with any other provision of this subchapter.

(b) Penalties.--

- (1) A violation of this subchapter pertaining to big game animals is a summary offense of the fourth degree.
- (2) A violation of this subchapter pertaining to any other game or wildlife, other than raccoons, is a summary offense of the seventh degree.
- (3) Each bird or animal involved in a violation constitutes a separate offense.

CHAPTER 21: GAME OR WILDLIFE PROTECTION

SUBCHAPTER C. DESTRUCTION OF GAME OR WILDLIFE IN SELF-DEFENSE

§ 2141. Killing game or wildlife to protect person.

(a) General rule.--It is unlawful for a person to kill any game or wildlife as a means of protection unless it is clearly evident from all the facts that a human is endangered to a degree that the immediate destruction of the game or wildlife is necessary.

(b) Report, safekeeping and investigation.--A person killing any game or wildlife under this subchapter shall report the event to an officer as soon as possible following the incident but in no case later than 24 hours, provide for safekeeping of the game or wildlife intact at the place where it was killed and be available for interview by the officer. The person killing the game or wildlife shall answer, without evasion, any pertinent questions of the officer making the investigation.

(c) Exoneration.--At the conclusion of any investigation when any game or wildlife is allegedly killed as protection to a person, the officer may exonerate the person for the otherwise unlawful killing of the game or wildlife. In all cases the officer shall seize and dispose of the game or wildlife as required by this title or upon instructions of the director.

(d) Prosecution.--Any officer making an investigation when game or wildlife was allegedly killed as a protection to a person shall proceed with prosecution as though the game or wildlife was unlawfully killed if the officer is dissatisfied with the explanation of the person killing the game or wildlife or if the physical facts of the killing do not support and sustain the facts alleged by the person killing the game or wildlife.

(e) Penalties.--A violation of this section relating to:

- (1) Threatened or endangered species is a misdemeanor of the third degree.
- (2) Elk or bear is a summary offense of the first degree.
- (3) Deer is a summary offense of the second degree.
- (4) Bobcat or otter is a summary offense of the third degree.
- (5) Wild turkey or beaver is a summary offense of the fourth degree.
- (6) Any other game or wildlife is a summary offense of the fifth degree.

CHAPTER 27 HUNTING AND FUR TAKING LICENSES

SUBCHAPTER A. GENERAL PROVISIONS

§ 2706.2. Elk hunting licenses.

(a) Application limitation.--Whenever the commission makes a determination to authorize a hunting season for the taking of elk, no person may submit more than one application for an elk hunting license in any license year. The commission shall hold a random drawing of applications for the issuance of elk licenses under this subsection at the Elk Country Visitor Center in the Township of Benezette.

(b) Special conservation license auction.--The commission is authorized to auction off a special license to hunters interested in the opportunity to hunt one elk subject to the following:

- (1) One license shall be auctioned annually.
- (2) The auction shall be open to residents and nonresidents of this Commonwealth.
- (3) The commission may, under 62 Pa.C.S. Pt. I (relating to Commonwealth Procurement Code), contract with a wildlife conservation organization to implement and conduct the auction. The commission shall promulgate regulations for the use of the license, remitting funds to the commission and conduct of the auction.
- (4) The contracted organization under paragraph (3):
 - (i) May retain administrative costs associated with the auction. The administrative costs shall be determined and agreed to by the contracted organization receiving the license prior to the license being awarded.
 - (ii) Shall return the proceeds remaining after retention of administrative costs under subparagraph (i) to the commission to be used pursuant to the contract under paragraph (3) in a manner consistent with the commission's elk management plan.
 - (iii) Shall report annually to the commission on the use of the proceeds from the auction. The commission shall, in its annual report to the General Assembly, include the use of all proceeds from the auction.
- (5) All license fees shall be paid to the commission.

(6) (Deleted by amendment).

(c) Special-license fundraiser.--In addition to any other elk license provided for under this section, the commission may hold a special-license fundraiser for hunters interested in the opportunity to hunt one elk, subject to the following:

(1) The commission may enter into a contract with a Pennsylvania-based nonprofit organization whose primary mission is the advancement of education, stewardship and habitat for the elk population in this commonwealth and that is a participant in a public-private partnership for the management and operation of the Elk Country Visitor Center in Benezette Township, Elk County, to auction or raffle one elk license annually.

(2) The entity which contracts with the commission under paragraph (1) may conduct a fundraiser for the opportunity for interested hunters to purchase the elk license. The fundraiser shall be open to all residents and nonresidents of this Commonwealth who wish to obtain the license. The subsequent use of the license must meet Federal and State hunting regulations.

(3) The entity which contracts with the commission under paragraph (1) may retain administrative costs associated with the auction. The administrative costs shall be determined and agreed to by the entity receiving the license prior to the license being awarded.

(4) The proceeds remaining after retention of administrative costs under paragraph (3) shall be returned to the commission and shall be used pursuant to the contract under paragraph (1) in a manner consistent with the commission's elk management plan.

(5) The entity shall report annually to the commission on the use of the proceeds from the special-license fundraiser. The commission shall, in its annual report to the General Assembly, include the use of all proceeds from the special license fundraiser.

(6) This subsection shall expire July 1, 2018.

(d) Background check.--A recipient selected to receive a license under subsection (b) or (c) must be subjected to a background check prior to being awarded the license. If one or more serious game law violations resulting in license revocation within the preceding ten years or three or more game law violations within the preceding ten years are found, the license may not be awarded to the recipient, and another recipient shall be chosen.

(Dec. 20, 2000, P.L.783, No.111, eff. 60 days; Oct. 9, 2008, P.L.1375, No.101, eff. 60 days; July 9, 2014, P.L.1016, No.116, eff. imd.)

2014 Amendment. Act 116 reenacted and amended the entire section.

APPENDIX E. COPY OF MEETING AGENDA USED TO DEVELOP THE ELK MANAGEMENT PLAN GOALS

**Elk Management in Pennsylvania
Meeting Agenda**

Date/Time: November 18, 2013 10:00AM

Location: Moshannon State Forest Headquarters
3372 State Park Rd. Penfield, PA 15849 (814) 765-0821

Attendees: Cal DuBrock – Pennsylvania Game Commission
John Dunn – Pennsylvania Game Commission
Chris Rosenberry – Pennsylvania Game Commission
Rawley Cogan – Keystone Elk Country Alliance
Doty McDowell – Pennsylvania Game Commission
Colleen Shannon – Pennsylvania Game Commission
David Matheson – Pennsylvania Department of Transportation
Mary Hosmer – Pennsylvania Federation of Sportsmen’s Clubs
Bill Klein – Rocky Mountain Elk Foundation
Tony Ross – Pennsylvania Game Commission
Emily Just – Pennsylvania Department of Conservation and Natural Resources
Russel Orner – Pennsylvania Farm Bureau
Jeremy Banfield – Pennsylvania Game Commission

Objective: Provide attendees with a current status of Pennsylvania’s elk herd and discuss/outline the goals and objectives for the future elk management plan (2014-2023).

Schedule: 10:00 AM – Introductions – lunch menu selection.
10:15 AM – Current status of PA elk (Jeremy Banfield).
10:45 AM – Overview of the existing Elk Management Plan (Jeremy Banfield).
11:00 AM – Discussion of future elk management.
- Population Dynamics
- Habitat
- Education and Outreach
- Elk-Human Conflicts
12:00 PM – Lunch break.
1:00 PM – Continued discussion of elk management goals/objectives, if needed.
2:00 PM – Adjourn.

Moderator: Cal DuBrock

