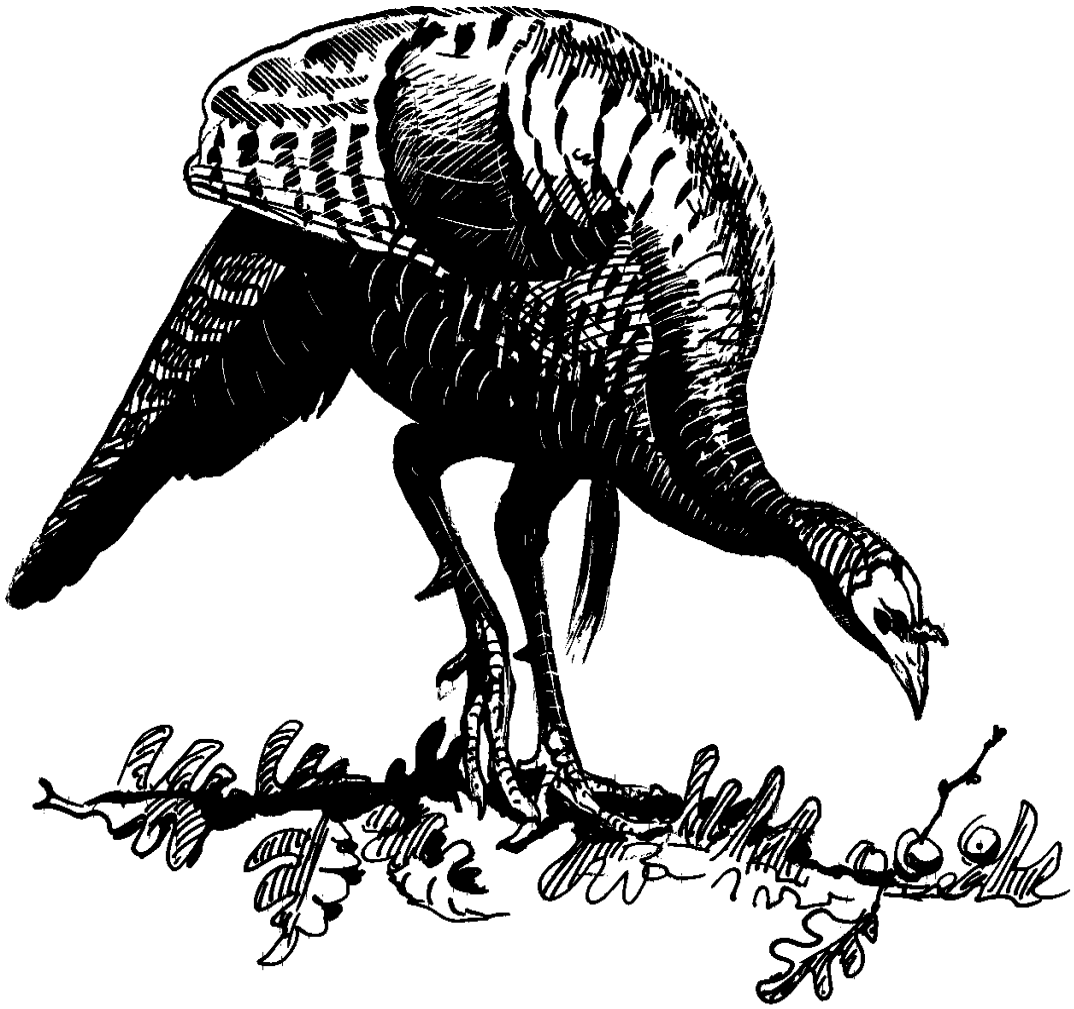
MANAGEMENT PLAN FOR WILD TURKEYS IN PENNSYLVANIA 2006 – 2015



MANAGEMENT PLAN
FOR
WILD TURKEYS
IN PENNSYLVANIA
2006 - 2015

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EXECUTIVE SUMMARY

Our first turkey management plan, written in 1999, helped us focus on the critical wild turkey issues and needs at that time, and helped build partnerships with other groups, agencies and organizations. Fifteen of our major accomplishments from that plan are highlighted on page 3.

This management plan identifies the strategic goal, objectives and strategies for guiding wild turkey management and research decisions during the next ten years, 2006 - 2015. Now that wild turkey population restoration is completed, the focus of wild turkey management for the next ten years centers on acquiring more detailed harvest data and research on harvest and survival rates for population modeling and directing harvest strategies, determining habitat and social carrying capacities, minimizing and abating human-turkey conflicts, quantifying, enhancing, and acquiring turkey habitat throughout the Commonwealth, assisting and educating land owners regarding turkey habitat management, and improving hunter safety through increased educational opportunities and law enforcement.

The strategic goal is to provide optimum wild turkey populations in suitable habitats throughout Pennsylvania for hunting and viewing recreation by current and future generations. This goal is to be achieved by completing strategies under six objectives. The objectives are: (1) population management - sustain or enhance healthy wild turkey populations in each Wildlife Management Unit (WMU) at or below social carrying capacity; (2) habitat - improve quality of existing, and minimize loss of, wild turkey habitat throughout the state; (3) information and education – assess and improve the publics' knowledge, awareness and understanding of the wild turkey resource and its management; (4) hunting heritage/hunter safety - promote and improve the knowledge, safety, and participation of wild turkey hunters; (5) wild turkey protection - improve hunter compliance with laws and regulations regarding wild turkey management; and (6) cooperative partnerships - maintain and enhance partnerships in all aspects of wild turkey management. The list of strategies accompanies each objective. Some strategies are to be accomplished within this 10-year span, while others are ongoing. This plan ties in directly with the agency's Strategic Plan, which calls for species management plans to guide management decisions, and is the foundation for program, project, and budget development.

Implementing the 47 strategies in this plan will require personnel and budget commitments, yet resources are always limited. Additional revenue and resources will be needed for scheduled completion of management plan objectives and strategies. To assist with implementation planning, Appendix 1 is included that summarizes suggested target dates. Appendix 2 is a summary of public comments received on the previous draft of this document, and Appendix 3 is an outline of the history of wild turkey management in Pennsylvania from 1954 to 2006.

The plan specifies our primary form of population management is maintaining a conservative fall either-sex harvest, because harvesting more than 10% of the fall population can lead to a decrease in future turkey populations. Currently we do not know fall harvest rates in Pennsylvania. An important strategy listed in the plan is to conduct studies to provide this important missing piece of information. We also do not open fall seasons on a day that coincides with the opening of other

small game hunting seasons to minimize opportunistic taking of turkeys. An important addition to this plan is specific guidelines for recommending fall turkey-hunting seasons. We maintain a statewide spring bearded-bird only hunting season to open after the average peak of nest incubation because the harvest of males, after hens have been bred, has minimal effect on breeding populations.

The plan also provides valuable information on the biology of wild turkeys, their history of population decline and recovery, their habitat requirements and population status, trends and management in Pennsylvania. Additional details presented include their recreational significance and public interest, including their economic benefits and potential future recreational opportunities. Relevant information and data, both historic and current, are included throughout the plan, with references listed in the literature cited section. Additionally, 16 tables and figures are used to present information from over 80 years of wild turkey research and management.

Turkey hunting is among the most challenging and rewarding types of outdoor recreation available. We endeavor to emphasize the experiences and challenges gained in turkey hunting, not the harvest. Many non-hunters and hunters alike know about wild turkeys and value their presence even if they seldom see turkeys. As turkey populations continue to expand into more human-populated portions of Pennsylvania, the public's knowledge of their presence and appreciation for their attributes will continue to grow, and possibly change. Through this planning tool we strive to maintain the wild turkey as a treasured natural resource.

SECTION I. MANAGEMENT GOAL, OBJECTIVES, AND STRATEGIES

GOAL: *Provide optimum wild turkey populations in suitable habitats throughout Pennsylvania for hunting and viewing recreation by current and future generations.*

Six objectives have been identified to accomplish the goal. A set of strategies (how to accomplish the objective) is outlined under each objective. Target timeframes for completion are included with each strategy, and work is to be completed by the end of the year specified. In cases where work is continuous or will be repeated annually, timeframes are not necessary. Target timeframes are summarized in Appendix 1 to help with budget and resource planning.

Population Objective: Sustain or enhance healthy wild turkey populations in each Wildlife Management Unit (WMU) at or below social carrying capacity.

Strategies

1.1 Annually provide both a statewide spring bearded bird-only season and a conservative fall either-sex season in WMUs that can sustain a fall harvest, while maintaining or enhancing populations at or below social carrying capacity.
1.2 Annually use fall season lengths as the primary means for managing populations by WMU.
1.3 Annually assess WMU turkey population status and trends by analyzing spring harvest densities (from report cards and Game Take Survey), and summer turkey sighting survey data.
1.4 By 2007 collect age and sex information of harvested turkeys for both fall and spring hunting seasons to build population models and help direct future management decisions.
1.5 By 2008 implement an annual spring gobbler hunter survey to obtain spring harvest information, by sex and age, in time for providing seasons and bag limits recommendations for the next hunting year.
1.6 By 2007 evaluate the new mid-Atlantic wild turkey population model for application in Pennsylvania, and implement in 2008.
1.7 By 2008, if the new model requires additional data, develop and initiate research to collect data to fully implement the model and improve outputs.
1.8 Continue to conduct the 4-year (2006-2009) multistate gobbler harvest and annual survival rate study, and utilize these data for the population model.
1.9 By 2010 begin a study to determine harvest and survival rates of hen turkeys to be used for population modeling and setting fall season lengths.
1.10 By 2009 determine if each WMU provides enough data for reliably analyzing population trends, or if combining data from some WMUs provides more reliable trends.
1.11 By 2009 determine whether the statewide two-bird spring bag limit has had any affect on the age structure of the turkey population; recommend regulations changes if needed.
1.12 By 2007 develop a set of standard solutions to perceived and actual conflicts caused by wild turkey populations (nuisance, agricultural damage, illegal releases of pen-reared wild turkeys).

1.13 By 2007 begin to quantify turkey complaints across the state by season, type and location.
1.14 By 2007 begin to train personnel in identifying agricultural damage caused by turkeys versus other wildlife species.
1.15 By 2008 determine wild turkey social carrying capacity by WMU.
1.16 By 2013 develop a habitat suitability model for large-scale turkey harvest and habitat assessment for Pennsylvania.

Habitat Objective: Improve quality of existing, and minimize loss of, wild turkey habitat throughout the state.

Strategies

2.1 By 2007, using existing information on turkey habitat requirements, identify wild turkey habitat management priorities for State Game Lands Management Plans taking into consideration landscape features and land use on adjacent properties.
2.2 Beginning in 2008, annually quantify habitat management practices being conducted on State Game Lands to benefit wild turkeys.
2.3 Annually evaluate efficacy of commercial and noncommercial habitat management practices on State Game Lands for creating and maintaining turkey habitat, especially brood rearing and winter habitat, and recommend adjustments where appropriate, as part of adaptive resource management.
2.4 By 2008 complete at least two demonstration areas per PGC Region on State Game Lands to promote, to other public agencies and private landowners, commercial and noncommercial forestry and herbaceous vegetation management practices beneficial to wild turkeys.
2.5 Beginning in 2009, annually conduct at least one workshop or field trip per PGC Region at a turkey habitat demonstration area for private landowners and other public land managers.
2.6 Annually develop and/or continue partnerships for funding and assistance with land acquisitions, easements, priority cooperative projects and habitat demonstration areas on State Game Lands.
2.7 Annually provide technical information and assistance regarding turkey habitat management (especially for brood-rearing and wintering habitat) to private landowners and other public land managers through the PGC website, the Regional Wildlife Management Program and Public Access Programs (Safety Zone, Farm Game, and Forest Game).
2.8 Annually promote use of prescribed fire and other appropriate management practices to establish and maintain oak regeneration, which provides an important fall and winter wild turkey food source.

Information and Education Objective: Assess and improve the publics' knowledge, awareness and understanding of the wild turkey resource and its management.

Strategies

3.1 Beginning in 2007, and at 5-year intervals, conduct surveys to determine knowledge, attitudes, characteristics and levels of satisfaction of hunters and other stakeholders toward wild turkey populations and management issues.
3.2 Annually report research and management findings and conclusions to the public through all forms of media.
3.3 Annually provide educational information through all forms of media and speaking engagements on various aspects of wild turkey biology, habitat management, and harvest management (including resolving nuisance/conflict situations, harvest reporting and its misconceptions and the importance of properly timing the opening of our spring season).
3.4 Beginning in 2007, develop and publish fact sheets or "frequently asked questions" information sheets on various aspects of wild turkey management addressing common questions and misunderstandings; put on PGC website, in the *Hunting and Trapping Digest* and *Game News* as appropriate.
3.5 By 2008, disseminate information through all forms of media to farmers and other landowners about turkey behavior and how to identify and handle crop damage and nuisances in urban-suburban areas.

Hunting Heritage/Hunter Safety Objective: Promote and improve the knowledge, safety and participation of wild turkey hunters.

Strategies

4.1 By 2008 evaluate the option of expanding hunter education programs to include an optional and separate course in wild turkey hunting and safety.
4.2 By 2009 determine participation rates of the various age segments of turkey hunters and recommend ways of increasing participation of those various segments.
4.3 Annually assess and explore opportunities for continued development of the turkey hunting aspect of the youth mentored hunting program in Pennsylvania.
4.4 By 2007 evaluate the pros and cons of expanding the youth spring gobbler season to an all-day season.
4.5 Annually consider implementation of expanded spring hunting opportunities, including, but not limited to, multiple bird bag limits, extended hunting hours, Sunday hunting, and longer seasons.
4.6 Annually maintain and expand the Game Commission's public access programs to help promote and protect these privately owned lands open to public hunting.
4.7 Annually acquire turkey habitat in order to expand hunting opportunities.
4.8 Once a database of turkey hunters is established develop and distribute educational and hunter safety materials directly to turkey hunters.
4.9 By 2011 investigate relationships between spring and fall hunter density and turkey hunter

safety, and compare with other states. If considered necessary, recommend regulation changes to control hunter density by WMU.

4.10 Annually conduct information and education programs within the agency and with partners to help minimize and control turkey hunting related shooting incidents and to promote wild turkey hunter safety/ethics.

4.11 Annually monitor hunter compliance with fluorescent orange turkey hunting regulations.

4.12 By 2007 review orange requirements, evaluate the pros and cons of regulatory alternatives and, if appropriate, recommend changes to the spring season fluorescent orange turkey hunting regulations.

4.13 Annually assure that complete information on turkey hunting related shooting incidents are included in all International Hunting Education Association reports.

Wild Turkey Protection: Improve hunter compliance with laws and regulations regarding wild turkey management.

Strategies

5.1 Annually assess hunter compliance with laws and regulations to protect the wild turkey resource.

5.2 Annually use wild turkey decoys and other appropriate law enforcement tools to discourage road hunting and poaching. Utilize partnerships to assist with purchasing equipment.

5.3 Annually seek legislation to increase penalties for serious violations.

Cooperative Partnerships Objective: Maintain and enhance partnerships in all aspects of wild turkey management.

Strategies

6.1 When requested, assist states and Canadian provinces with their wild turkey restoration or range expansion programs by trapping and transferring turkeys, if biologically, socially and economically feasible.

6.2 Continue the partnership with the National Wild Turkey Federation in implementing all aspects of the wild turkey management plan in Pennsylvania.

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ACKNOWLEDGEMENTS

Many people including employees of the Pennsylvania Game Commission, Cooperative Wildlife Research Unit staff at Pennsylvania State University, graduate students and volunteers, particularly those from local chapters of the National Wild Turkey Federation, helped to collect the data discussed in this document. All data contained herein are subject to revision from corrections, improved analyses, and/or regrouping of data.

SECTION II. BACKGROUND

Turkey Management Planning

We accomplished a great deal during the 5-year cycle of our first "Management Plan for Wild Turkeys in Pennsylvania" (Drake 1999). Major achievements of the 1999 plan included:

1) Annually assessed turkey population trends with harvest and summer sighting indices.
2) Conducted a 2.5-year radio-telemetry study in southcentral Pennsylvania (Wildlife Management Unit 5A) to assess the reasons for the low population level, and developed management strategies to restore the population.
3) With financial support from the Pennsylvania Chapter, National Wild Turkey Federation, the northeast states commissioned the development of an eastern wild turkey population model, to identify the data components most needed for effectively managing our wild turkey resource in the 21st century.
4) Maintained and/or exceeded our baseline statewide turkey hunter success rates (spring and fall).
5) Created 22 Wildlife Management Units, replacing the 12 Turkey Management Areas that had been in place.
6) Established several turkey habitat management demonstration areas on State Game Lands, and created or maintained 1,000s of acres of wild turkey habitat, much of which involved cooperative projects with conservation organizations, sportsmen clubs, and federal, state and local agencies. Additionally, we acquired 37,178 acres of State Game Lands since 1999.
7) Adopted, in 2001, a prescribed burn policy to enhance wildlife habitat.
8) Signed a cooperative agreement with the National Wild Turkey Federation to partially fund a NWTF Regional Biologist to work closely with agency staff on wild turkey research, population management, and habitat management, as well as provide technical assistance to private landowners.
9) Established a Regional Wildlife Management Program to, among other tasks, provide direct technical assistance to landowners.
10) Established a wild turkey web page on the Game Commission web site, published many articles on wild turkey biology and management in both popular and scientific publications, and regularly gave public presentations.
11) Conducted a survey in 2001 to determine attitudes, characteristics and levels of satisfaction of hunters and other publics toward wild turkeys and turkey management issues.
12) Implemented, in 2001, a one-half hour segment of turkey hunting education to include safety, ethics, and hunter responsibility into the existing basic hunter education program.
13) Supported legislation and created regulations to legalize the use of manmade blinds in 2002 to more safely hunt turkeys, to allow the harvest of a second spring turkey in 2006, and the creation, in July 2006, of the Mentored Youth Hunting Program, which allows Mentored Youth to hunt spring turkeys, among some other game.
14) Established new regulations in 2002 requiring a Game Commission permit prior to

releasing game-farm turkeys, to help eliminate their release into the wild.

15) Transferred 515 wild turkeys to southeast PA from 2000-2003 to fully restore turkey populations in areas of that region that can support turkey populations.

The 5-year cycle of the first plan, however, did not provide adequate time to accomplish some objectives. Therefore, this revision has a 10-year cycle (2006 – 2015). The revision process, which began in 2004, included input from all Game Commission Bureaus, the Board of Commissioners, conservation organizations, and the general public. During the first public review process (October 11 to December 9, 2005) we received 153 comments from 90 individuals outside the agency plus an in-depth review by the Pennsylvania Chapter National Wild Turkey Federation. Due to the extent of revisions after the initial review we provided a second public review (October 24 to November 24, 2006) where we received 90 comments from 39 individuals and organizations inside and outside the agency (Appendix 2). Comments were reviewed and, where applicable, incorporated into this final plan.

Taxonomic Description

The wild turkey (*Meleagris gallopavo*) is native to North America, and does not naturally exist on any other continent. Of six subspecies, the eastern wild turkey (*M. g. silvestris*) is the largest and the only one to occur in Pennsylvania. The males, or gobblers, can exceed 25 pounds in weight, but average 17 to 21 pounds. Females, or hens, on average weigh 8 to 11 pounds (Pelham and Dickson 1992). Hens usually lack the beard and spurs, have a grayish colored and more feathered head, and have breast feathers with buff or chestnut colored tips in contrast to the black tips of the gobbler. Wild turkeys are predominantly vegetarians. At various times of the year, their diet can consist of green vegetation, grass seed, soft and hard mast, as well as roots and tubers. However, part of their diet, especially that of young turkey poults and brooding hens, consists of insects, amphibians, small reptiles, crustaceans, and other animal matter.

History and Distribution

Wild turkeys were abundant and widely distributed throughout most of North America when settlers first arrived. Native Americans and early settlers depended on turkeys as a reliable and important source of food. However, by the 1930s, wild turkey populations were extirpated or reduced to dangerously low levels except in the more remote and rugged portions of their original range. Up to 10% of the 30,000 turkeys remaining nationwide survived in the rugged Ridge and Valley Province of central Pennsylvania. These locales were not suitable for farming or lumbering, and were difficult for hunters to access. The two major factors responsible for the near extinction of wild turkeys were excessive sustenance and market hunting by early settlers and destruction of forests by logging and agricultural development (Kennamer et al. 1992a).

