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MANAGEMENT PLAN

FOR

WHITE-TAILED DEER

IN PENNSYLVANIA

(2003-2007)

Bureau of Wildlife Management
Pennsylvania Game Commission

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INTRODUCTION

Based on their economic value and aesthetic appeal, white-tailed deer (*Odocoileus virginianus*) are one of the most important big game species in the United States. The recovery of Pennsylvania's deer population early in the 1900s to their present abundance provides many recreational opportunities for both hunters and non-hunters alike. However, excessive concentrations of deer can cause serious socioeconomic and ecological problems such as deer-vehicle accidents (Stout et al. 1993, Romin and Bissonnette 1996), crop depredation (Conover 1997, Mower et al. 1997), and reduced forest regeneration (deCalesta 1994, McShea et al. 1997).

The many ways deer impact people and the ways people view deer are countless. This is a fundamental problem and is probably the most challenging part of managing deer herds; there can only be one target deer density that will benefit some stakeholder groups but will be to the detriment of other stakeholder groups (Roseberry and Woolf 1991). The process of documenting deer population target densities, which stakeholder groups will likely be positively and negatively impacted at these deer densities, and establishing management goals and objectives are primary reasons for developing a deer management plan. As McCullough (1979:250) suggested, "A rational program of deer management must start with the establishment of objectives. What segments of the public will benefit or what are the trade-offs between special interest groups?"

This plan will first discuss (1) the history of deer in Pennsylvania, (2) deer biology and ecology, and (3) many of the positive and negative impacts deer have on economy, environment and people of Pennsylvania. The latter sections discuss principles of deer herd management, their population ecology, and likely consequences of harvest management options given what is known about their population ecology. It will be up to the key stakeholders of deer in

Pennsylvania to establish goals and objectives, which will be used to frame the future of Pennsylvania's deer management program.

HISTORY OF PENNSYLVANIA'S DEER HERD

Prior to European settlement in Pennsylvania, deer populations were likely limited by extensive tracts of mature forests that supported few deer, by predation from wolves (*Canis lupus*) and mountain lions (*Felix concolor*), and by Native American harvests (McCabe and McCabe 1984). Deer densities declined dramatically because of subsistence and market hunting, and habitat changes caused by land-use practices of settlers from Europe. Deer were scarce throughout the Eastern and Midwestern United States around 1900 (McCabe and McCabe 1984). In Pennsylvania, game wardens began enforcing the deer harvest law in 1896 and the Pennsylvania Game Commission (PGC) began stocking deer in 1906 (Kosack 1995). Early successional habitat that provided excellent deer habitat became abundant throughout Pennsylvania due to logging practices that occurred during the late 1800s and early 1900s. Excellent habitat coupled with limited antlerless harvests allowed deer herds to expand throughout the Commonwealth and dramatically increase in number.

Deer densities were extremely high by the mid 1900s (Latham 1950). Increased antlerless harvests and severe winter weather conditions coupled with a low food supply caused by over-browsed habitats substantially reduced deer herd numbers during the early 1950s. The PGC closed the antlerless deer hunting season throughout the Commonwealth in 1956 because deer densities were low and hunters complained that an over-harvest occurred in 1955 (Kosack 1995). Antlerless deer continued to be under-harvested and the population continued to grow despite an increasing antlerless kill during the late 1950s and 1960s. Deer density goals based on

forage availability in forested habitats were established by the PGC in 1979. Deer densities fluctuated but generally grew throughout the 1980s and 1990s even though deer numbers were 50 to >100 percent above goal throughout the Commonwealth (Pennsylvania Deer Statistics 1982-2000).

In attempt to solve problems with their deer herd, the PGC modified the framework of Pennsylvania's deer hunting season in the late 1990s. Liberalized antlerless tags were issued and the separate buck and doe seasons were combined to maximize hunter opportunities for harvesting antlerless deer. Historically, there was a 2-week buck season followed by a 3-day antlerless season which occurred the following Monday after the buck season closed. The primary problems with the separate seasons were: (1) weather could adversely affect antlerless harvests during the short antlerless season, (2) hunters interested in obtaining venison were forced to kill a buck which caused extremely high harvest rates (80-90% statewide) of adult bucks, and (3) participation rates during the antlerless season were probably suppressed because some hunters already killed a buck and the season occurred during the middle of the week. Thus, the PGC held its first concurrent season since 1907 in 2001. Although holding concurrent seasons is common in other Northeastern and Midwestern states (Appendix A), it was an innovative management strategy for Pennsylvania. Deer harvest data collected in 2001 were typical of other states holding concurrent seasons (Roseberry and Woolf 1991), which suggests hunters were initially interested in harvesting antlered bucks but became more willing to harvest antlerless deer as the hunting season progressed and fewer antlered males were available (Roseberry and Woolf 1988, Shultz 1992, Grund 2001).

NATURAL HISTORY

Taxonomy, Anatomy, and Physiology

White-tailed deer are ungulates, or hoofed mammals, belonging to the family Cervidae. Some unique characteristics distinguishing white-tailed deer from other cervids are branched antlers, a four-part stomach and the absence of a gall bladder. Ancestors of modern deer had five toes; through evolution the first toe disappeared, the second and fifth toes became "dew claws", and the third and fourth toes enlarged to form hooves. Consequently, deer actually walk on their toenails, which is keratinized tissue similar to human fingernails. Like our fingernails, the hooves on white-tailed deer continue to grow and therefore, will become wider with age.