Recovery of wild turkey populations from near extinction to present levels was a success story attributable to modern wildlife conservation principles and scientific wildlife management. The estimated wild turkey population in 2004 was 6.4 million birds in the United States, Canada, and

Mexico (National Wild Turkey Federation 2004). Wild turkey populations now exist in every state except Alaska.

Several factors were responsible for the remarkable recovery of wild turkeys to their present abundance. Loss of many "wilderness" species including wild turkeys led to a change in "conservation ethics" by the early part of the 20th Century. Therefore, conservation agencies gave the few remaining wild turkeys greater protection with seasons, bag limits, and the establishment of refuges. Forest stands regenerated again into suitable habitat following the Great Depression. After World War II, restoration programs and scientific research and management of wild turkey populations provided the final key to full recovery (Kennamer et al. 1992a).

When Pennsylvania was first settled, eastern wild turkeys were abundant, with the exception of the Allegheny Plateau Region in the northcentral part of the state. Prolonged deep snow cover and understory shading from vast expanses of forests containing virgin white pine (*Pinus strobus*) and eastern hemlock (*Tsuga canadensis*) probably combined to create an unsuitable environment for wild turkeys in this region (Wunz and Hayden 1981).

By the early 1900s, in the Northeast, only Maryland, Pennsylvania, and West Virginia had any remaining native populations. In Pennsylvania, small flocks of wild turkeys remained in remote, rugged areas of our southcentral mountains south of Lock Haven (Latham 1941, Wunz and Hayden 1981).

Efforts to protect Pennsylvania's threatened wild turkey populations were initiated in 1873 with the introduction of the first turkey-hunting season. Turkey hunting was banned statewide from January 1 to October 1 with a $25 fine for killing or possessing a turkey out of season. In 1917, the fall bag limit for wild turkeys was set at one wild turkey of either sex per year. While most states needed to close their turkey seasons, the Game Commission offered fall turkey hunting statewide for every year but 1913, 1914, and 1926 (Latham 1941, Casalena and Eriksen 2003a). This fall-only tradition of hunting wild turkeys of either sex with shotguns, rifles, or archery was broken in 1968 with the first spring "gobbler" season, which was limited to the take of only bearded turkeys with shotguns or archery. The spring turkey-hunting season was timed to open after most hens were bred so that the hunting of gobblers would not affect turkey population levels. That year, the Game Commission also liberalized the annual limit to two birds - one either-sex turkey in the fall and one bearded turkey in the spring.

Enlightened public conservation attitudes, increased law enforcement, regeneration of forests cut over during the late 1800s, and farmland abandonment all contributed to expansion of remnant flocks. By the early 1950s, turkeys had naturally expanded northward into the second growth, broadleaf deciduous forests that had replaced the previously unoccupied virgin forests of the northcentral Allegheny Plateau Region (Wunz 1978). By 1978 turkeys occupied more than three-quarters of the range available in the Commonwealth, and nearly half of the Commonwealth was considered habitable to turkeys (Wunz 1978). Re-introduction efforts using pen-reared turkeys led many sportsmen to credit this program with achieving what natural dispersal of native wild turkeys from the southcentral range actually accomplished (Wunz and Hayden 1981).

Release of game farm turkeys began in Pennsylvania as early as 1915. The Pennsylvania Game Commission raised and released more than 200,000 game farm turkeys between 1930 and 1980 (Wunz and Hayden 1981). By the end of the 1970s, releases of wild-trapped turkeys led to successful establishment of self-sustaining wild populations in areas where years of game farm introductions had failed (Wunz and Hayden 1981). In 1979, the Commission committed to accelerated transfers of wild-trapped turkeys into the state's remaining suitable but unoccupied turkey habitats. In 1980, the Game Commission ended game farm turkey production.

Pennsylvania's wild turkey range expansion program was completed in 2003 as an unqualified success (Casalena 2003a). We now have wild turkey populations in all suitable habitats throughout the state. Today, some of our highest densities occur in parts of the state that were once considered unsuitable for wild turkeys when transfers were first started. We are presently maintaining healthy statewide spring and fall harvests and hunter success rates that suggest our statewide population also is very healthy. Pennsylvania has more wild turkey hunters and higher harvests than all the other Mid-Atlantic States. In 2002, Pennsylvania's wild turkey harvest ranked third in the nation behind Missouri and Georgia (National Wild Turkey Federation 2004).

Wild turkey management in Pennsylvania has progressed through the stages of exploitation, protection and conservation, habitat regeneration, natural range expansion, and trap and transfer range expansion (Appendix 3). Our focus on wild turkey management now is habitat management and optimizing consumptive and nonconsumptive recreation, while minimizing human conflict.

SECTION III. WILD TURKEY HABITAT

Land Use Trends

The quantity and quality of habitat for wild turkeys in Pennsylvania is dictated by land use trends. A major factor in the resurgence of our wild turkey population to present levels is the regeneration of timber stands cut during the late 1800s (Wunz and Hayden 1981).

Trends in the amount of forested area in Pennsylvania illustrated an increase of about 6% between 1955 and 1965, which slowed to an increase of about 1% from 1965 to 1978 (Powell and Considine 1982), and an additional 1% from 1978 to 1989 (Alerich 1993). Some increases resulted from abandonment of marginal agricultural land. From 1989 to 2002 there was no significant change in acreage of forested land, with 16,652,100 acres (± 149,869 acres) recorded in 2002 (McWilliams et al. 2004). Approximately 57% of Pennsylvania is forested.

Our forests are also getting older. In 1965, 45, 35, and 19% of our timber stands were in sawtimber, poletimber, and seedling-sapling size categories, respectively (Ferguson 1968). By 2002, sawtimber size stands had increased to 60% while poletimber and seedling-sapling categories declined to approximately 32 and 8%, respectively (McWilliams et al. 2004). Since 1955 the area of seedling-sapling stands decreased by well over 50%. Pennsylvania contains more timber today than at any time since the late 1800s. However, forest regeneration is a problem, statewide, regardless of region, landowner or forest type (McWilliams et al. 2004). Over-browsing by white-tailed deer (*Odocoileous virginianus*) and acid rain are the major causes of poor forest regeneration (Stroymayer and Warren 1997, Waller and Alverson 1997**,** Tilghman 1989). The 2002 forest inventory revealed that forest types dominated by red maple (*Acer rubrum*) have increased by 22% since 1989 to almost 1,000,000 acres. High value mixed oak (7,500,000 acres) and northern hardwoods (6,500,000 acres) still comprise the majority of our forest types (McWilliams et al. 2004). A similar trend exists in West Virginia, where the most common tree species no longer are oaks (*Quercus* sp.) and hickories (*Carya* sp.), but red maple and birch (*Betula* sp.) (J. Pack, West Virginia DNR pers. comm.).

Farmland has declined substantially since the early 1900s. More than 60% of Pennsylvania was in farmland in 1900 (U.S. Dept. of Commerce 1901). By 1992, only 25% of our land area remained in farms (U.S. Dept. of Commerce 1993). The decline in farming has slowed in recent years. The amount of farmland in Pennsylvania declined by 6% between 1982 and 1992, but slowed to a 1% decline from 1997 to 2002. During the 2002 census, there were 7,737,584 acres in farms in Pennsylvania, representing 58,209 farms (U.S. Department of Commerce 2002).

Recent losses of farmland and forestland have primarily resulted from conversions to commercial use (roads, rights-of-way, and other industrial development), housing, mining, public recreation, and others (Powell and Considine 1982). Continued losses to these factors seem likely in the future. Assuming continuation of gradual changes in overall land use, effects on wild turkey habitat in the near future should be small. Gradual long-term declines in wild turkey habitat are likely, however, if present trends continue unabated.

Loss of our native American chestnut (*Castanea dentata*) has been considered a net loss in habitat quality for wildlife in Pennsylvania and for wild turkeys specifically. American chestnut trees were prolific nut producers and produced nuts every year, which provided an excellent, reliable fall/winter food source for wild turkeys and other wildlife. Without this consistent food source, wild turkeys are more susceptible to mast shortages accompanied by winter stress, and in extreme cases, winter mortality.

Recent outbreaks of forest insect pests and pathogens have the potential for causing further deterioration of forest habitat quality because of the attendant loss of mast production resulting from tree and shrub mortality. According to forest ecologists, forest pests causing the greatest threats to our forestlands are: gypsy moth (*Lymantria dispar*), beech scale-nectary complex, geometrid complex, forest tent caterpillar (*Malacosoma disstria*), fall cankerworm (*Alsophila pometaria)*, hemlock woolly adelgid (*Adelges tsugae*), dogwood anthracnose (*Discula* sp.), and periodic cycadas (J. Unger, PA Bureau of Forestry, pers. comm.). These, and other forest pests, threaten important sources of mast production for wild turkeys. Forest ecologists cannot predict future trends, and eventual forest ecosystem effects from these outbreaks. Natural enemies and weather are the main causes of outbreaks, and, therefore predicting outbreaks is difficult. Gypsy moth outbreaks now occur in Pennsylvania on about a 7-year cycle like in its native Asian continent. The next outbreak is expected between 2007-2010 (J. Unger, PA Bureau of Forestry, pers. comm.).

Maintaining the oak component in some sites is becoming increasingly difficult (Wunz and Pack 1992, Stroymayer and Warren 1997, McWilliams et al. 2004). Gradual loss of oak in our forests, an integral component of wild turkey habitat, will continue unless steps are taken to correct it. One of the major factors preventing forest regeneration is over browsing by white-tailed deer (Stroymayer and Warren 1997, Waller and Alverson 1997). Foresters in the Allegheny National Forest have shown that high deer densities have depressed the regeneration of several valuable hardwood species to well below acceptable stocking levels (Waller and Alverson 1997, Tilghman 1989). In many areas of Pennsylvania, especially the northcentral region, sustained deer browsing has eliminated the seedlings and saplings of all tree species, leaving a grass and fern-dominated understory. The shade created by the ferns prevents future germination of seedlings, further deterring regeneration (Waller and Alverson 1997, Horsley and Marquis 1983). The Pennsylvania Game Commission has recently taken action to reduce the overabundant deer herd according to goals established in the deer management plan (Pennsylvania Game Commission 2003). Invasion of exotic species in over browsed areas is also becoming apparent, especially in southeastern and southcentral Pennsylvania (Waller and Alverson 1997). *Ailanthus altissima*, an Asian species with little value for wildlife or market is becoming more prominent, especially in southern Pennsylvania.

Other factors affecting forest regeneration include: 1) outbreaks of defoliating insects; 2) weevils (*Curculio* sp.) that can attack up to 95% of acorns in an area, making the acorns unviable; 3) a tendency for good sites to regenerate into northern hardwoods instead of oaks; and 4) selective harvests without consideration of advanced oak regeneration (J. Unger, PA Bureau of Forestry, pers. comm.).

Although tree mortality results in mast loss for wild turkey, it can also be beneficial. Additional sunlight on or near the ground can favor grasses, shrubs, and early successional growth. In some situations where deer over-browsing is not significant, additional benefits in diversity of species, timber size class, and habitat types, as well as improved mast production in understory species could outweigh losses of mast from mature overstory trees. Forest and wildlife ecologists have not yet determined the net long-term effect of forest defoliation and mortality on wild turkey habitat.

Habitat Relationships

Past research implied wild turkeys need large, mature forest tracts with limited human disturbance (Latham 1956, Mosby 1959, Shaw 1959). However, recent studies suggest such views reflected more the need for reducing legal and illegal hunting mortality and large-scale habitat loss, rather than the actual habitat requirements of the species (Porter 1992, Wunz and Pack 1992). We now know habitat diversity is the most important factor affecting quality of wild turkey habitat. Habitat diversity is the interspersion of habitat types to meet all life requirements within a turkey's one-half to three square mile home range (Brown 1980, Kurzejeski and Lewis 1990, Badyaev et al. 1996). Eastern wild turkeys were recently restored in South Dakota in landscapes with very little (less than 15%) forest cover (Leif 2000). Using population densities as an indicator of habitat quality, data from Missouri, Iowa, and Minnesota suggest that optimum habitat for wild turkeys is a 50:50 mix of forested to open land (Little 1980). Open land in the best turkey habitat in the Northeast ranges from 10 to 40% (Pack 1986a). Presently in Pennsylvania, the 7 Wildlife Management Units with the highest reported spring harvest densities (number turkeys harvested per square mile) averaged 60% of their land area forested (range 51 – 70%).

Wild turkeys are, perhaps, best described as habitat generalists (Lewis 1992) adaptable to a variety of environmental and habitat conditions (Dickson et al. 1978). Optimum wild turkey habitat generally has a diversity of habitat types, successional stages, and plant species within the home range of wild turkeys. Diversity provides two important factors for wild turkeys: (1) it affords a range of habitat conditions within their home range providing for their varying seasonal life requirements, and (2) it provides a variety of food sources that are less susceptible to complete failure during years of overall poor natural food production.

In Pennsylvania's maturing forest landscape, interspersion is achieved through forest management practices that arrange various forest age classes and small openings in close proximity. For example, young regenerating stands in the 0 - 5-year age class provide brooding habitat in summer and soft mast in fall. Stands in the 6 - 20-year age class also provide soft mast in addition to fall cover, nesting cover and some brooding habitat. Mixed hardwood forests >40 years of age produce hard mast, nesting cover and if thinned and/or burned, provide herbaceous groundcover and invertebrates for broods. Ideal habitat conditions result when landscapes are a mosaic of various age classes. Timber management, both commercial and non-commercial, is the tool through which such conditions are attained.

Clearings, or forest openings, are important to the quality of habitat. However, the size and interspersion of clearings within an individual turkey's home range are probably more important than

the total percentage of clearings over a given area. As a habitat component, clearings are most important during the brood-rearing period as they provide protective cover, ample invertebrates for food, and a zone of visibility for brood hens (Everett et al. 1985, Metzler and Speake 1985, Sisson et al. 1991, Hurst 1992). The most beneficial clearings are those dominated by forbs and "weeds" present in the seedbank as opposed to monocultures of planted perennial cool-season grasses such as timothy (*Phleum pratense*), orchardgrass (*Dactylis glomerata)*, bluegrass (*Poa pratensis*), and fescue (*Festuca* spp.) that develop dense thatch and harbor relatively few invertebrates (Healy and Nenno 1983, Harper et al. 2001).

Extensive areas of cleared land are not suitable as eastern wild turkey habitat (Porter 1992) and may present barriers to natural dispersal (Wunz and Hayden 1981). Porter (1980) and Crim (1981) considered timber and crop field associations important as wintering areas, but Kurzejeski and Lewis (1990) found that turkeys in northern Missouri seldom used crop fields not bordered by mature timber stands.

Much of Pennsylvania's landscape is a mosaic of woodlots mixed with agricultural, rural residential and open areas such as fallow or rejuvenating fields, reclaimed strip mines and shrub/scrub lands. This mosaic provides the close proximity of varying habitat types, which support a turkey's life requirements throughout the year.

Wild turkeys have shown the ability to populate habitats close to humans in areas previously considered unsuitable. Wunz (1985) reported that turkeys could tolerate heavily fragmented habitats with high levels of human disturbance if restrictions on fall hunting adequately protected the turkeys. As turkeys continue to inhabit excellent habitats in proximity to humans, their tolerance to human disturbance may further surprise us. However, "the fact remains that lower human populations and less access to turkey range generally result in less poaching, less chance of legal over-harvest, less destruction of habitat, and less harassment by people and free-ranging dogs" (Wunz and Pack 1992).

Large, heavily forested areas of Pennsylvania such as WMUs 2F and 2G presently support lower wild turkey population densities than areas with a diversity of habitats such as WMU 1A, 2A, 2B and 2D. However, with continued human population trends and the permanent conversion of turkey habitat to residential, commercial, and industrial development, the future of wild turkey populations remains unclear. With a large portion of heavily human-populated areas of the state supporting growing wild turkey populations, nuisance turkey complaints are increasing. Maintaining healthy and huntable wild turkey populations while avoiding the public image of a pest species is becoming a challenge for wildlife agencies throughout the range of the wild turkey (Teft et al. 2002). We need to determine wild turkey social carrying capacity, not only in urban areas, but also across the state.

Future wild turkey habitat improvements will depend largely on 5 approaches:

1) Enhancing existing habitat by incorporating favorable habitat management approaches for wild turkeys into commercial forestry, agriculture, mining, industrial development, and housing development;
2) Continued regeneration of mast-producing trees as well as maintenance of beneficial groundcover;
3) Continuing the noncommercial habitat management practices for wild turkeys on State Game Lands, as well as encouraging noncommercial habitat management into other public and private land-use practices via demonstration areas, workshops and technical information. Landowners will adopt noncommercial practices to the degree dictated largely by the availability of information, labor, funds, and the priority of need or interest of those involved;
4) Maintaining and improving the conditions of turkey habitat, especially existing brood rearing and winter habitat (including log landings and logging roads), across the Commonwealth; and
5) Developing and continuing existing partnerships for funding and assisting with land acquisitions and conservation easements, and encouraging programs to preserve habitat and habitat corridors.

Nesting Habitat

The ground-nesting turkey hen has a preference for nesting in locations with well developed herbaceous and shrub lateral cover (Everett 1982, Lazarus and Porter 1985, Still and Bauman 1990, Badyaev 1995). Picman (1988) and Badyaev (1995) demonstrated the importance of cover to ground nesting birds. Young clearcuts, thinned timber stands, fields, and croplands provide quality habitat for nesting and brooding (Zwank et al. 1988, Porter 1992). Intuitively, enhancing the nesting habitat should improve nesting success rates. Hayden (1989) noted a preference for nesting in clearcuts in intensively managed forest habitats in northcentral Pennsylvania. During a study in south-central Pennsylvania, researchers found no correlation between the habitat variables they studied and nest success (Lowles 2002). Over-browsing by deer was not significant, so lateral cover of the understory was not limiting. The best approaches to enhancing nesting habitat are conventional silvicultural regeneration practices, especially even-aged timber management in areas where the deer population has not hindered advanced regeneration, and promoting habitat diversity.

Spring weather may be an important factor influencing population dynamics of eastern wild turkeys. In Mississippi, researchers found a correlation between the number of rainfall events and nest success (Lowrey et al. 2000). In New York, May rainfall may negatively affect the subsequent fall harvest (Fleming and Porter 2000). Wildlife managers cannot change weather patterns, making habitat management even more important for nest success and brood survival.

Brood Range

Researchers have reported that the most important parameter in wild turkey population dynamics, next to nest success and juvenile, yearling, and adult survival, is brood survival (Roberts and Porter 1996). Good brood range for turkeys in Pennsylvania consists of forested sites with a forb

understory, savannas next to mature forests (Hayden 1979), forb covered wooded roads (e.g. logging roads), herbaceous openings in forested areas and agricultural fields adjacent to wooded areas. Forbs harbor an abundant source of insects for poults to meet their high protein requirements early in life (Miller et al. 2001, Edelmann et al. 2001). Also, sufficient understory or vertical cover is important for poults to avoid predators. However, too much cover may obstruct the hen's vision (Porter 1992). Research has shown that successful hens are more often found in brood habitat with abundant vertical ground cover from 20 – 60 cm (Porter 1980, Healy and Nenno 1983, Peoples et al. 1996). Trees afford heat regulation to poults by providing shade and protection from rain. They also may provide escape from ground predators for those old enough to fly (Porter 1992). The primary value of good quality brood range is to enhance poult survival. Researchers have not determined the importance of brood range to Pennsylvania turkey populations, but high-quality brood range is likely limiting in portions of our wild turkey range lacking diversity. Wildlife managers in the South have used prescribed burning to promote herbaceous ground cover (Stoddard 1963, Lewis et al. 1964, Peoples et al. 1996); those in the Northeast have been slow to accept this practice. Alternatively, openings dominated by perennial cool-season grasses can be mowed annually to every other year toward the end of the growing season so by next spring the herbaceous cover will be low enough for poults to move through and glean insects from vegetation (Healy & Nenno 1983).

Fall Habitat

During fall, both young and adult turkeys seek foods high in fat and protein. Young turkeys continue to grow, and both young and adults build fat reserves from the fat content of hard mast, such as acorns and nuts (Porter 1992). Optimal fall range for wild turkeys in Pennsylvania generally is forested habitat with hard mast as the most important food source, along with forest openings planted with fruit- and nut-producing trees and shrubs. Fall range should include adequate trees in good to excellent mast producing age classes, a diversity of mast-producing species, and a diversity of hard- and soft- mast-producing understory shrubs and vines. Prudent use of uneven- and even-aged timber management systems, and management of plantings in open areas can achieve these conditions.

Even-aged timber management is the prevalent, large-scale forest management system in Pennsylvania. In large, forested tracts, when clearcuts are 30 to 50 acres in size and on 80 to 120 year rotations, sufficient adjacent stands of mast producing age remain to satisfy the fall requirements of turkeys within their range. In addition, 1 - 20 year old clearcuts established through even-aged management provide valuable nesting and fall-hunting escape cover (Hayden 1989).

The quality of fall range is not considered limiting to turkey survival in Pennsylvania. Researchers have not determined whether it may be limiting to the condition of turkeys entering the winter, their eventual survival, their spring breeding condition, or reproductive success. Also, availability of breeding sites, roosting sites, and water generally are not considered limiting to wild turkeys in Pennsylvania.

Winter Habitat

The northern tier of Pennsylvania is near the northern perimeter of historical eastern wild turkey range. The suitability of winter habitat with respect to the availability of adequate food and thermal shelter may be one of the limiting factors for wild turkeys in parts of Pennsylvania. Even today, with habitat improvement from successional changes, over-winter mortality during severe winters can occur, usually at a small scale though, but is not a threat to the statewide population. We have not experienced a turkey population decline from winter mortality in northern Pennsylvania since the severe winters of 1976-78. Wunz and Hayden (1975) determined that winter mortality usually is not severe unless both deep, fluffy snow (8 inches or more) and persistent low temperatures that keep the snow fluffy for more than two weeks occur together. These conditions make food on the forest floor inaccessible and restrict turkey movements to limited sources of available food. Conversely, packed or crusted snow cover allows wild turkeys to travel to sources of food. Other studies have confirmed this (Austin and DeGraff 1975, Roberts et al. 1995, Vander Haegen et al. 1989), and hypothesized that juxtaposition of roosting habitat to secondary food resources was important to winter survival of northern populations. South-facing slopes that contain spring seeps, waste grains, or spread manure provide excellent food sources during severe winters (Wright et al. 1996).

During infrequent severe winters, wild turkey mortality can occur not only throughout northern Pennsylvania, but also throughout the entire Allegheny Plateau and in some areas of the remainder of the state if combinations of severe winter weather and poor natural food supplies coexist. Typically, juvenile turkeys are affected more than adults. Most often though, temperature fluctuations cause a crust to form on the snow, allowing turkeys to travel to food sources before large-scale mortalities occur.

Rather than actual mortality, severe winters, accompanied by low natural food supplies have greater potential to negatively affect hens' nesting productivity. Hens that enter the breeding season in poor physical condition are less likely to nest, or are less likely to renest if their first nest attempt fails. First-year hens are affected more than adult hens (Porter et al. 1983, Vander Haegen et al. 1988).

During winter, turkeys feed primarily on hard mast available on the forest floor. If hard mast is scarce, they consume ferns, bulbs, tubers, and spore heads of club moss as alternative food sources (Wunz and Pack 1992). Turkeys also forage on grass, grass seeds and forbs in crop fields and clearings. Secondary or supplemental foods may be significant factors for winter survival, particularly in marginal habitat. Turkeys will utilize agricultural waste grains, corn and grain from spread manure, and silage from trench silos as well as backyard bird feeders in residential areas. The proximity of supplemental foods to thermal roosting cover may also be a factor in winter survival during severe winters. During severe winters, especially in heavily forested areas, vegetation and aquatic life in and near spring seeps may be their sole source of food and can be essential for survival (Wunz and Pack 1992). In the mountains of West Virginia, when snow depths exceed 4 inches, about 85% of turkey feeding activity occurs in spring seeps and their connecting small streams (Healy and Casalena 1996).

Winter thermal shelter helps reduce turkey losses by moderating snow cover depths and reducing energy losses caused by low ambient temperatures and wind chill. Wild turkeys often frequent and roost in conifer stands on north and east facing slopes and bottom areas where terrain further moderates prevailing westerly winds (Wunz and Pack 1992). Conifer stands are especially important during severe winters. Winter shelter recommendations for wild turkeys generally suggest that 5 to 10% (Pennsylvania Game Commission PAM HEP HSI Model for wild turkeys, Wunz and Pack 1992) of forested areas be in conifers. Many extensively forested areas in the more rugged and remote portions of Pennsylvania are probably presently limiting in respect to their availability of winter thermal shelter for wild turkeys and other species of wildlife. With the onset of Hemlock wooly adelgid, which has severely affected many hemlock stands throughout much of the southern half of the state, conifer stands may become limiting if this exotic forest pest is not controlled.

Artificial winter-feeding for wild turkeys has been a controversial issue. Disease and parasite transmission, predation, and poaching are potential problems. The effort and expense of supplemental winter-feeding programs deems them ineffective and impractical. Further, scientific studies of winter-feeding programs are almost universal in pointing out the large numbers of disadvantages as opposed to very few advantages (Hixon 1997, Wunz and Hayden 1975). In northern Pennsylvania for example, turkey populations declined following three successive severe winters from 1976-1978. Populations on two large hunting preserves in the same area declined just as severely even with extremely intensive feeding programs that would be impractical for state agencies or sportsmen's groups (Wunz 1987b).

The Pennsylvania Game Commission's 2003 policy on winter-feeding of animals states "The Pennsylvania Game Commission will not support the winter-feeding of game birds or animals. The Agency will develop and maintain wildlife habitat as a means of averting major winter losses" (Pennsylvania Game Commission 2003). Although habitat management practices can be expensive, they can provide long-lasting improvements to winter habitat, are cost-effective, and can benefit a large number of species and their varying needs throughout the year (Wunz 1987b). Additionally, during winters with heavy snow accumulations, the Game Commission plows some roads and herbaceous openings on State Game Lands to assist wildlife in traveling and acquiring natural foods.

Inter-specific Competition

Bailey et al. (1951) discussed competition for food between turkeys and other wildlife species with similar food preferences. To what degree competition for food limits wild turkey populations is unclear (Hurst 1992). Marquis and Brenneman (1981) and Tilghman (1989) suggested that the effect(s) of high white-tailed deer populations on forested habitats in Pennsylvania could be detrimental to turkeys, and that deer detrimentally could affect tree species composition. Wunz (1987a) found that deer hindered habitat management for turkeys in Pennsylvania. The extent of the long-term impact of deer on wild turkey habitat is not well known.

Although rumors exist of wild turkeys competing directly with, and even consuming, ruffed grouse, these rumors are unfounded. Wild turkeys are much more of a generalist than ruffed grouse, shifting their seasonal range to where suitable food and shelter are abundant (R. Eriksen, National Wild

Turkey Federation, pers. com.). Ruffed grouse prefer early successional stage forests. Decreases in early seral stages have facilitated increases in older forests with highly productive mast crops, which has aided in turkey population expansion. During winter, turkeys feed primarily on mast, and roots, and tubers on the ground and will consume waste grains in agricultural fields, whereas grouse forage primarily on tree buds. Wild turkeys are considered to have little or no detrimental effect on the habitat of other wildlife species.

Wildlife Management Units

Wild turkey populations, along with most other game species, are managed via Wildlife Management Units (WMUs) in Pennsylvania (Figure 1). Adopted in 2003, 22 WMUs are grouped and identified within 5 large physiographic units (Rosenberry and Lovallo 2002). Boundaries of these WMUs follow major streams and highways to include areas of homogeneous habitat, wildlife population densities, hunter participation, hunter access, land use, major land ownership, and human demographics. Prior to 2003, turkeys were managed in 12 Turkey Management Areas (Figure 2). Further harvest, hunter and summer sighting data analyses are needed to determine if data from several WMUs should be pooled to provide more reliable trend information for turkey management.

Figure 1. Pennsylvania Wildlife Management Units (WMUs).

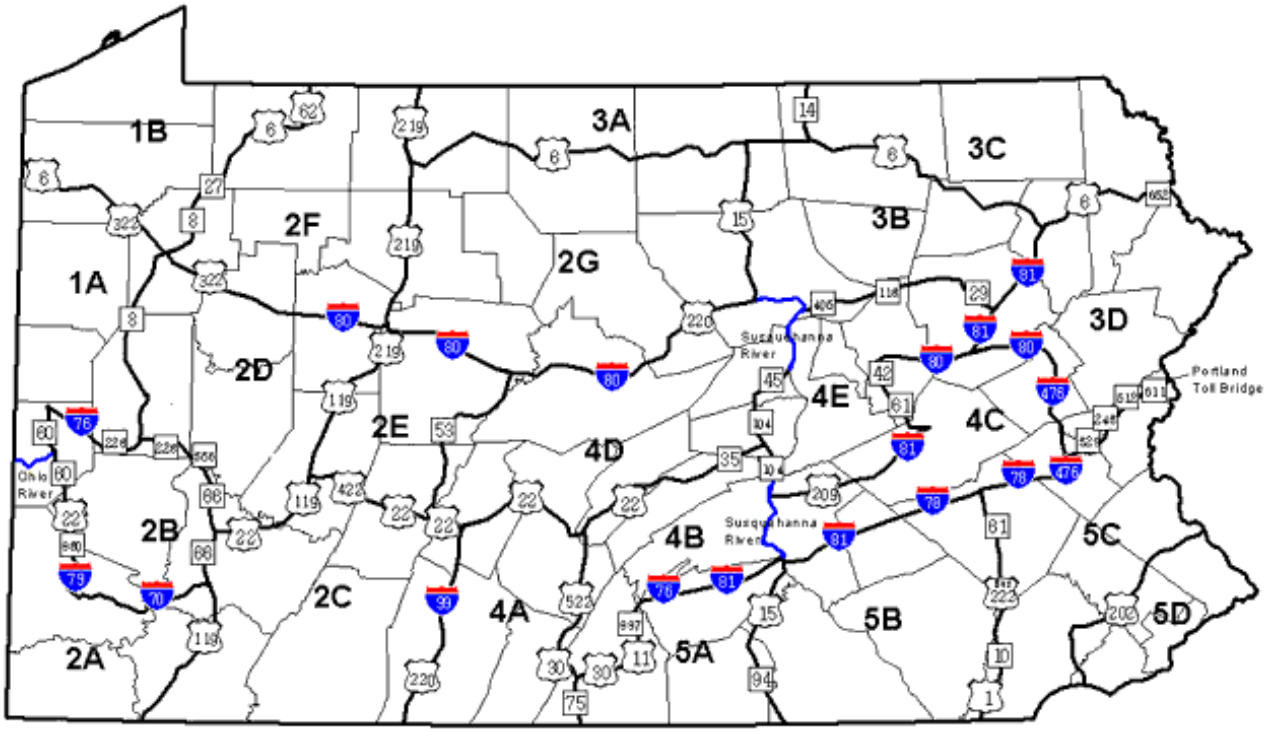
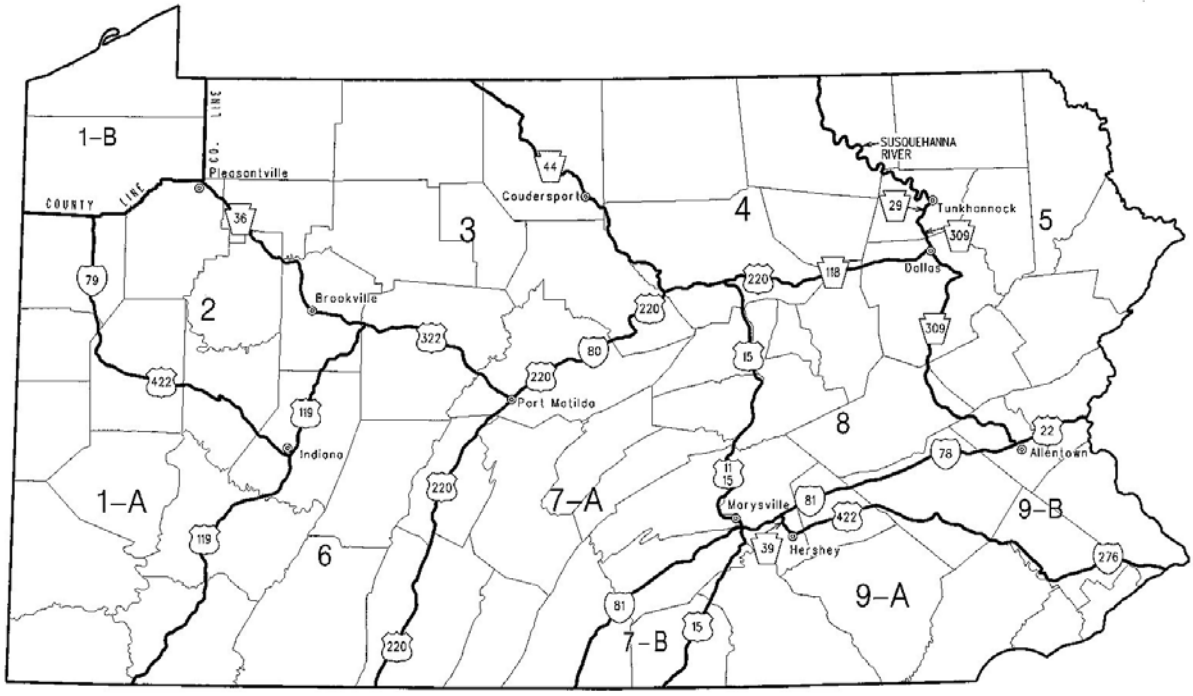


Figure 2. Former Turkey Management Areas.



SECTION IV. WILD TURKEY POPULATIONS

Population Demographics

Recruitment

Dynamics of Pennsylvania's wild turkey populations depend on reproduction (gains) and mortality (losses). Factors affecting reproduction are nesting and renesting rates, nest and hen success, clutch size, fertility rates, hatching success, and poult survival. Vangilder (1992) provides an excellent review of recruitment data collected in other states.

Hayden (1980) studied wild turkey reproduction in Pennsylvania, primarily on Armenia Mountain, Tioga County, in WMU 2G. Using radio-instrumented hens, nesting rates were 97% for adult hens and 56% for juveniles. Hatching success rates (i.e., hens that hatched one or more live poults) were 83% for adults and 100% for juveniles. Average clutch size was 12.

The only other in-depth turkey study recently conducted in Pennsylvania was on WMU 5A from 1999-2001. Reproductive effort and success of radio-tagged hens varied considerably among years and between age-classes (Lowles 2002). Nest initiation rates were 75% and 92% for adult hens, for the two years, and 56% and 67% for sub-adult hens. Hatching success rates were 67% and 36% for adult hens, for the two years, and 50% and 56% for sub-adult hens. Average clutch sizes were 12 for adults and 10 for sub-adults (Lowles 2002). This population had been showing signs of decreasing since the 1980s, voiding comparisons to other WMUs where turkey populations were doing well.

Roberts et al. (1995) found that nest success was the primary factor contributing to annual population change in a radio-instrumented hen study in south-central New York. Mean nest success was 38% (range, 26 - 58%) during the 4-year study. The authors concluded that annual nest success and poult survival influenced annual population fluctuations more than annual survival rates. Vangilder et al. (1987) reported annual variation in nest success from 18% to 45% in Missouri, and Glidden (1977) reported a range from 20 to 56% in southwestern New York. Norman et al. (2001) reported incubation completion rates varied from 38 to 65% in Virginia and West Virginia. Hayden's (1980) Armenia Mountain nest success was considerably above the mean success rates found in other states: Massachusetts - 45% (Vander Haegen et al. 1988), Minnesota - 63% (Porter et al. 1983), Missouri - 31% (Vangilder et al. 1987), southwestern New York - 44% (Glidden 1977), and western Virginia – during a 2-year study, 40.5% during year 1 and 72% during year 2 (Godfrey and Norman 2000). Measures of reproductive data, by age and WMU (such as nesting rates, nest success, renesting rate and success, and poult mortality rates) merit additional research in Pennsylvania as time and resources permit. This information is important for modeling the populations by WMU, as well as for understanding the population structure and how Pennsylvania's turkey populations differ from those in other states.

Survival

Data regarding wild turkey survival in Pennsylvania are limited. Vangilder (1992) provides an excellent review of survival data collected in other states.

Predation, harvest (legal, illegal, and crippling loss), and other factors (accidental, disease and parasites, and winter-related) are the major causes of turkey mortality. Predation is the primary mortality factor affecting wild turkeys (Vangilder 1992). Illegal harvests (Kimmel and Kurzejeski 1985, Williams and Austin 1988, Wright and Vangilder 2001) and legal harvests (Little et al. 1990, Williams and Austin 1988, Pack et al. 1999) also are substantial sources of mortality. Annual survival rates for adults range from 45 to 70% and exhibit high annual variation in radio-telemetry studies (Vangilder 1992). Pack et al. (1999) concluded that legal fall hunting mortality is additive and varies with fall mast conditions, and, therefore, fall hunting seasons should be implemented or increased cautiously.

In Pennsylvania, disease outbreaks in wild turkeys are not major mortality factors and have not caused significant population declines. The most common diseases identified to date are avian pox (caused by the poxvirus group) and histomoniasis (blackhead disease, caused by the protozoan parasite *Histomonas meleagridis*). These diseases tend to infect a few flocks, on very local levels, every year or two, and usually occur during warmer months. Most outbreaks are associated with well-intentioned humans feeding wild turkeys as this unnatural concentration of wild turkeys spreads the highly infectious diseases very quickly from the original carrier to other birds and flocks. For this reason, feeding of turkeys, throughout the year, is highly discouraged.

During a radio-telemetry study in WMU 5A from 1999-2001 to determine the causes of a decline in the wild turkey population, annual survival of adult hens was 48% (1999) and 64% (2000). Annual sub-adult survival was 13% (1999) and 28% (2000) (Lowles 2002). These sub-adults survival rates were lower than results from similar studies (Vangilder and Kurzejeski 1995, Vangilder 1992). Fall hunting mortality accounted for much of the mortality in two of the three years. Since 2003, the fall hunting season has been closed in WMU 5A to aid population recovery.

Survival rates likely are higher in other WMUs. However, additional data collection is required to document those rates. Fall hunting season length varies among WMUs, and, therefore, annual survival rates also most likely vary. Wild turkey survival, by sex and age, is an area needing additional research in Pennsylvania, especially as it relates to fall season length in each WMU, as this is an important aspect of managing populations.

Wild Turkey Population Management

Harvests

We use two methods for estimating turkey harvests. Final spring and fall harvests are calculated from our annual Game Take (GT) Survey, which is mailed each April to two percent of the year's hunters (Rosenberry 2003). The survey queries hunters regarding the previous year's spring and fall

turkey seasons, as well as other species. GT results are finalized each July, so spring harvest results are finalized 14 months following the spring season and 8 months following the fall season. In 2004, due to agency budget constraints, the GT survey was not conducted.

Because of this delay in harvest information, preliminary harvests are estimated following each season via mandatory harvest report cards that hunters are required to complete and mail within ten days of harvesting a turkey during each season. Not all hunters report their harvest, so the reported harvest is adjusted by the reporting rate. We determine the statewide reporting rate by matching hunting license numbers of successful hunters from the GT Survey with license numbers on turkey harvest report cards for the fall reporting rate, and hunter name match for the spring reporting rate because the sample is from the spring season prior to the current license year (Casalena 2003b). We use a three-year rolling statewide average reporting rate. Current statewide spring and fall reporting rates are approximately 16% and 30%, respectively. During the 2001 Pennsylvania Turkey Hunter Survey, when turkey hunters were asked why successful turkey hunters did not report their harvest, 62% ($\pm$ 2%) thought hunters simply forgot and 49% thought hunters did not realize the importance of report cards (Pennsylvania Game Commission 2002). We look to Internet and telephone reporting options to provide better reporting rates.

Another important harvest management need is to obtain final spring harvest information, by sex and age, in a more timely manner than the current GT Survey. One option includes a spring turkey hunter survey mailed to a sample of hunters immediately following the spring season. However, funding for an additional annual survey has been lacking. Acquiring an electronic database via a point-of-sale licensing system would allow surveys to be completed in a more timely manner in order to make season recommendations based on current year data.

Annual statewide combined spring and fall harvests, determined from GT surveys, have averaged nearly 60,000 turkeys during the 1990s, with over 600,000 turkeys harvested during the decade (Figure. 3). Present harvests show a long-term increasing trend with peaks in 1995 and 2001 (Figures. 3 & 4). Comparisons to historical turkey harvest data (Pennsylvania Game Commission 1975) also show harvests during the 1990s and 2000s to be the highest on record. Prior to 1964, wildlife conservation officers estimated the statewide turkey harvest. From 1965 to 1970 harvest estimates were based on data from an in-season postal survey. The survey yielded daily success rates. These rates were applied to hunter-days of hunting effort, obtained from the first (1965) mail survey to determine the harvest estimate (Wunz and Shope 1980). In 1971 the current GT survey was initiated. Although the methods of calculating harvest have changed over time, the trend still shows the harvests and population have exhibited steady growth since the 1950s.

Figure 3. Pennsylvania total (spring + fall) turkey harvest trends by decade.

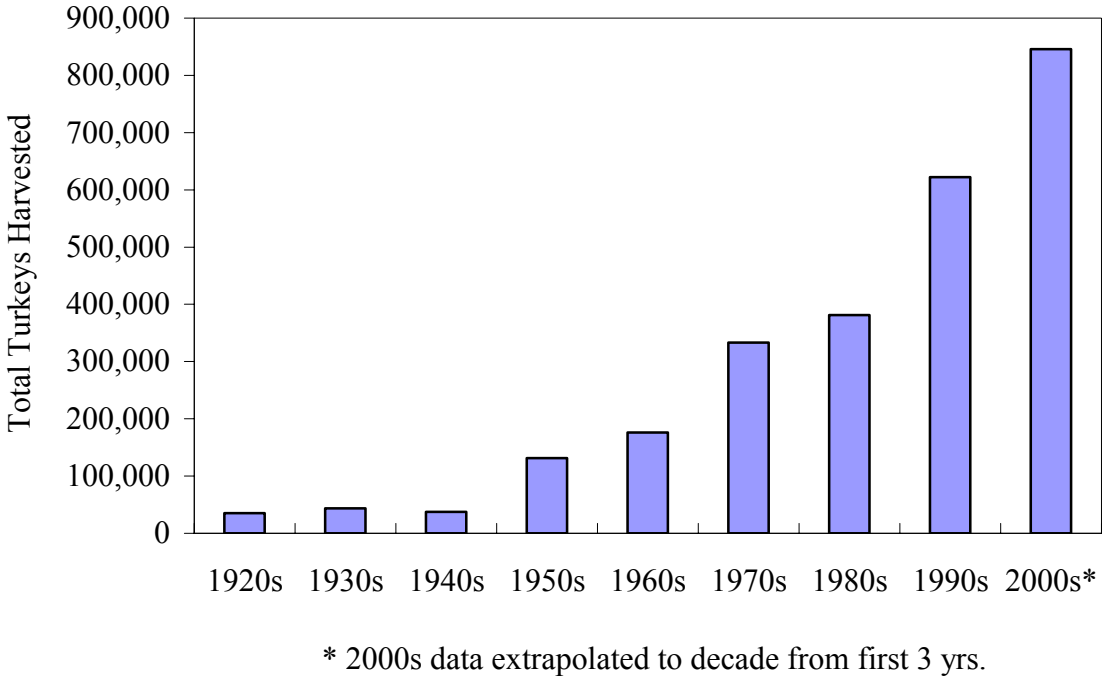
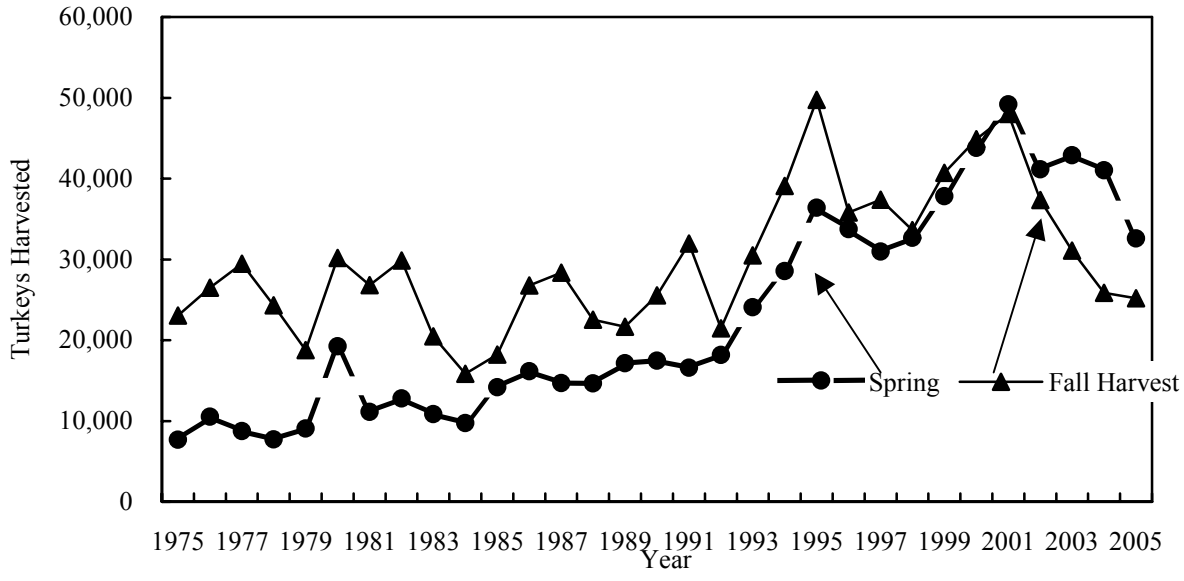


Figure 4. Pennsylvania spring and fall wild turkey harvests, 1975-2005. Data are from annual Game-Take surveys, except 2004 when data were calculated harvests from reported harvests.



Harvest Management

Pennsylvania's wild turkey harvest strategy is to maintain both a statewide spring bearded bird-only season and a conservative fall either-sex season in WMUs that can sustain a fall harvest, but allow continued population stability and/or growth. Wild turkey population levels are managed through regulating the fall either-sex harvest. Because all licensed hunters in Pennsylvania can participate in turkey hunting, we manage fall turkey harvests through regulation of fall hunting season lengths within WMUs (Tables 1 & 2).

Table 1. Pennsylvania fall turkey hunting season lengths, by Turkey Management Area (TMA), 1993 – 2002. In 2003, TMAs were replaced with Wildlife Management Units.

	Fall turkey hunting season lengths (weeks)									
TMA	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1A	0	0	6 days	1	1	1	2	2	2	2
1B	0	0	6 days	1	1	1	2	2	2	2
2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3
4	3	3	3	3	3	3	3	3	3	3
5	3	3	3	3	3	3	3	3	3	3
6	2	2	3	3	2	2	2	3	3	3
7A	2	2	3	3	2	2	2	3	2	3
7B	2	2	1	1	1	1	1	1	1	6 days
8	2	2	3	3	2	2	2	3	3	3
9A	0	0	0	0	0	0	0	3 days	0	0
9B	0	0	3 days	5days	5days	5 days	6 days	1	1	1

Spring Turkey Hunting Season

We annually conduct a statewide 4-week (including 5 Saturdays) spring gobbler season with the assumption that effects on breeding populations are minimal. This assumption is based on opening the spring season in conjunction with the average peak of nest incubation, the Saturday closest to May 1. Beginning in 2004, a one-day statewide youth-only hunt is held the Saturday prior to the regular season opening. In years when the last week of the season would overlap with Memorial Day, the regular season and youth-only hunt open one week earlier. The average Pennsylvania statewide incubation date was April 28 from a ten-year study, 1953-63, where field personnel aged all broods they saw throughout the summer months (Rinell et al. 1965). More recently, during a radio-telemetry study (1999-2001) in south-central Pennsylvania, the average incubation date of first nests was May 15 after a cold, snowy winter (1999) and May 8 after a normal winter (2000) (Casalena et al. 2003). By coordinating the opening of the season with the peak of nest incubation, we decrease the probability of illegal and accidental hen mortality, as well as nest abandonment by the hens that are in the process of laying their clutch. Hens in the egg-laying stage are more susceptible to nest abandonment than hens that have begun incubating (incubation begins after a full clutch is laid).

Table 2. Pennsylvania fall turkey hunting season lengths, by Wildlife Management Units (WMU), 2003 - 2006.

	Fall turkey hunting season lengths (weeks)			
WMU	2003	2004	2005	2006
1A	3	3	2	2
1B	2	2	2	2
2A	3	3	3	3
2B	3	3	3	3
2C	3	2	2	2
2D	3	3	3	3
2E	3	2	2	2
2F	3	3	3	3
2G	3	3	3	3
3A	3	3	3	3
3B	3	3	3	3
3C	3	3	3	3
3D	3	3	3	3
4A	3	2	2	2
4B	3	2	2	2
4C	3	3	3	3
4D	3	2	2	2
4E	3	3	3	3
5A	0	0	0	0
5B	0	0	0	0
5C	1	1	6 days	6 days
5D	1	1	6 days	6 days

The youth season opens prior to the peak of nest incubation. However, the statewide harvest estimate of the 2004 spring youth-only hunt was 2,925 bearded birds, approximately 7 percent of the total harvest. Therefore, this small harvest should have minimal effect on reproduction.

In a recent study that reviewed data on nesting phenology in 34 states and Canadian provinces, researchers found that 25 jurisdictions opened spring hunting seasons more than two weeks prior to the mean date of incubation initiation, and 18 of those also allowed fall either-sex hunting (Whittaker et al. 2004). As extended fall seasons and spring hunting during the pre-incubation period can lead to additive and unsustainable levels of female kill, the researchers concluded that harvest management in many areas has the potential to negatively affect population dynamics, future harvests, and hunter satisfaction. Eight states open the spring season 1-14 days prior to mean incubation initiation (during egg-laying), including Pennsylvania, but our season typically opens 0-5 days prior to mean nest incubation initiation. The other states are: Massachusetts, Maine, New Hampshire, New York, Vermont, Wisconsin and West Virginia. Therefore, maintaining the current regular spring season opening date in Pennsylvania to coincide with the peak of turkey nest

incubation is important. This will minimize the probability of accidental and illegal hen mortality, as well as nest abandonment of turkey hens that, any earlier, would be in the process of laying their clutch.

State legislation passed in 2004 authorized the Game Commission to allow the harvest of wild turkeys over and above the number of turkey harvest tags attached to the regular license. This legislation gave authority to the Game Commission for determining in what season(s) to use the tag(s), the number of additional tags per hunter, and whether they would be valid statewide or only in certain WMUs. In 2004, the Bureau of Wildlife Management recommended the additional tag to be issued only for the spring season at this time and not during the fall season because "…of the potential to negatively impact the population from the fall either-sex hunting season. The alternative is to increase the spring gobbler season bag limit. There is increased interest in spring hunting among Pennsylvania hunters, and spring gobbler season poses minimal potential for adverse impact to wild turkey populations" (Pennsylvania Game Commission 2004).

Commission action in January 2005 approved one additional license per hunter to harvest a second bearded bird, statewide, during the spring gobbler season, beginning in 2006. The license ($21 for residents, $41 for non-residents) must be purchased prior to the season. The statewide spring season bag limit was increased from one to 2 bearded birds, one turkey per day, with appropriate license. Turkey hunters may continue to harvest one bearded bird in the spring with the regular hunting license. Along with the additional license, hunters are given an additional report card for reporting the additional harvest. As with the first turkey, hunters are required to report their harvest to the Game Commission within 10 days. Additionally, regardless of success all hunters are required to complete and mail in their report card within 10 days of the end of the season.

The Bureau of Wildlife Management does not expect any negative effects to the turkey population from a multiple-bird spring bag limit (see "Two-bird Spring Bag Limit" section V). However, the Bureau will continue to determine the harvest increase due to the second tag, by WMU, and the age structure of the harvest. This information will allow us to properly assess the impact of the two-bird spring bag limit.

Fall Turkey Hunting Season

Hen mortality is an important long-term factor influencing turkey populations. In Pennsylvania, fall hen mortality is controlled through variation in fall season length. The fall turkey-hunting season begins on either the last Saturday in October or the first Saturday in November. Season lengths vary by WMU from a closed season to a maximum season of three weeks (Tables 1 - 2). The longer the fall season, the greater the number of hens harvested. Research has shown that harvesting more than 10% of the population in the fall can lead to a decrease in future turkey populations (Healy and Powell 1999). Also, during years of poor reproduction, the percentage of adult birds in the fall harvest increases (few juveniles available), providing a smaller carry-over of adult hens into the spring breeding population. Research has revealed that when fall harvests approach or exceed spring

harvests, population growth slows (Healy and Powell 1999, Pack et al. 1999). Pennsylvania's fall harvests consistently exceeded spring harvests until 2001 (Figure 4).

During a two-year period (2004-05), WMUs with a three-week fall season length (WMUs 2F, 2G, 3A, 3B, 3C and 3D) demonstrated that 51% of the harvest occurred during the first week (Saturday to Saturday), 24% during the second and 25% during the third (Casalena 2006). Thus, we can affect hen mortality with changes in season length.

Fall season lengths are proposed each year to the Board of Commissioners in conjunction with all game species season/bag limits. Following a 60-day period for public comment, the Commission adopts all final seasons and bag limits for the next hunting year, which begins annually on July 1st. Fall season lengths are established prior to knowledge of the outcome of the spring breeding season. Therefore, season lengths are set conservatively in case of poor reproduction.

We maintain the opening day of the fall turkey season separate from other big game and small game seasons. Pack (1986b) has shown that scheduling the opening of fall turkey season so it does not coincide with the opening date of other game seasons has been effective at reducing harvest rates in West Virginia. During concurrent seasons, and especially on opening days, much of the turkey harvest was associated with opportunistic taking by hunters pursuing other species.

Turkey Management by WMU

Trends in turkey harvest and populations are determined via the following methods. For each WMU, we estimate spring harvest densities by dividing the calculated harvest by the total square miles in each WMU (Table 3). Also, every Wildlife Conservation Officer (WCO) annually conducts a summer turkey sighting survey, which provides a trend index for summer population levels by WMU (Table 4, Casalena 2003b). WCOs record their daily mileage and the number of wild turkeys seen each day while in the field during the months of June, July, and August. The index of total turkeys seen per 1,000 miles driven during daylight hours is calculated for each district, with each district being assigned to a WMU. Our spring harvest density calculations and summer sighting indices are independent of each other, and we assume that their trends are indicative of the trend in the turkey populations. However, with the conversion from Turkey Management Areas to Wildlife Management Units in 2003 we had to reconstruct the previous years' data to the smaller WMUs, and, in so doing, the data sets became smaller. Therefore, to strengthen trend indicators we may need more time than the current 3-5 years to determine trends, or we may need to pool data from similar WMUs.

In WMUs 1A, 2A and 2B spring harvest densities have been well above the statewide average (Table 3). We hypothesize that the more conservative fall hunting seasons that were maintained from 1995 – 1998 in these WMUs, together with optimal turkey habitat, may be the reasons these WMUs have the highest spring harvest densities. Although we have achieved these high spring densities, we do not know whether we can sustain them, given the recent fall hunting season expansion to 3 weeks. From 1998 – 2003, we increased the fall season from 1 week to 3 weeks, and

summer sightings continued to increase, but the spring harvest density trend did not (Tables 3 - 4). The 3-week season may be a limiting factor for these populations.

Table 3. Trends in Pennsylvania spring turkey harvest density (turkeys harvested per square mile), by WMU, determined from reported harvests corrected for reporting rates.

WMU	1995	1996	1997	1998	1999	2000	2001	2002	2003[a]	2004	2005
1A	1.57	1.33	1.31	1.26	1.46	1.69	1.88	1.47	1.52	1.31	0.95
1B	0.86	0.95	1.19	1.11	1.28	1.63	1.72	1.49	1.43	1.40	0.94
2A	1.71	1.50	1.44	1.36	1.62	1.83	2.01	1.47	1.59	1.44	1.40
2B	1.72	1.51	1.45	1.36	1.63	1.84	2.01	1.47	1.59	1.46	1.22
2C	0.75	0.70	0.74	0.75	0.78	0.87	1.05	0.81	0.72	0.73	0.63
2D	1.56	1.09	1.00	1.06	1.12	1.34	1.59	1.36	1.34	1.61	0.99
2E	0.73	0.67	0.70	0.72	0.75	0.84	1.02	0.79	0.71	0.77	0.59
2F	0.74	0.51	0.48	0.51	0.56	0.72	0.89	0.77	0.79	0.80	0.54
2G	0.61	0.48	0.46	0.49	0.58	0.67	0.82	0.72	0.76	0.56	0.39
3A	0.73	0.63	0.60	0.64	0.77	0.79	0.95	0.87	0.92	0.80	0.63
3B	0.81	0.76	0.71	0.75	0.91	0.91	1.07	0.98	1.05	0.94	0.62
3C	0.76	0.79	0.74	0.71	0.86	0.96	1.11	0.92	1.07	1.04	0.76
3D	0.76	0.80	0.75	0.70	0.86	0.98	1.12	0.92	1.08	0.92	0.77
4A	0.56	0.55	0.53	0.50	0.60	0.67	0.71	0.64	0.73	0.59	0.65
4B	0.56	0.56	0.53	0.50	0.61	0.67	0.71	0.64	0.74	0.78	0.81
4C	0.86	0.96	0.87	0.97	1.17	1.41	1.35	1.14	1.33	1.45	1.28
4D	0.59	0.57	0.55	0.53	0.62	0.70	0.76	0.67	0.73	0.60	0.46
4E	0.87	0.98	0.88	1.00	1.21	1.46	1.35	1.16	1.35	1.34	1.18
5A	0.35	0.37	0.26	0.22	0.26	0.31	0.47	0.36	0.41	0.39	0.32
5B	0.16	0.20	0.16	0.17	0.17	0.24	0.28	0.25	0.28	0.20	0.21
5C	0.50	0.59	0.58	0.55	0.62	0.78	0.86	0.81	0.78	0.76	0.72
5D	0.32	0.39	0.36	0.35	0.39	0.50	0.56	0.53	0.52	0.15	0.10
State Average	0.81	0.74	0.72	0.72	0.83	0.97	1.09	0.91	0.96	0.91	0.70

[a] In 2003 Turkey Management Areas (TMA) were changed to Wildlife Management Units (WMU). Data prior to 2003 were collected by TMA and converted to WMU.

Among WMUs with a long history of fall hunting--WMUs 3C and 3D--average spring harvest densities and summer sighting indices have decreased slightly since their record harvests of 2001 (Tables 3 and 4). Three-week fall seasons do not seem to be limiting these populations.

However, in the predominately publicly owned and forested habitat of WMUs 2F and 2G, spring harvest densities have remained relatively steady and below the statewide average, and summer sightings have fluctuated considerably. Determining whether or not the 3-week fall season may be limiting further population expansion in WMUs 2F and 2G is difficult without knowing the fall harvest rate.

Table 4. Average number of wild turkeys observed during daylight hours per 1,000 miles driven, by WMU, June – August, 1995 – 2005. Surveys conducted from vehicles by Wildlife Conservation Officers.

WMU	1995	1996	1997	1998	1999	2000	2001	2002	2003[a]	2004	2005
1A	30.7	16.8	18.4	38.0	39.3	32.3	45.6	39.8	35.5	77.9	40.0
1B	70.6	39.3	36.8	43.9	67.9	39.4	41.8	45.4	35.4	33.4	29.8
2A	35.7	51.6	37.9	47.8	74.5	140.3	58.8	54.3	47.6	45.0	25.6
2B	7.1	11.8	8.4	11.7	9.5	9.0	8.8	68.1	59.5	94.8	11.0
2C	10.7	12.8	3.8	10.9	19.1	16.1	21.9	16.9	8.4	8.7	12.6
2D	18.7	9.8	16.0	16.3	24.1	26.4	11.6	28.2	21.2	18.2	14.0
2E	18.3	2.4	9.3	9.0	29.8	47.5	42.6	29.0	20.0	19.7	8.1
2F	29.5	20.5	18.8	39.3	63.9	20.5	50.7	34.3	21.6	20.1	18.7
2G	30.2	18.8	18.4	24.6	31.7	54.7	60.2	40.2	21.8	22.6	25.3
3A	41.4	29.2	29.1	13.3	30.4	25.8	45.7	56.9	25.7	27.9	55.0
3B	21.8	5.7	19.7	19.4	21.3	17.1	21.9	19.0	16.4	14.9	15.3
3C	37.4	16.5	34.4	24.3	52.6	22.1	37.4	31.1	24.9	27.8	55.2
3D	23.2	11.7	17.2	24.7	44.7	25.6	39.3	77.8	24.9	26.6	34.2
4A	29.7	23.1	32.8	23.6	28.0	39.0	45.6	37.5	10.8	79.9	60.6
4B	14.7	9.1	4.2	4.5	15.1	44.2	39.4	30.9	7.3	42.7	5.0
4C	8.6	13.5	23.7	8.7	12.7	8.8	8.1	15.5	10.9	11.9	12.3
4D	13.1	8.8	3.8	9.3	7.4	18.1	11.3	17.8	10.5	12.4	12.4
4E	4.1	10.5	8.9	18.7	17.9	10.5	12.9	20.1	14.3	21.9	28.7
5A	8.0	3.9	0.0	2.7	2.4	0.9	5.5	9.3	1.5	2.3	3.4
5B	5.5	10.9	5.0	2.2	6.1	3.7	5.6	6.2	2.5	6.1	3.4
5C	5.8	10.9	11.0	9.8	11.9	49.6	16.6	9.4	9.8	5.3	9.5
5D	1.4	2.0	0.1	0.0	0.6	1.8	2.3	7.3	19.7	3.3	1.1
State Average	22.4	16.4	16.5	19.1	28.1	30.3	29.4	31.1	19.2	24.8	20.5

[a] In 2003 Turkey Management Areas (TMA) were changed to Wildlife Management Units (WMU). Data prior to 2003 were collected by TMA and converted to WMU.

WMUs 4C and 4E have maintained an average spring harvest density of approximately 1.4 turkeys/mi^2 since 2000 when the fall seasons were increased from 2 to 3 weeks, compared to an average of 1.0 turkeys/mi^2 in the years prior to 2000 (Table 3). Summer sighting indices also have increased (Table 4). The 3-week seasons do not seem to be limiting the populations in these WMUs.

Establishing harvest density goals such as those attained in WMUs 1A, 2A and 2B may not be achievable in other WMUs due to differences in habitat quality, hunter participation, and harvest vulnerability. Although habitat in the other WMUs may not be as suitable as WMUs 1A, 2A and

2B, we attempt to manage fall harvests to maintain achievable and sustainable levels, and, where feasible, encourage future growth.

Statewide, our highest harvests on record (both spring and fall) were during 2001, and highest summer sightings followed in 2002 (Tables 3 and Table 4). Three consecutive years of excellent spring weather preceded by warm winters with abundant fall mast crops may have allowed for record recruitment and harvests.

Additional information about relationships between harvest density, habitat quality, and harvest vulnerability would be useful for determining habitat carrying capacity. More detailed data regarding specific habitat types, and interspersion or diversity factors among WMUs would help in analyzing population-habitat relationships and are available from recent U.S. Forest Service forest inventory and Geographic Information System (GIS) data. Fleming and Porter (2000) developed a habitat suitability model for large-scale habitat assessment as a useful tool in harvest and habitat management for wild turkeys in New York. This is an additional aspect of future research needs in Pennsylvania.

Decision-making guidelines for recommending fall turkey-hunting seasons

We determine fall season length by monitoring trends in spring harvest density and summer sighting indices for at least a 3-year period to determine whether the fall season length affects the population in a given WMU. From these trends we make adjustments in fall season length. Wild turkey populations can fluctuate significantly on an annual basis and, in the Mid-Atlantic States, are regulated mostly by annual productivity when fall season structure remains conservative and the spring season is timed to open on or after the peak of nest incubation, as is the case with Pennsylvania, in most years.

Prior to 1997, extensions to our fall turkey hunting seasons were made at the October Board of Commissioners meeting if summer turkey sighting indices suggested higher populations compared to the baseline year of 1990 (Drake 1997). October fall season extensions were eliminated in 1997 because changes in season length after publication in the Pennsylvania Hunting and Trapping Digest were believed to cause confusion to turkey hunters despite news releases (Drake 1999b). From 1997 – 2005, fall season length recommendations were based on comparisons of spring harvest densities and summer sighting indices to the baseline year of 1995. The baseline year of 1995 was selected because it represented the highest population and harvest levels when the 1999 turkey management plan was written. We now have witnessed new population and harvest highs. Biological carrying capacity of Pennsylvania's turkey population likely has not been attained and continued conservative fall harvest management may allow the population to gradually increase. Maintaining a static number as a harvest management objective does not allow for natural population fluctuations, or changes in the biological and social carrying capacities. Therefore, the following guidelines are now used in preparing staff recommendations for wild turkey seasons:

1) Recommend opening fall turkey seasons in WMUs that have been closed to fall turkey hunting:
    a. When spring harvest densities have exceeded 1.0 turkey per square mile for three

consecutive years, or
   b. When population indices indicate no population growth after 5 years.
2) Maintain fall season length if trend indices for 3 years are not consistently higher or lower than the population index values when the most recent season length change occurred.
3) Extend the fall season length up to a week at a time, not to exceed a 3-week season, if the previous 3 years of population trend indices are above the population index values when the most recent season length change occurred. However, if a turkey population in a WMU demonstrates a repeated pattern of adverse effects from a longer season, season length increases should be delayed until the population grows to a higher level, or until research indicates that fall harvest rates are not suppressing the population.
4) Decrease gradually, or eliminate, the fall season in a WMU if:
   a. The previous 3 years of population trend indices are consistently below population index values when the most recent season length change occurred, or
   b. The previous 3 years of trend indices show a consistent declining trend if no recent season length change has occurred, or
   c. Additional research indicates that harvest rates or other factors are suppressing the population.
5) Do not increase the fall bag limit unless/until research supports such action.
6) Maintain the opening day of the fall turkey season separate from other big game and small game seasons to minimize the opportunistic taking of turkeys by hunters pursuing other species during opening day.

In WMUs where population trends are no longer increasing and fall season lengths have remained the same, the turkey population most likely has either reached biological carrying capacity or fall harvest rates are limiting population growth. In these areas, the wild turkey harvest likely will fluctuate annually and will be dependent on year-to-year production, because population expansion is no longer compensating for high harvest rates or production variability due to weather. In WMUs where population trends are increasing, the carrying capacity most likely has not been reached, so harvests most likely will increase due to population expansion compensating for production and weather variability (J. Pack, West Virginia DNR pers. comm.). However, without information on harvest rates in Pennsylvania, we can only speculate whether or not we have reached biological carrying capacity.

Future gains in Pennsylvania's wild turkey populations largely depend on wise fall harvest management. We need to determine optimum fall harvest rates by WMU to allow maximum recreational opportunity without jeopardizing the status of the turkey population. To do that, we will need turkey harvest rate information to improve decisions regarding harvest management. Little et al. (1990), and Vangilder and Kurzejeski (1995) have stated that, unless specifics of a turkey population are known, conservative approaches to both spring and fall harvests are warranted. This suggestion is especially appropriate in Pennsylvania, and is a guiding principle for our harvest management, until we are able to obtain more specific population and demographic data.

Harvest Rates

Legal harvest mortality rate is the percentage of a wild turkey population that is legally harvested. This information is essential for determining population estimates and for gauging the effect of harvest on population status. Of all game species that are sensitive to harvest, we lack this information only for the wild turkey in Pennsylvania. We will have spring gobbler season harvest rates by 2010, when the tri-state (Pennsylvania, New York and Ohio), 4-year gobbler harvest rate and survival rate study is finalized (Diefenbach 2005). We do not know the harvest rates from the fall season in Pennsylvania. Data from a radio-telemetry study in WMU 5A (formerly TMA 7B), from 1999-2001 showed fall harvest rates of hens averaged 15% (Casalena et al. in press). However, results may not be applicable to most of Pennsylvania because this area receives heavy hunter pressure, recruitment during the study was shown to be lower than average, and the population density was low due to a population decline. Data from WMU 2G from the late 1970s showed fall harvest rates of approximately 35% of the population (Hayden 1980). The researcher speculated that the turkey population could sustain fall harvests of 30-35%. However, the sample size of turkeys was very small, recruitment was shown to be high, and the population most likely was still expanding from restoration efforts. Therefore, the data are not applicable for most of Pennsylvania where range expansion is complete. A review of spring and fall legal-harvest mortality data obtained from studies in other states by Vangilder (1992) indicated harvest rates vary from 0 to nearly 90% depending upon season of the year, sex, age, sample size, study design, and other variables. Legal fall harvest rates of hens ranged from 2 to 9% with 4 weeks of fall hunting in West Virginia (average 4%) and 3 to 20% with 9 weeks of fall hunting in Virginia (average 12%) (Pack et al. 1999). Turkey population models predict that sustained fall harvests of less than 10% (for both males and females) permit continued population growth, but sustained fall harvests greater than this level predict population declines. Furthermore, the models predict spring gobbler harvests of less than 30% also will allow continued population growth (Healy and Powell 1999). Spring and fall harvests are believed to be additive for hens; illegal taking of hens during the spring season will reduce the allowable fall take (Vangilder and Kurzejeski 1995).

From three years of wild turkey transfers into TMA 9A (now parts of WMUs 5B and 5C), 2001-2003, minimum spring gobbler harvests were 5%, 10% and 11% each year, consecutively (Casalena 2003a). Actual harvest rates were higher because reporting rate was not 100%, but we cannot predict to what degree higher. The harvest rates are not applicable to the rest of the state because hunter pressure is lower there, and the turkey population is in the phase of expansion. Turkey and hunter densities vary considerably among Pennsylvania's WMUs, which would lead us to believe turkey harvest rates also vary among WMUs. Application of legal harvest rates obtained in other states also may not be appropriate for Pennsylvania because we have more hunters, higher hunter densities, and higher harvests than most states. From the tri-state gobbler harvest and survival rate study, we anticipate having a large enough data set by the fourth year to calculate harvest rates by WMU or groupings of WMUs. Actual fall harvest rate information represents one of the most important areas of research deficiency in Pennsylvania's wild turkey management program. Collection of these data on a WMU basis will be expensive, particularly if there is substantial variation in harvest rates among WMUs. Reliable harvest rates also are needed to assess the importance and effectiveness of fall harvests and season lengths on population growth. Data on fall

harvest rates (statewide and by WMU or WMU grouping) would allow us to determine if fall harvests exceed the recommended 10% for population maintenance. In the absence of fall harvest rate studies, a conservative approach to fall hunting season planning is required.

Population Trends

Similar to most northeastern states, we derive a general estimate of our wild turkey population based on the spring harvest multiplied by an assumed harvest rate. Many states use a 10% harvest rate, based on past wild turkey research (e.g., Lewis and Kelly 1973). More recent information from Wisconsin indicated they have a 16% spring harvest rate (Paisley et al. 1996). Minnesota, with a season framework regulated by area and time period similar to Wisconsin, uses a 15% harvest rate (Kimmel 1998). We assume a statewide 12% harvest rate, but harvest rates in Pennsylvania likely vary by WMU. The current 4-year, gobbler harvest and survival rate study will provide, for the first time, a verified statewide spring gobbler harvest rate, as well as allow us to determine if harvest rates differ among WMUs. We also assume a 50% sex ratio, based on the assumption that female and male annual survival rates are similar. Research has shown that the higher natural mortality level of females is offset by the harvest mortality of gobblers during the spring gobbler season (Healy and Powell 1999).

Currently we estimate only the spring turkey population because this is the minimum population, having experienced mortality from fall harvest, winter, and spring dispersal. Also, unlike the fall turkey-hunting season, which varies from 0 - 3 weeks depending on WMU, the spring season is a standard 4-week season, statewide. Therefore, we assume that annual variation in spring harvest is due more to population fluctuations than other factors. Any change to the spring season framework, such as the change to a 2-bird spring bag limit in 2006, will change the harvest rate, and therefore, affect our population model.

We would benefit from a population model that would predict population levels prior to the fall hunting season to aid in predicting the outcome and effect of the fall turkey season on the population, and to obtain better insights regarding factors influencing population fluctuations.

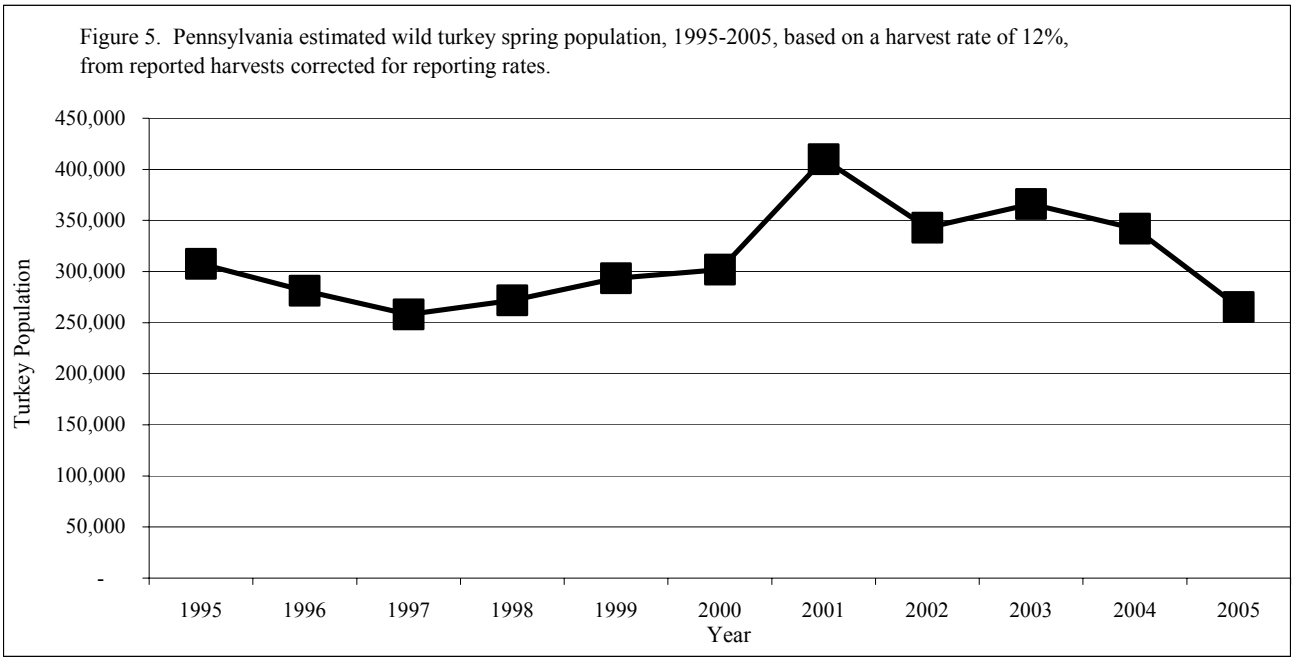
Healy and Powell (1999) recommend that harvest data collection include date, time, age, sex, and location (to the WMU) of kill. These data allow calculation of the most useful indices of abundance and provide a complete description of the harvest and population dynamics. We collect date, time and location of kill. As of 2003, we also collect age and sex information on the GT survey, and expect to continue to collect these data through new harvest reporting formats that will be available with the point-of-sale licensing system. This would allow us to obtain the information in a more timely manner and to crosscheck consistency of the data.

Pennsylvania's estimated statewide spring wild turkey population increased from 1997 to a peak in 2001, at approximately 410,000 turkeys (Figure 5). This peak was most likely due to several consecutive mild winters with abundant fall foods (especially in 1998 and 2000), above average recruitment years, and conservative fall hunting season lengths in some of our WMUs. This also may be an indication of the population approaching carrying capacity, but further research is needed

to verify this speculation. With three consecutive years of lower recruitment (2001-2003), accompanied by liberalized fall seasons in 2002 and 2003 and harsh winters, the 2005 spring turkey population was approximately 272,000.

Our 1999 "Management Plan for Wild Turkeys in Pennsylvania" (Drake 1999a) specified the population objective was to develop reliable indices and estimates of Pennsylvania's wild turkey populations for each WMU by 2005. In support of this objective, the Northeast Wild Turkey Technical Committee commissioned, in 2001, the development of a regional wild turkey population model, using the most current data available (McGhee 2004). The National Wild Turkey Federation Chapters in each state provided funding. McGhee's (2004) model was completed in 2006 and will be used during this plan's cycle to develop a new population model for Pennsylvania. The model shows what types of data are most useful as population predictors, regionally and on a state-by-state basis. This information will be useful in determining where our data needs are most critical for developing a more predictive population model for Pennsylvania. Ultimately, funding availability will dictate when we can develop a new population model for Pennsylvania.

Figure 5. Pennsylvania estimated wild turkey spring population, 1995-2005, based on a harvest rate of 12%, from reported harvests corrected for reporting rates.



Although research during the past century has revealed a great deal of information regarding wild turkey population dynamics and habitat requirements, we do not know the biological carrying capacity, which differs with habitat, and, therefore, WMU. Through our fall season length management though we have been able to conclude that manipulation of season length, in some WMUs, has helped us regulate turkey population trends.

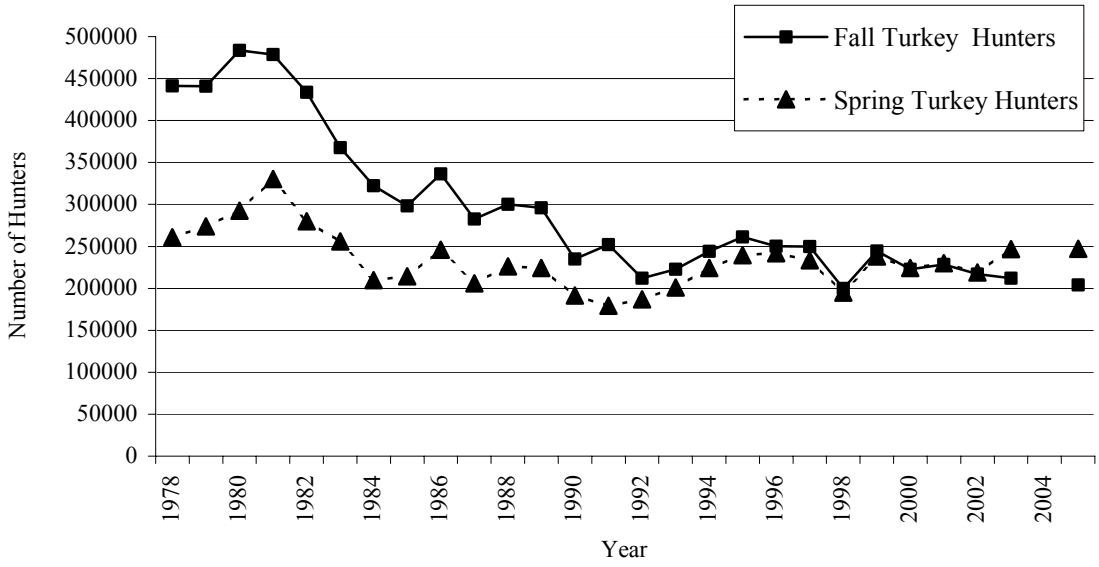
SECTION V. RECREATIONAL SIGNIFICANCE AND PUBLIC

INTEREST

Hunting Participation

Turkey hunting participation has declined in Pennsylvania since its peak in 1981 (Figure 6). Both spring and fall hunters dropped rather sharply in number, perhaps caused by a license fee increase in 1982. Spring hunter numbers have remained fairly stable since 1985, even though the number of hunters in Pennsylvania has declined nearly 30% during the same time period. Number of fall turkey hunters has continued to decline since 1985, but more gradually in recent years. Spring turkey hunting participation is increasing relative to fall. In 1978, fall hunters exceeded spring hunters by 69%. By 1996, the number of fall and spring turkey hunters was nearly equal, and since 2000 spring turkey hunters have outnumbered fall turkey hunters.

Figure 6. Number of spring and fall turkey hunters in Pennsylvania, 1978-2005. No hunter participation available for 2004.



In the 2001 Pennsylvania Turkey Hunter Survey (Pennsylvania Game Commission 2002), we asked hunters which seasons they hunted in 2000-01. Sixty-six percent hunted both fall 2000 and spring 2001, 21% hunted fall 2000 only, and 13% hunted spring 2001 only. The survey had a 95% confidence interval of $\pm$2%. More hunters are beginning to hunt both seasons. During the 1997 Pennsylvania Turkey Hunter Survey (Diefenbach 1996), 50% said that they hunted spring and fall, 28% hunted only during the fall, and 23% hunted only during the spring. During the 2000-01 license year, spring (41%) and fall (47%) turkey hunters hunted for 3 to 5 days (41%)(Pennsylvania Game Commission 2002).

In 2003, an estimated 305,839 hunters participated in spring and fall turkey hunting, combined. Total turkey-hunting participation ranks second in popularity behind deer hunting (790,595) (Rosenberry 2003). The number of turkey hunters exceeds rabbit (*Sylvilagus* sp.) (181,426) and squirrel (*Sciurus sp.*) (199,922) hunters (Rosenberry 2003). An independent survey conducted by Responsive Management Inc. showed that during the 2000 and 2001 license years, wild turkeys were the second most popular game species to hunt in Pennsylvania next to deer, with 49% of the 913 respondents hunting turkeys (Responsive Management 2004).

In 2000-01, the average Pennsylvania turkey hunter was 44 years old and had taken 7 turkeys in 14 years of turkey hunting. Most turkey hunters were males (97%) who lived in rural areas or small towns (71%), and hunted turkey predominantly in PA (88%, Pennsylvania Game Commission 2002). Responsive Management (2004) reported the main factor that affects general hunting participation in Pennsylvania was an aging hunting population. The same is likely true for turkey hunters in Pennsylvania.

Mentored Youth Hunt Program

In 2006 Pennsylvania became the first state in the nation, under the Families Afield Initiative, to pass legislation designed to encourage more young people to be introduced to hunting at an earlier age. The Mentor is a licensed person 21 years or older who is serving as guide to one Mentored Youth and must secure a valid, current hunting license or otherwise qualify for a license and fee exemptions prior to engaging in any mentored youth hunting activities. The Mentored Youth is an unlicensed person no older than 11 years of age accompanied by a mentor. During the 2006-07-license year, a Mentored Youth may hunt spring turkeys, squirrels, and groundhogs in their respective seasons. Antlered deer will be added during the 2007-08 license year. The Mentored Youth must be stationary and within arms reach of the Mentor at all times while in possession of any lawful hunting device while engaged in hunting or related activities. The Mentor must carry the device to and from the hunting spot. The Mentor accompanies only one Mentored Youth at a time, and the two must collectively possess only one lawful hunting device at any given time while engaged in hunting or related activities. Both the Mentor and Mentored Youth must abide by any fluorescent orange regulations, and the Mentored Youth must tag and report any wild turkey taken by making and attaching a tag that contains the same information as a harvest tag. Also, the Mentored Youth must report their harvest.

Hunter Success

Spring hunter success rates, percent of hunters who harvest a spring turkey (Table 5), fluctuate annually in Pennsylvania, dependent on the turkey population, age structure, and hunter density. We obtain spring hunter success rates, by WMU, by dividing calculated harvests by the number of participants acquired from the GT Survey. Success rates vary substantially among WMUs and range from an average (2001 – 2003) of 9.9% in WMU 4B to 26.0% in WMU 5D, and 34.6% in WMU 3D. Some of this variability might be associated with hunter density because the average spring hunter density (2001 – 2003) in WMU 5D is one of the lowest in the state (1.6 hunters per square

mile), but is 3.5 in WMU 3D, 7.4 in WMU 4B, and ranges up to 8.9 hunters per square mile in WMU 2B. Compared to Ohio and New York, Pennsylvania's spring hunter success is lower, possibly due to the higher number of turkey hunters and hunter density in Pennsylvania (Table 6).

Table 5. Spring turkey hunter success rates (%) by WMU in Pennsylvania, 1995 – 2005, determined from calculated reported harvest. No hunter participation data available for 2004.

WMU	1995	1996	1997	1998	1999	2000	2001	2002	2003[a]	2005
1A	24.5	21.4	19.4	17.2	17.0	21.9	20.6	18.6	29.5	14.8
1B	17.5	21.4	17.7	16.2	14.3	24.2	19.3	22.1	27.3	14.8
2A	29.1	26.3	24.5	16.7	17.6	22.8	19.0	15.8	28.7	19.8
2B	29.2	26.4	24.6	16.7	17.6	22.8	19.0	15.8	23.2	20.4
2C	12.9	12.8	12.7	24.2	15.5	21.0	26.5	21.2	14.3	12.1
2D	19.1	13.8	12.4	19.2	17.0	18.4	27.3	25.1	19.7	14.5
2E	12.4	12.1	12.1	23.9	15.2	20.2	27.0	21.3	10.3	8.4
2F	11.1	8.3	7.7	16.2	12.2	14.4	29.2	20.7	13.1	10.2
2G	9.6	8.3	8.2	14.1	13.1	14.1	26.6	16.8	12.3	7.1
3A	10.7	9.6	10.3	14.0	17.6	15.0	26.7	16.4	12.9	8.9
3B	12.0	11.2	12.2	15.4	22.0	16.9	29.1	17.5	14.5	9.8
3C	14.9	15.7	14.0	27.0	29.5	22.1	48.5	28.7	18.7	13.4
3D	15.5	16.6	14.3	30.6	31.0	23.3	53.0	31.6	19.2	17.5
4A	11.6	10.4	11.6	7.7	7.4	10.2	7.3	10.5	12.9	13.3
4B	11.7	10.5	11.7	7.7	7.5	10.3	7.4	10.6	11.6	9.4
4C	16.9	17.0	16.4	28.5	28.8	29.1	39.5	23.7	20.0	14.8
4D	11.6	10.6	11.5	9.3	8.4	11.6	9.2	11.9	11.2	8.7
4E	16.7	16.5	16.5	24.9	25.0	28.1	31.0	21.1	21.6	17.7
5A	10.9	12.2	8.8	9.8	9.1	8.3	9.6	10.3	23.7	13.9
5B	18.8	20.5	16.2	17.0	17.3	25.9	29.9	25.4	26.3	29.9
5C	25.7	27.6	25.2	20.2	20.1	26.0	28.6	24.8	23.4	20.4
5D	25.7	27.4	24.4	18.7	18.7	26.3	27.6	24.5	[b]	16.5
State Average	15.3	14.2	14.0	16.8	15.9	18.9	21.4	18.8	17.7	12.9

[a] In 2003 Turkey Management Areas (TMA) were changed to Wildlife Management Units. Data prior to 2003 were collected by TMA and converted to WMU.
[b] Insufficient sample size.

Table 6. Statewide spring turkey hunter and harvest information for Ohio (average for 2000-04 hunting seasons), New York (2004 hunting season), and Pennsylvania (average for 2000-03 hunting seasons).

State	Harvest	No. hunters	Hunter success	Hunter density (hunters/sq. mile) [a]
Ohio	21,183	77,324	30%	3.6
New York	26,300	100,000	25%	2.0
Pennsylvania	44,256	230,027	19%	5.1

[a] Within the range of turkeys in Ohio.

Fall hunter success rates (Table 7) are more variable than spring success rates due to varying fall season lengths, mast supply (hard and soft) and recruitment (Wunz and Ross 1994). In 2003, fall hunter success rate varied from a low of 9.1% in WMU 4B (3-week season) to 20.3% in WMU 1A, (2-week season).

According to the 2001 Turkey Hunter Survey, the statewide spring 2001 hunter success was 22% and ranged from 17% on public owned land to 25% on non-posted, privately owned land (Pennsylvania Game Commission 2002). Fall 2000 hunter success was 20% and ranged from 16% on public owned land to 23% on non-posted, privately owned land (Pennsylvania Game Commission 2002).

Sporting Arms

All spring turkey hunters are required by regulation to hunt with shotgun or bow and arrow. During the fall season, hunters in most WMUs also are permitted to use rifles, muzzle loading rifles, crossbows and handguns. During the 2001 Pennsylvania Turkey Hunter Survey, we asked hunters which type of sporting arm they use the most for fall hunting (Pennsylvania Game Commission 2002). Five percent did not hunt turkeys during the fall. Most fall turkey hunters (71%) used shotguns. Others used a rifle (10%), a combination rifle/shotgun (9%), a bow and arrow (4%), and less than one percent each used a handgun or muzzleloader. Crossbows became legal for the fall season beginning in 2006.

Quality Hunting and Hunter Satisfaction

Seventy percent of the respondents to the 2001 survey believed the Pennsylvania Game Commission was doing a good to excellent job with overall management of wild turkeys (Pennsylvania Game Commission 2002). In view of recent increasing turkey harvests, hunting success, and populations, a high degree of satisfaction was not surprising, although there was a slight decrease in satisfaction from the 1995 survey (77%, Diefenbach 1996).

Table 7. Fall turkey hunter success rates (%) by WMU in Pennsylvania, 1995 – 2005, determined by calculated reported harvest. No hunter participation data available for 2004.

WMU	1995	1996	1997	1998	1999	2000	2001	2002	2003[a]	2005
1A	27.2	19.8	18.3	21.0	18.7	28.8	16.4	22.7	20.3	13.1
1B	20.2	22.9	14.1	20.1	15.8	22.0	20.6	22.7	16.3	15.4
2A	30.9	19.6	20.4	20.5	19.2	31.0	13.3	19.4	19.1	13.7
2B	31.0	19.7	20.5	20.5	19.2	31.1	13.3	19.4	17.5	18.3
2C	19.5	13.7	12.3	30.4	18.7	19.3	26.5	18.1	13.9	10.4
2D	22.4	17.2	16.4	21.9	18.9	26.7	23.4	29.2	14.8	12.6
2E	18.8	13.0	11.9	29.2	18.1	18.9	26.9	18.0	9.8	7.7
2F	13.6	7.9	9.6	17.3	13.2	17.3	26.6	18.4	12.2	8.6
2G	12.9	6.6	8.8	14.3	12.8	14.7	27.6	15.2	10.3	9.1
3A	14.3	7.6	9.7	13.1	15.2	14.5	32.2	16.2	10.0	12.5
3B	15.4	8.7	11.0	13.3	18.1	14.9	36.9	17.1	10.1	10.4
3C	16.2	10.0	13.3	19.3	24.0	16.9	46.7	18.3	12.6	12.7
3D	16.4	10.4	13.9	21.3	25.7	17.5	49.0	18.7	14.0	11.3
4A	11.8	8.0	10.7	8.3	7.0	14.3	10.5	9.9	10.6	10.6
4B	11.8	8.1	10.7	8.4	7.0	14.4	10.5	9.9	9.1	8.7
4C	17.3	16.5	18.1	23.7	30.8	21.5	43.7	21.0	13.2	10.6
4D	12.9	8.7	10.8	10.0	8.2	14.9	12.3	11.0	9.0	9.6
4E	16.9	16.7	18.3	21.3	25.6	21.1	35.0	19.9	15.1	13.7
5A	9.6	5.2	5.9	7.0	7.9	12.6	7.8	9.1	Closed	Closed
5B	17.9	19.8	16.2	17.6	13.0	40.8	13.8	11.2	Closed	Closed
5C	22.5	19.1	18.9	19.9	21.2	27.0	21.7	12.0	11.7	10.9
5D	24.6	22.3	21.1	19.3	18.3	32.2	17.4	10.8	19.1	4.1
State Average	16.5	11.7	12.7	16.8	15.2	19.5	21.0	17.2	12.8	11.1

[a] In 2003 Turkey Management Areas (TMA) were changed to Wildlife Management Units. Data prior to 2003 were collected by TMA and converted to WMU.

Turkey hunters may not relate success directly to satisfaction. For many of our turkey hunters, a large population of turkeys may be more important than harvesting a turkey. If this is the case, management approaches that promote large turkey populations may be more valuable than those maximizing their harvests, although the two probably are related. During the 2001 survey, most hunters (63%) considered the turkey populations (spring and fall) to be "about right" where the hunters did most of their hunting (Pennsylvania Game Commission 2002).

In a survey of Florida turkey hunters, Williams and Austin (1988) concluded, "Many factors contributing to a good hunting experience can be directly attributed to human activities, many of which can be dealt with through regulations." However, management regulations designed to address hunter behavior or safety concerns, such as quotas, shot size, gauge restrictions, baiting, use of decoys, and fluorescent orange, affect not only hunter satisfaction, but also population and harvest

management. Management of turkey populations and turkey hunters are highly interrelated (Vangilder 1992).

Pennsylvania has traditionally chosen to restrict turkey-hunting participation through season lengths rather than quotas on numbers of hunters. Many other states require turkey hunters to purchase a turkey-hunting permit for specific areas or specific dates. They often establish quotas to regulate harvests, distribute hunting pressure, reduce interference from other hunters, and reduce the risk of turkey hunting incidents. Pennsylvania turkey hunters continue to favor our tradition of unlimited participation, although not as strongly as in 1995. During the 2001 survey, only 61% disagreed with restrictions on the number of fall turkey hunters to increase safety and satisfaction of turkey hunters, compared to 73% in 1995. Almost half the respondents disagreed that there are too many other hunters in the woods during the fall turkey season, (48% in 2001 and 45% in 1995, Diefenbach 1996, Pennsylvania Game Commission 2002).

Most Pennsylvania turkey hunters (65%) continue to favor conservative fall harvest management to enhance continued population growth. Most turkey hunters did not favor increased spring season lengths or bag limits. However, comparing the 2001 and 1995 turkey hunter surveys, more hunters in 2001 (33% in 2001, 22% in 1995) favored a two-bird fall bag limit and more (30% in 2001 and 20% in 1995) favored a two-bearded bird bag limit in the spring. A slight majority of turkey hunters continue to favor longer fall seasons (45% agree, 38% disagree, 18% undecided). Yet, fewer disagreed with maintaining fall season lengths or bag limits even if future turkey populations decline (65% in 2001 versus 88% in 1995). Nevertheless, 51% of turkey hunters were willing to forego one week of fall turkey hunting if future populations, harvests, and season lengths would increase (compared to 47% in 1995, Pennsylvania Game Commission 2002).

Most turkey hunters continued to agree that turkey hunter conduct and ethics were acceptable, favored using decoys while turkey hunting, and did not favor Sunday turkey hunting or turkey hunting with dogs. Attitudes toward access on gated roads and use of blinds for turkey hunting continued to be evenly divided (Pennsylvania Game Commission 2002).

Overall, our present turkey hunting management approaches and regulations seem to satisfy Pennsylvania turkey hunters. In some areas, sportsmen may want change although there appears to be no clear consensus. Future regulation changes will require appropriate management justification and hunter education to ensure their continuing support. We should complete turkey hunter surveys every 5 years to document changes in hunter knowledge, attitudes and opinions. Due to present agency financial constraints, the next survey is due to be completed in 2007.

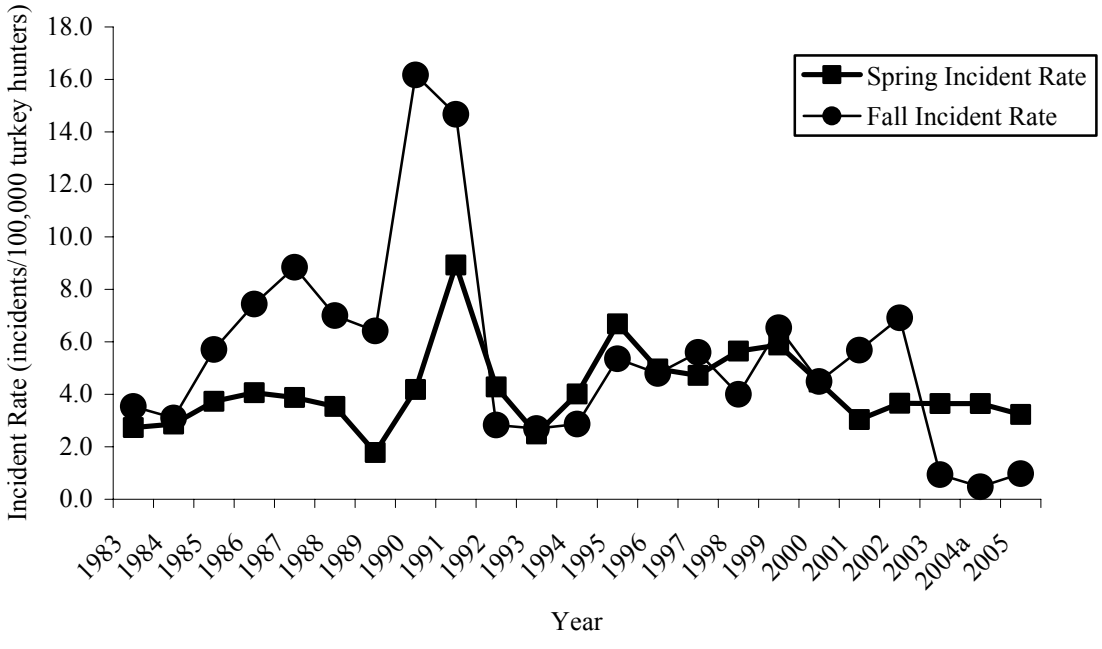
Turkey Hunting Ethics and Safety

Turkey hunting is among the most challenging and rewarding types of outdoor recreation available. In its purest form, turkey hunting requires a wide range of skills including locating turkeys, calling ability, hunting strategy, knowledge of turkey behavior, and persistence. The future of turkey hunting depends on the spirit of fair chase, not how big or how many turkeys are taken. The experiences and challenges in turkey hunting - not harvest - must be emphasized.

Unfortunately, a small, but unacceptable, minority of turkey hunters persists in conduct that reflects poorly on the hunter and deprives other hunters of the opportunity for fair chase. These turkey hunters exceed legal bag limits, illegally harvest hens in the spring, and/or do not report harvested turkeys.

Unusually high turkey hunting related incidents during the fall of 1990 and 1991, as well as during the spring of 1991 (Figure 7), elicited safety concerns from the public. During the fall turkey season of 1990 there were 38 total incidents, 3 fatal. During the 1991 spring season there were 16 total incidents, 0 fatal (Snyder 2006). The Commission responded to protect turkey hunters and their public image by enacting mandatory fluorescent orange regulations beginning in the fall of 1992. Fall hunting incidents fell sharply following enactment of these regulations. Spring incidents have been relatively stable throughout the pre and post-regulation periods. For comparative purposes, the Game Commission tracks trends in hunting-relating shooting incidents by measuring the accident rate per 100,000 participants. In Pennsylvania, hunting-related shooting incidents have declined by nearly 80% since hunter education training began in 1959 (Snyder 2006).

Figure 7. Pennsylvania turkey-hunting related shooting incident rates (incidents per 100,000 turkey hunters), spring and fall, 1983-2005. Flourescent orange requirements began Fall 1992. Hunter participation not available for 2004; 2003 data were used.



Recent turkey hunting incident rates remain below Pennsylvania's overall hunting incident rates and on par with the national average for spring turkey hunting. The spring 2005 incident rate was 3.6

turkey-hunting incidents per 100,000 turkey hunters. The national average for spring turkey hunting related shooting incidents was 3.0 incidents per 100,000 turkey hunters (Snyder 2006, NWTF 2005).

From 1993 – 2003, turkey hunting related shooting incidents (HRSIs) represented 26% of the 898 total HRSIs. Of the total 223 turkey-related HRSIs, 168 (75%) were shot for game, and 36 (16%) were shot in the line of fire. In 5 of the 6 fatal incidents the offender had 10+ years of turkey hunting experience. All 6 fatal victims were wearing full camouflage. In a majority of the HRSIs that were reported, offenders stated that they thought they saw a turkey or heard turkey sounds and then witnessed movement. Offenders did not state that they waited for the 'turkey' to fully present itself before firing (Snyder 2003).

During the fall 2003, 2004, and 2005 seasons, there were 2, 1, and 2 non-fatal turkey-related HRSIs, respectively, representing a dramatic decrease in turkey-related incidents from the previous 9-year average of 12 per fall season. In all incidents the offender failed to identify the target because all victims were shot for game. We do not know the reason for this sudden drop in turkey-related HRSIs, but strive to keep this trend continuing through educational efforts. The PA Chapter NWTF also has undertaken an educational campaign to sustain this trend.

Fluorescent orange regulations for turkey hunting remain a contentious issue, but have received more hunter support. Overall, turkey hunter support for regulations requiring some fluorescent orange has increased from 25% to 71%, between the 1995 and 2001 surveys. The majority of turkey hunters (70%) supported wearing 100 square inches of fluorescent orange when moving during spring and fall, compared to 54% in 1995. Additionally, turkey hunters are beginning to support (44%) the requirement to wear 250 square inches of fluorescent orange during the overlap with small game seasons, compared to only 21% in 1995 (Pennsylvania Game Commission 2002). However, the NWTF Turkey Hunting Safety Task Force, which has met three times between 1991 and 2005, continues to maintain its position to "not recommend the mandated use of hunter orange clothing for turkey hunters" (National Wild Turkey Federation 2005). Pennsylvania is the only state in the nation to mandate the use of fluorescent orange for turkey hunting. Rather than fluorescent orange, the Task Force emphasizes education and awareness as key to safety, and has developed a new hunter safety curriculum for state wildlife management agencies to incorporate into their hunter safety programs. The Task Force also concluded that lower hunter densities appear to improve hunter safety. Therefore, the Task Force encouraged agencies to expand hunting opportunity through changes in season length, hunting hours and access (National Wild Turkey Federation 2005).

The Game Commission's programs for reporting violations, SPORT (Sportsmen Policing Our Ranks Together) and the toll-free TIP Hotline (Turn-In-A-Poacher), together with the National Wild Turkey Federation's reward program, which all provide rewards to be paid to the individual/s who provided the information that led to a conviction, continue to help motivate the public to report turkey-hunting violations.

The use of rifles for fall turkey hunting in Pennsylvania also is a safety issue. The percentage of fatalities in rifle related turkey-hunting incidents is much higher than with shotguns. Nationwide,

405 hunters were shot while fall turkey hunting from 1985 to 1992. Shotguns were used in 340 fall incidents with 11 (3%) fatalities. Rifles were used in 65 fall incidents, and 24 (37%) of these shootings were fatal (Eriksen 1997). In Pennsylvania, rifle-related incidents had even higher fatality rates. Between 1982 and 1991, 6 of 273 shotgun related incidents were fatal (2%). Thirteen of 24 (54%) rifle related incidents were fatal (Filkosky 1992).

Fall turkey hunting with rifles is traditional in Pennsylvania. Substantial support remains for fall rifle hunting even though most turkey hunters use shotguns. Respondents to the 2001 survey were evenly split on whether rifles should be illegal for fall hunting (44% agreed, 44% disagreed, 12% undecided, Pennsylvania Game Commission 2002). Because opposition to regulations on rifles exceeds their use, some of this opposition may arise from concerns regarding the right to bear arms. Also, when asked if crossbows should be legal for turkey hunting, 48% disagreed and 28% agreed (Pennsylvania Game Commission 2002); however, crossbows became legal in 2006 for the fall season.

Two-bird Spring Bag Limit

Spring turkey hunting poses less of a risk of overharvest than the either-sex fall turkey season. Over time hunter emphasis on spring hunting has become more pronounced, and spring turkey hunters now exceed fall hunters (Figure 6). Thirty-two other states, plus the province of Ontario, have spring bag limits of more than one bird (season limits of two to five, most commonly two), and 16 states have a one-bird spring limit (Alaska does not have a wild turkey season). Many of the states that limit the harvest to one gobbler per hunter have small turkey populations or hunting permit quotas that don't allow everyone to hunt. Some examples are Delaware, Rhode Island, Maine, New Hampshire, and Arizona.

Research has shown that properly timed and implemented multiple–bird, spring limits have not caused turkey population declines (Casalena and Eriksen 2003b). Pennsylvania, however, has a large number of wild turkey hunters and harvests. Therefore, our recent increase in the spring bag limit to two bearded birds must be coupled with sufficient population monitoring to assess any possible effects prior to any additional season changes.

Some potential disadvantages of a multiple-bird spring bag limit are increased breeding and nesting disturbance, additional illegal spring hen mortality, and increased hunter interference. Hunter surveys from other states show that hunters favor a high proportion of adult males in the population, and that hearing a gobbler, seeing turkeys, and calling turkeys contribute more to the quality of a hunt than killing a bird (Cartwright and Smith 1990, Vangilder et al. 1990, Little et al. 2000). With the incorporation of a 2-bird spring bag limit, coupled with Pennsylvania's high turkey hunter numbers, and possible future season liberalizations, our 4-year gobbler harvest/survival rate research study is important to determine the age structure of the harvest for developing informed decisions on future seasons and bag limits. Because harvest rates change with an increase in bag limit, these data also are necessary for revising our turkey population model, which currently is based on an assumed, not estimated, harvest rate.

Regarding the concern that a multiple-bird bag limit may affect the age structure of males, the ratio of juvenile to adult gobblers in the harvest is similar in states with single-gobbler bag limits and those with multiple-bird bag limits (Table 8, Eriksen and Casalena, in press). Multiple-gobbler limits appear not to affect the ages of the birds taken. Rather, reproductive success in previous years affects the number of jakes and adult toms in the harvest. Also, the percentage of jakes to adults in the harvest does not seem to change much according to a state's land area or to the size of the turkey harvest. The states in Table 8 have annual spring harvests ranging from a few hundred (Rhode Island) to more than 50,000 (Wisconsin and Missouri, Eriksen and Casalena, in press).

Table 8. Percentage of juvenile males (jakes) versus adult males (gobblers) in the 2003 spring turkey season, harvest, and season limit, for northeast states, other surrounding states, and two states with large spring turkey harvests (Wisconsin and Missouri). Taken from Eriksen and Casalena (in press).

State	2003 Spring Harvest	Juvenile Males	Adult Males	Season Limit
Connecticut	2,367	32%	68%	3
New Jersey	3,584	35%	65%	3+
New York	36,000	Unknown	Unknown	2
Ontario	6,400	57%	43%	2
Maryland	3,120	31%	69%	2
Massachusetts	2,217	35%	65%	2
New Hampshire	2,600	36%	64%	1
Rhode Island	275	20%	80%	1
Ohio	20,368	27%	73%	2
Virginia	17,988	39%	61%	3
West Virginia	12,544	40%	60%	2
Wisconsin	42,970	32%	68%	2
Missouri	58,421	35%	65%	2
Pennsylvania	42,876	Unknown	Unknown	1

Additional Spring Turkey Hunting Options

A complete discussion of spring turkey hunting options (season dates, spring hunting hours, bag limits, and regulating hunter numbers) and their possible effects is provided in Casalena and Eriksen (2003b), www.pgc.state.pa.us.

Fall Turkey Dogs

Currently in Pennsylvania turkey hunters are prohibited from using dogs to aid their hunt, during either season. The 2001 Pennsylvania Turkey Hunter Survey (Diefenbach 2002) revealed that 75% of the respondents did not approve of legalizing dogs for fall turkey hunting (15% approved of legalizing and 9% were undecided). There seems to be a small, but growing, interest in using specially trained 'turkey dogs' during the fall turkey season. During the public review process for this management plan there were 113 public comments, 18 of which requested permitting the use of turkey dogs for the fall turkey season. Because this is a new issue for Pennsylvania, a survey was conducted (Eriksen 2006) to determine which states and provinces allow turkey dogs, and if there are any concerns regarding the impact of dog hunting on turkey populations.

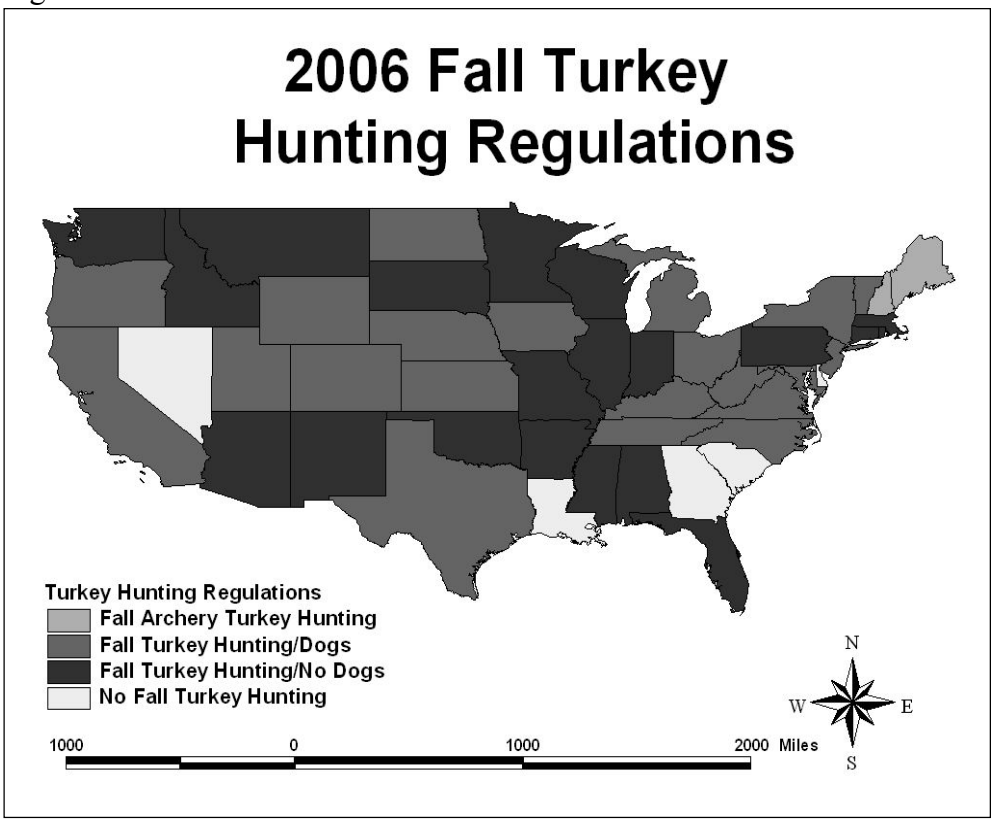
According to Eriksen's (2006) survey of all states and provinces, six jurisdictions have no fall turkey season (Delaware, Georgia, Louisiana, Nevada, Ontario and South Carolina), two states (Maine and New Hampshire) have archery only fall seasons, and the remaining 42 jurisdictions have firearm fall or winter hunting seasons for wild turkeys (Figure 8). Among the 42 states with firearm fall turkey hunting seasons, 20 prohibit the use of dogs for turkey hunting. Twenty-two states allow the use of dogs by fall turkey hunters. Fall hunter success rates among the responding states ranged from 6 to 50 percent and the average fall hunter success rate was 29 percent (N = 19). It should be noted, however, that extremely high fall hunter success rates in some western and mid-western states affected the average significantly. No state in which fall turkey hunters use dogs was able to report success rates for fall turkey hunters using dogs verses success rates for those who hunt without dogs. No state had precise figures on the number of fall hunters using dogs. However, most of the responding states reported that the number of turkey hunters using dogs for fall hunting was "very small" or "very low". When queried for a percentage figure, several biologists estimated that less than 10 percent of fall hunters employ dogs for turkey hunting. At least 4 states reported estimating that less than 5 percent of fall turkey hunters use dogs. Only one biologist estimated that more than 10 percent of fall turkey hunters used dogs.

None of the biologists reported concerns about the impact of dog hunting on turkey populations. One biologist expressed concern not about fall hunting with dogs, but about the potential impact of dog training on wintering turkey flocks. Another indicated agency concern about pheasant hunters (Eriksen 2006).

Economic Benefits

The average hunter spent about $914 on his or her sport in Pennsylvania in 2001 (U.S. Dept. of Interior 2003). Estimated expenditures per spender for big game, small game (including turkeys), migratory birds, and other animals were $566, $182, $260, and $103, respectively.

Figure 8.



A survey of spring turkey hunters in Pennsylvania (Baumann et al. 1991) showed average expenditures of $180.70 per successful resident. This estimate is similar to the small game hunter expenditures estimated by the U.S. Dept. of Interior (2003). Assuming similar expenditures for an estimated 280,756 Pennsylvania turkey hunters (Rosenberry 2002), Pennsylvanians expend almost 51 million dollars annually to hunt turkeys. These expenditures, along with income stimulated through the multiplier effect, provide a substantial contribution to Pennsylvania's economy from wild turkey hunters.

Non-consumptive Use

Many non-hunters and hunters alike know about wild turkeys and value their presence even if they seldom see them. Turkeys are not as abundant as other wildlife species, such as deer, cottontail rabbits, gray squirrels, and many songbirds. They generally are secretive and wary of human contact. This makes viewing wild turkeys less frequent and, perhaps, a more valued type of wildlife viewing. As their populations continue to expand into more human-populated portions of Pennsylvania, the public's knowledge of their presence and appreciation for their particular attributes will continue to grow, and possibly change.

For some, the sight of a hen and her brood rounding up insects in a farm field is that much more special because of its infrequency. Others derive satisfaction from seeing turkeys or hearing gobbling during the spring and knowing that self-sustaining turkey populations are thriving.

Many people find photographing wild turkeys in natural surroundings more challenging and enjoyable than firearm hunting. Videography of turkey hunting and wild turkey behavior has also attracted considerable interest and attention lately. Turkey hunting seminars, calling contests, turkeys hunting videos and television shows have also become quite popular among hunters as well as non-hunters.

Human Conflicts, Nuisance Turkeys, Agricultural Damage

Farmers occasionally blame wild turkeys for agricultural depredations; however, studies in Iowa (Gabry et al. 1993), Wisconsin (Paisley and Kubisiak 1994), and the northeastern states (Teft et al. 2002) attributed most losses to other wildlife species. Researchers in these states found that, despite perceptions, the actual effect of wild turkeys on agriculture was small.

As wild turkey populations continue to build and demonstrate their ability to adapt and coexist in relatively high human-populated suburban settings, nuisance situations have increased. While some people are pleased and protective of wild turkey presence, next-door neighbors may object to roosting turkeys and droppings on their homes, patios, shrubbery, and vehicles, scratching in vegetable and flower gardens, aggressive behavior toward humans, and undesired gobbling and commotion during the breeding season.

Some consider fall turkey hunting as an approach to addressing problems created by "nuisance turkeys" in suburban situations. Unfortunately, fall hunters cannot gain access to most of these problem areas. Therefore, this approach could be counterproductive because fall hunting might affect accessible wild flocks more than the "nuisance flocks."

Guidelines have been prepared for handling nuisance wild turkey conflicts. These guidelines begin with education of landowners regarding turkey behavior and methods to modify this behavior. Where problems persist, field officers are directed to determine whether the birds are wild or domestic. Turkeys will be removed by the PGC if they are determined to be pen-reared and the owner cannot be identified. Only in cases where damage/nuisance is severe, behavioral modification is not successful, and hunting is not effective, or public safety is an issue, will removal of wild turkeys occur. In most cases human-habituated turkeys removed from suburban areas are to be euthanized because; (1) existing problems will be transferred elsewhere, (2) there is potential for disease transmission, (3) survival of transferred birds could result in perpetuation of undesirable genetic and behavioral traits to other populations (Craven et al. 1998), and (4) all suitable habitat for wild turkeys in Pennsylvania is occupied. Due to the potential for varying attitudes within localized situations, all interested parties should be notified that nuisance turkeys will be euthanized in accordance with recommendations of the American Veterinary Medical Association (Andrews et al. 1993) and a community consensus for such action is to be sought. Where possible, euthanized turkeys suitable for human consumption are to be made available to local families and/or food banks.

Paid Wild Turkey Hunting License

The issue of a separate turkey-hunting license is often proposed by turkey hunting enthusiasts. Traditionally, the Commission has not required Pennsylvania hunters to purchase a turkey-hunting license for the regular spring and fall turkey seasons. Purchase of a general hunting license allows any hunter to harvest one bird per season. Most states, however, require a paid permit to hunt turkeys. In the northeast U.S., only Maryland, Pennsylvania and Virginia allow turkey hunting without a permit or special license. Since 2006, hunters may opt to purchase an additional spring turkey-hunting license to harvest a second spring bird.

During the 1995 survey of turkey hunters (Diefenbach 1996), 72% of respondents disagreed with the idea a paid turkey-hunting license for harvesting one bird per season even though wild turkeys are the only big game species that does not generate revenue through a paid permit. The question was not asked on the 2001 survey. One group that favors a separate turkey-hunting license is the Pennsylvania Chapter of the National Wild Turkey Federation.

A database of turkey hunter addresses would result from the sale of a turkey-hunting license and could simplify dissemination of educational turkey management materials and enhance collection of biological data. The automated licensing system currently being implemented by the agency also might provide a turkey hunter database if hunters are queried about their hunting plans. The management plan yearly budget will require additional revenue to keep implementation of the strategies on schedule.

Educational Needs

Both the 1995 and 2001 Pennsylvania Turkey Hunter Surveys (Diefenbach 1996, Pennsylvania Game Commission 2002) identified areas of our wild turkey management program requiring additional educational efforts. Continued misunderstandings by turkey hunters persist in areas such as turkey harvest reporting, turkey population control, effects of the fall turkey season on the turkey population, timing of the spring season, and illegal hen mortality during our spring seasons. Additionally, turkey hunters did not support turkey transfers to other states, but did support in-state transfers.

Turkey hunting-related incident rates remain a concern. Continued and additional turkey hunting safety education is necessary to maintain the low rate of these incidents for the safety of future turkey hunters as well as to maintain their ethical and responsible image with the public.

Pennsylvania's turkey populations and management approaches are doing well but future changes and challenges are inevitable. We will need improved management data and additional life history studies to meet these challenges. We must educate turkey hunters on the importance of their providing better data and of the need for their support in funding necessary research that will allow us to keep pace with change.

Game Farm Turkeys

The National Wild Turkey Federation defines a pen-reared "wild" turkey (game farm turkey) as any wild turkey eggs or wild turkeys hatched and/or raised under human control. The difference between game farm and wild turkeys is primarily behavioral.

The importation, sale, and/or release of game farm turkeys is addressed in Title 58, Chapter 137, Sect. 137.2 of the Pennsylvania Game and Wildlife Code. The Code states, "It is unlawful to release turkeys into the wild without first obtaining a permit from the Commission. The permit applicant shall provide proof the turkeys to be released have been tested using procedures prescribed by the Department of Agriculture in 7 Pa. Code Chapter 15 (relating to control and eradication of pullorum disease) and have been found free of disease. If the turkeys to be released have been raised in this Commonwealth in accordance with 7 Pa. Code Chapter 15 and regularly tested under those regulations within 12 months of release, a permit is not required."

Game-farm turkeys can be exported without a health certificate. Although game-farm turkeys continue to pose a potential disease transmission or genetic dilution threat to wild populations, evidence of substantial harm from either factor to wild populations in Pennsylvania or elsewhere are anecdotal or lacking.

Game-farm turkeys continue to present wild turkey management problems in other tangible ways. Illegally released game-farm turkeys appear to have established populations in suburban situations (especially in southeastern PA in WMU 5B, 5C and 5D). These flocks often become habituated to humans and, although some enjoy them, they are nuisances to others nearby. There is no substantial justification to allow release of game farm turkeys, especially given the statewide wild turkey population. If private landowners have suitable turkey habitat and wish to have turkeys present there appears to be a high probability that wild flocks will expand into and populate those areas, unless they are geographically isolated. If no suitable habitat is present, releasing game farm turkeys will not lead to a sustainable population unless supplemental food is provided, which lends itself to nuisance situations and disease transmission due to concentrated feeding.

Menagerie owners, hunting preserve owners, and private propagators have vigorously opposed the elimination of game-farm turkeys in Pennsylvania and other states. Most opposition probably comes from the belief that restrictions on game-farm turkeys could lead to restrictions on other species in the future. Actual income from game-farm turkeys is probably minimal, particularly in view of their attendant problems. Paid preserve turkey hunting detracts from the public image of turkey hunting and hunters and provides fuel for anti-hunters. Out-of-state transfers of game-farm turkeys have created management problems for other states, such as Rhode Island in 1993 (Brian Tefft, Rhode Island Division of Fish & Wildlife, pers. comm.). In-state sale to private individuals for novelty or curiosity can result in illegal or inadvertent releases of game-farm turkeys to the wild, which are difficult to regulate and enforce.

The National Wild Turkey Federation developed a brochure and article explaining the problems associated with releasing game-farm turkeys, which was featured in the Pennsylvania Game News,

and is on both the PGC and NWTF web sites (Eriksen 2002). More public education on this topic is necessary.

Trap and Transfer

Trap and transfer of wild birds has been a phenomenal success and an essential tool in restoring wild turkey populations in Pennsylvania and throughout most of the United States. From 1958 – 2003 the Game Commission transferred 2,771 wild turkeys within Pennsylvania to restore our wild turkey populations. There were two primary biological reasons for the program's effectiveness: (1) good quality wild birds were used to replace restoration efforts with inferior game-farm turkeys, and (2) it accelerated establishment of viable breeding populations in suitable but unoccupied habitat by transporting birds past unsuitable habitats and major river systems rather than depending on the relatively slow process of natural dispersal.

Remnant wild populations in our south-central mountains required more than 40 years to cross the West Branch of the Susquehanna to populate north-central Pennsylvania and southern New York. Our wild turkey trap and transfer program began slowly in the 1960s and was accelerated in the 1970s and 1980s. By 1989, most suitable habitats throughout the state were occupied by viable breeding populations. However, turkey populations in southeastern Pennsylvania did not expand to all suitable habitats due to fragmented landscape. In 2000, the habitat was re-assessed to determine if sufficient unoccupied turkey habitat existed within southeastern counties for additional releases. The criteria we used for turkey habitat was 50 km^2 (20 mi^2 or 12,350 acres) of continuous turkey habitat consisting of: (1) forest – minimum 15%; (2) urban/commercial – less than 5%; and (3) agriculture/shrub – remainder. We plotted the criteria onto a Geographic Information System (GIS) map, and identified potential release areas. Human population density also was considered to avoid potential human/turkey conflicts as much as possible. Most release sites were open to public hunting. During the winters of 2000 – 2003, 515 wild turkeys were transferred to 21 sites (169 males, 346 females) within southern Berks, Chester, southern Lancaster and York counties. Fall turkey-hunting season was closed in this area (WMU 5B) to facilitate population restoration; however, the spring season remains open.

Trap and transfer of wild birds into suppressed wild populations to augment or encourage growth should not be used as a management option. In situations where viable populations exist but are not doing well, we need to determine the factors limiting the population and correct them. If not corrected, those factors suppressing resident birds will have even greater effect on additional birds from other parts of the state because they are less adapted to their new surroundings. Transfer of sufficient numbers of turkeys could increase populations briefly, but populations will again decline if solutions to the original problems are not identified and corrected. Transfers also could confound and delay the detection of limiting factors because those additional transferred birds that survive temporarily could mask and offset continued high losses or low recruitment rates.

In-state transfers should be used only where viability of wild turkey populations over large areas is threatened. In such instances, fall hunting should be closed until the spring harvest density reaches one turkey per square mile for three consecutive years.

Some states and Canadian provinces have not completed their restoration or range expansion programs. Previous out-of-state transfers, in cooperation with the National Wild Turkey Federation's Target 2000 Program (now called "Making Tracks"), have been mutually beneficial to the recipient states and us, and should be continued if requested, if not otherwise precluded by financial constraints or other priorities. Our Regional Wild Turkey Trap and Transfer Crews are trained and equipped. Sources of wild birds are adequate in Pennsylvania to allow limited out-of-state transfers without undue detriment to turkey hunter recreation. Additionally, the majority of transferred birds are trapped at sites that are closed to public hunting and/or are on private land. Since 1979 we have transferred 855 wild turkeys to 9 other states, the most recent being 53 wild turkeys transferred to South Dakota in 2006 in exchange for wild ring-necked pheasants, which were released in southwestern Pennsylvania in cooperation with a ring-necked pheasant restoration study conducted by California University of Pennsylvania.

In the 2001 Turkey Hunter Survey (Pennsylvania Game Commission 2002), 80% of the respondents favored in-state transfers to augment low populations while only 43% supported transfers out-of-state. This is an increase from 71% in the 1995 survey. Continued education is necessary on the values of assisting other states with wild turkey restoration, as well as the biological shortcomings of augmenting low populations with in-state transfers.

Cooperative Partnerships

Public landowners (e.g., U.S. Army Corps of Engineers, U.S. National Park Service, U.S. Fish and Wildlife Service, Allegheny National Forest, DCNR-Bureau of Forestry, DCNR-Bureau of State Parks, and many county and local governments) have partnered with the Game Commission to advance wild turkey management in providing huntable public land, enhanced habitat, wildlife viewing, and educational programs.

The largest conservation group with a primary stake in the wild turkey resource is the National Wild Turkey Federation (NWTF), founded in 1973. The mission of the NWTF is the conservation of the wild turkey and preservation of the turkey hunting tradition. More than 525,000 volunteers and avid turkey hunters throughout North America and 11 foreign countries are members. Through fund raising efforts since 1985, the NWTF and partners together have spent more than $186 million on nearly 27,000 projects to benefit the wild turkey. These projects include all aspects of wild turkey management, such as habitat management, land acquisition, research, information and education, restoration, activities for youth, women and the handicapped, hunting safety, law enforcement, reward payments to people who report turkey-hunting violations that lead to a conviction, and others. The NWTF's assistance, coordination, and support with Game Commission wild turkey management have been extremely valuable and we can anticipate considerable future growth.

The Pennsylvania Chapter of the NWTF has been a very active force in Pennsylvania's turkey management program since 1975. Pennsylvania's Chapter is one of the largest state chapters with more than 22,600 members. The Chapter's membership makes up 10% of our turkey hunters. While the views of the Chapter may not always reflect those of the average turkey hunter (Pennsylvania

Game Commission 2002), they may provide a more progressive and resource oriented-reflection of the attitudes of the avid turkey hunter.

The Pennsylvania Chapter's past contributions to wild turkeys have been substantial. From 1985 - 2003, the Chapter spent more than $3.5 million on 1,545 Super Fund Projects. These projects encouraged total cooperator expenditures of more than $10,000,000 in Pennsylvania for habitat enhancement, land acquisition, education, programs for youth, women and the handicapped, and hunting safety programs. In 2003, the Pennsylvania Chapter generated $1,400,000 through various fund raising activities such as banquets. In 2005, the Pennsylvania Chapter approved spending more than $164,000 on wild turkey habitat projects conducted not only on State Game Lands (SGLs), but also on state forests, state parks, U.S. Army Corps of Engineers properties, the Allegheny National Forest, local municipality properties and private properties open to public hunting. Of the 66 approved habitat projects, 46 were on SGLs.

These projects included creating turkey brood habitat and feeding areas; planting fruit- and nut-producing trees and shrubs; planting conifers for winter habitat; renting equipment and purchasing lime, seed, and fertilizer for maintaining existing wildlife openings; fencing orchards and trees from deer; and the NWTF's Seed Subsidy Program. This strong partnership between the Game Commission and PANWTF helps improve habitat not only for the wild turkey, but also for a wide variety of wildlife species.

The Pennsylvania Chapter NWTF has strongly supported the Game Commission's wild turkey management approaches in the past. The agency meets annually with the leadership of the Pennsylvania Chapter to continue this close agency coordination. The Game Commission wild turkey biologist and Assistant Director of the Bureau of Wildlife Management serve as technical representatives to both the Pennsylvania Chapter and the National Federation to ensure a flow of information, cooperation, and mutual support necessary to maximize future wild turkey management progress.

There are a number of programs available to private landowners for managing wild turkey habitat on private lands, such as the Game Commission's Private Lands Assistance Section, the PA DCNR's Forest Stewardship Program, Penn State's Forest Extension, the Game Commission's Forest Wildlife and Farm Game Cooperative Programs, NWTF's Wild Turkey Woodlands Program, USDA/NRCS programs, and private woodland owners' associations. Private industry can promote the wild turkey while obtaining valuable public relations if given the proper direction and incentives. Land-use industries (e.g., farming, forestry, energy and mining) are anxious to carry out wildlife practices if given proper and practical direction. In addition, conservation organizations and the public are willing to help. Public outreach is necessary as well as landowner incentive programs and resources to involve more public in habitat enhancement projects on private lands.

SECTION VI. LITERATURE CITED

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APPENDIX 1. Implementation schedule for turkey management plan for Pennsylvania, 2006-2015

Objective and Strategies	By End of Year									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Population Objective										
Strategy:										
1.1 Provide spring and fall hunting opportunities while maintaining or enhancing populations at or below social carrying capacity	●	●	●	●	●	●	●	●	●	●
1.2 Use fall season lengths as primary means for managing populations	●	●	●	●	●	●	●	●	●	●
1.3 Assess turkey population status and trends	●	●	●	●	●	●	●	●	●	●
1.4 Collect age and sex information of harvested turkeys for spring and fall seasons		●	●	●	●	●	●	●	●	●
1.5 Implement spring gobbler hunter survey			●	●	●	●	●	●	●	●
1.6 Evaluate the new mid-Atlantic turkey population model for application in Pennsylvania, and implement in 2008		●	●							
1.7 If necessary, develop and implement research to collect data to validate the new population model			●							
1.8 Conduct the 4-year multi-state gobbler harvest and annual survival rate study	●	●	●	●						
1.9 Conduct a hen harvest and annual survival rate study.					●	●	●	●	●	
1.10 Determine if the sample units of WMUs provide reliable trends for harvest and summer sighting data			●	●						
1.11 Determine if the two-bird spring bag limit has any effect on the turkey age structure and, if needed, recommend regulation changes			●	●						
1.12 Develop standard solutions to nuisance turkey complaints		●								
1.13 Quantify turkey complaints by season, type and location		●	●	●	●	●	●	●	●	●
1.14 Train personnel in identifying agricultural damage caused by turkeys	●	●								
1.15 Define wild turkey social carrying capacity by WMU							●	●		
1.16 Develop a habitat suitability model as a tool in harvest and habitat management								●	●	●

APPENDIX 1. Continued.

Objective and Strategies	By End of Year									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Habitat Objective										
Strategy:										
2.1 Determine turkey habitat management priorities for State Game Lands while considering habitat on adjacent properties	●	●								
2.2 Quantify habitat management practices that benefit turkeys on State Game Lands			●	●	●	●	●	●	●	●
2.3 Evaluate efficacy of habitat management practices on State Game Lands, and recommend adjustments	●	●	●	●	●	●	●	●	●	●
2.4 Develop at least two demonstration areas per Region to promote habitat management to other public agencies and private landowners	●	●	●							
2.5 Conduct at least one workshop or field trip per Region at a demonstration area				●	●	●	●	●	●	●
2.6 Develop and/or continue partnerships for habitat funding	●	●	●	●	●	●	●	●	●	●
2.7 Provide technical information and assistance regarding turkey habitat management to other public land managers and private landowners	●	●	●	●	●	●	●	●	●	●
2.8 Promote use of prescribed fire	●	●	●	●	●	●	●	●	●	●
Information & Education Objective										
Strategy:										
3.1 Survey hunters and other stakeholders regarding turkey populations and management issues		●					●			
3.2 Report research and management findings to the public through all forms of media	●	●	●	●	●	●	●	●	●	●
3.3 Provide educational information through all forms of media and speaking engagements	●	●	●	●	●	●	●	●	●	●
3.4 Develop and publish fact sheets		●	●	●	●	●				
3.5 Provide information to landowners about turkey behavior and depredation			●	●	●	●	●	●	●	●

APPENDIX 1. Continued.

Objective and Strategies	By End of Year									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Hunting Heritage/Hunter Safety Objective										
Strategy:										
4.1 Evaluate the option of expanding hunter education to include an optional and separate course on wild turkey hunting and safety			●							
4.2 Determine participation rates of the various age segments of hunters and develop ways of increasing participation				●						
4.3 Assess and explore opportunities for continued development of the youth mentored hunting program	●	●	●	●	●	●	●	●	●	●
4.4 Consider expanding the youth spring gobbler season to an all-day season	●	●								
4.5 Consider implementation of expanded spring hunting opportunities	●	●	●	●	●	●	●	●	●	●
4.6 Maintain and expand the Game Commission's public access programs to promote and protect these privately owned lands open to public hunting	●	●	●	●	●	●	●	●	●	●
4.7 Acquire turkey habitat to expand hunting opportunities	●	●	●	●	●	●	●	●	●	●
4.8 Develop and distribute educational and hunter safety materials directly to turkey hunters		●	●	●	●	●	●	●	●	●
4.9 Investigate relationships between spring and fall hunter density and turkey hunter safety, and recommend regulation changes if necessary					●	●				
4.10 Conduct information and education programs to control turkey hunting related shooting incidents and promote wild turkey hunter safety/ethics	●	●	●	●	●	●	●	●	●	●
4.11 Monitor compliance with fluorescent orange turkey hunting regulations	●	●	●	●	●	●	●	●	●	●
4.12 Review orange requirements, evaluate regulatory alternatives, and, if appropriate, recommend changes to the spring season fluorescent orange turkey hunting regulations	●	●								
4.13 Assure that complete information on turkey hunting related shooting incidents are included in all International Hunting Education Association reports	●	●	●	●	●	●	●	●	●	●

APPENDIX 1. Continued.

Objective and Strategies	By End of Year									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Wild Turkey Protection										
Strategy:										
5.1 Assess compliance with laws and regulations to protect the wild turkey resource	●	●	●	●	●	●	●	●	●	●
5.2 Use wild turkey decoys and other appropriate law enforcement tools to discourage road hunting and poaching, and utilize partnerships to assist with purchasing equipment	●	●	●	●	●	●	●	●	●	●
5.3 Seek legislation to increase penalties for serious violations	●	●	●	●	●	●	●	●	●	●
Cooperative Partnerships Objective										
Strategy:										
6.1 Assist states and Canadian provinces with wild turkey restoration through trap and transfers where feasible	●	●	●	●	●	●	●	●	●	●
6.2 Continue the partnership with the National Wild Turkey Federation	●	●	●	●	●	●	●	●	●	●

APPENDIX 2. Summary of public comments, from second public review

The second draft of this management plan was made available for public comment from October 24 to November 24, 2006 (30-day comment period). A news release and posting on the Game Commission's web page 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 via the web page, through e-mail, or in writing to the agency's Harrisburg Office.

We received 34 correspondences from individuals, along with comments from the Pennsylvania Chapter National Wild Turkey Federation (3) and the National Wild Turkey Federation (2). Duplicate correspondences were excluded. Most correspondences contained more than one comment. A total of 90 comments were identified. For example, a correspondence that stated, "I support both extending spring hunting hours and hunting with dogs during the fall, but do not support a two-bird spring bag limit" would be divided into 3 comments: one each supporting archery hunting, and pursuit with dogs, and one against the two-bird spring bag limit.

Thirty-six topics were identified from the 90 comments. The number of comments received for each topic is noted below, along with the management plan strategies most related to the topic.

	Topic	Comments Received	Most Related Strategies
1	Eliminate the second spring tag	3	1.1; 1.10; 4.5
2	Second spring tag is too expensive	4	none
3	Second spring tag is too expensive for nonresidents	1	none
4	Should not have 2nd spring tag with declining population	1	none
5	Permit all-day spring hunting, or extend hours on public land	3	1.1; 4.5
6	Open spring season earlier	3	1.1; 4.5
7	Create hunter option, 1 turkey each season or 2 in spring	1	1.1; 1.2; 1.3
8	Allow 2nd tag in spring or fall, bearded bird only both seasons	1	1.1; 1.2; 1.3
9	Increase fall bag limit	4	1.1; 1.2; 1.3
10	Permit use of turkey dogs during fall season	3	1.1; 4.2
11	Lengthen or open fall seasons in specific WMUs	6	1.1; 1.2; 1.3; 4.6
12	Open fall season Thurs, Fri, Sat of Thanksgiving in northern tier	1	1.1; 1.2; 1.3; 4.6
13	Fall season - hens only	1	1.1; 1.2; 1.3
14	No rifles during fall season, or restrict rifles in more WMUs	1	4.10; 5.1
15	Open fall archery for turkeys during entire deer archery season	1	1.1; 1.2; 4.2
16	Create a general turkey license	3	none
17	Compliments on management plan &/or turkey management	4	none
18	Do not manage turkey population at all	2	none
19	Permit Sunday hunting	3	1.1; 1.2; 4.5
20	Do not permit Sunday hunting	1	1.1; 1.2; 4.5
21	Loosen predator hunting restrictions - too many predators	1	none
22	Do not manage like the deer program	4	none
23	Free junior license	1	none
24	Support the plan with funding	3	none
25	Implement plan with minor changes	4	none
26	Use as adaptive mgmt tool, making any changes throughout 10-yrs	1	none

APPENDIX 2. Continued.

	Topic	Comments Received	Most Related Strategies
27	NWTF will assist with funding implementation of plan	4	none
28	Accomplish some strategies earlier than specified in plan	2	none
29	Collect reproductive data by age and WMU	2	1.7
30	Acquire fall harvest rate data for setting fall season length	2	1.9
31	Acquire age/sex data of the harvests	2	1.4
32	Continue to review HRSIs and develop ways to reduce them	2	4.9; 4.10; 4.11; 4.12; 4.13
33	Define social carrying capacity	1	1.15
34	Define turkey habitat life requirements in text	1	2.1
35	Turkeys are doing well, don't change anything	2	none
36	Specific editorial comments	11	none
	Total	90	

APPENDIX 3. History of wild turkey management in Pennsylvania, 1954 – 2006

1954	First statewide fall season since 1929.
1958	Began full-scale wild turkey trap and transfers to repopulate turkeys within Pennsylvania.
1960's	PGC stopped winter-feeding of wildlife due to research results on lack of benefits.
1968	First spring gobbler-hunting season (1 week long).
1972	Spring gobbler season expanded to 2 weeks.
1975	Spring gobbler season expanded to 3 weeks.
1980	Game farm production of turkeys was stopped to restore turkey populations with wild-trapped turkeys into the state's remaining suitable but unoccupied turkey habitats.
1984	Spring gobbler season expanded to the current 4-week season.
1985	Turkey Management Areas established to more effectively manage wild turkey populations at more local levels.
1992-93	Florescent orange requirements for fall (1992) and spring (1993) turkey seasons.
1999	Management Plan for Wild Turkeys in Pennsylvania signed and adopted.
1999-2001	Radio telemetry research study on TMA 7B (now WMU 5A) to determine causes of a suppressed turkey population.
2000	Game Commission signed an MOU with the National Wild Turkey Federation to partially fund the NWTF Regional Biologist to assist the agency with all forms of wild turkey management and research. Creation of a wild turkey web page on the Game Commission web site to provide accurate public information and education on wild turkey management and research.
2000-03	Wild turkey transfers into southeast Pennsylvania where habitat existed but populations were lacking, which completed the agency's turkey restoration program. Over 3,500 wild turkeys transferred within Pennsylvania and to 8 other states.
2001	Record wild turkey population due to several consecutive mild winters with abundant fall foods, above average summer recruitment, and conservative fall hunting season lengths in some of our WMUs. Prescribed burn policy approved for use as habitat management tool on State Game Lands. Turkey hunter survey conducted to determine hunter attitudes, characteristics and satisfaction. Basic hunter education program expanded to include a 1/2-hour segment of turkey hunting education to include safety, ethics, and hunter responsibility. Northeastern states commissioned development of a regional wild turkey population model, partially funded by each state chapter NWTF. Wild turkey hunting and safety segment added to hunter/trapper education course.
2002	Use of manmade blinds to hunt turkeys becomes legal. Game Commission permit required prior to releasing game-farm turkeys, to help eliminate the release of game-farm turkeys into the wild.
2003	Turkey management now uses 22 Wildlife Management Units, revised from the 12 Turkey Management Areas. WMU 5A closed to fall turkey hunting to help increase that turkey population. Research continued on WMU 5A to determine turkey usage of herbaceous openings on Michaux State Forest.
2005	Established 6 Game Commission Regional Wildlife Management Supervisors, to provide, among other tasks, direct technical assistance to private landowners and agency staff. Approved the increase to a two-bird spring bag limit, with appropriate license, to begin spring 2006.
2006	Five-year, multi-state research study initiated, "Wild turkey spring harvest rates and annual survival rates", with Ohio and New York, partially funded by the NWTF and PANWTF. 8,040-second spring licenses sold with mandatory reporting whether or not the hunter harvests a second turkey. Mentored Youth Hunting Program initiated (July 2006), allowing mentor and mentored youth to hunt spring gobbler, squirrel and groundhogs.

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