The white-tailed deer's coat and color will change throughout the year. Deer tend to appear more reddish and their coat is relatively thin during the warm summer months. Deer will shed their summer pelage in late summer or early fall and replace it with a thick, brownish-grey winter coat. The winter coat consists of both a short underfur and hollow, outside guard hairs that provides additional insulation and protection during the colder winter months. The winter coat is shed in mid- to late-spring**.**

Deer have four sets of external glands that are primarily used for communication and to display its social status and breeding condition. The most prominent glands are the tarsal and metatarsal glands, which are located on the hind leg. The tarsal gland, located on the inner side of the hind leg, is primarily used to identify individual deer. The metatarsal gland, which is located on the lower part of the leg, is thought to be partially responsible for regulating body temperature. Interdigital glands are located between the hooves and some biologists believe deer use these glands to leave scent trails for other deer to follow. Pre-orbital glands function as tear glands and are rubbed on branches to convey sex and social hierarchy.

Deer from northern climates tend to have larger body sizes than their southern counterparts. This is advantageous for deer because animals with larger body sizes have proportionately less body surface, which assists them in retaining body heat during cold weather. Conversely, smaller body sizes are more efficient at cooling during warmer weather. Seasonally, deer typically lose weight during winter and regain weight during the spring, summer, and fall months (Mautz 1978). However, there are some differences in metabolic demands between the sexes; males tend to lose weight as they expend a great deal of energy during the rut whereas the metabolic demands on females are greatest during summer while rearing their fawns (Moen 1976). The enormous amount of energy expended during the rut often predisposes males to have higher winter mortality rates than females (Mautz 1978, Clutton-Brock et al. 1982, Gaillard et al. 1993, Owen-Smith 1993). Due to the energy requirements needed for lactation, females spend more time feeding during summer months and may abandon their fawn if they are not in good physical condition during the summer (Beier 1987).

Productivity

Generally, deer productivity rates are higher in regions with an abundant food supply. Thus, deer occupying farmland regions typically have higher productivity rates than deer in forested regions (Haugen 1975, Gladfelter 1984, Kerr and Peterson 1988, Fuller 1990). Further, productivity rates vary with the age of the doe with adult does having the highest productivity rates and yearlings have higher productivity rates than fawn does. In farmland regions, a high percentage of fawns and almost all yearling and adult does breed each year (Haugen 1975, Gladfelter 1984). In contrast, female fawns are less likely to reproduce in forested regions where the food supply is less abundant (Kerr and Peterson 1988) and yearling females may not breed if they are malnourished in fall (Verme 1969, McCullough 1979). Fawns in farmland regions tend

to be heavier which allows them to reach puberty earlier (Haugen 1975, Gladfelter 1984, Verme and Ozoga 1987). Verme and Ozoga (1980) found that as little as a 10% reduction in food consumption inhibits skeletal growth and fat accretion. Limited food thereby stunts the growth of fawn females in deteriorated habitats, which prevents them from breeding in poor ranges.

Mortality

Summer mortality is generally low for all sex- and age-classes (Nelson and Mech 1981, Dusek et al. 1989, Nixon et al. 1991, Van Deelan et al. 1997). Fawns have higher mortality rates than other age cohorts, and are most susceptible to predation during summer months (Shultz 1982, Dusek et al. 1989, Pennsylvania Game Commission Fawn Study). Deer/vehicle collisions are the primary source of mortality that occurs during summer months for yearling and adult deer (Gladfelter 1984, Nixon et al. 1991). Deer killed during the hunting season account for most annual mortality (Nelson and Mech 1981, Nixon et al. 1991, Van Deelan et al. 1997, Grund 2001). Hunting-related crippling losses are variable and unpredictable, and might double the reported harvest in some states (Hardin and Roseberry 1976, Beattie 1980, McPhillips et al. 1985, Nixon et al. 1991, Krueger 1995). Further, poaching also accounts for some annual mortality (Beattie et al. 1980, Nixon et al. 1991). Winter mortality is generally higher for deer occupying northern climates or predominately forested areas than for deer in agricultural regions or southern climates (Gladfelter 1984, Nixon et al. 1991, Van Deelan et al. 1997, Grund 2001). This is largely due to winter weather conditions being more severe in northern regions and farmland deer tend to be in better condition at the onset of winter (Verme and Doepker 1988, Grund 2001). Verme and Doepker (1988) estimated 77,000 deer died during a severe winter in northern Michigan, of which 82% were fawns. Additionally, the presence of wolves can

increase deer mortality rates in regions where the two species co-exist (Nelson and Mech 1981, DelGuidice 1998, Filipiak 1998).

Deer Activity and Movement Patterns

Deer tend to be most active at dawn and dusk (Micheal 1970, Kammermeyer and Marchinton 1977, Ivey and Causey 1984, Beier and McCullough 1990, Fritzen et al. 1995, Grund 1998) but activity patterns will vary across seasons and can be affected by environmental conditions. For example, deer tend to be inactive when temperatures are very hot or very cold and other factors such as wind speed, cloud cover, and relative humidity may also affect deer activity patterns (Beier and McCullough 1990). On a seasonal basis, deer in northern climates tend to be most active during spring and fall and least active during winter (Hoskinson and Mech 1976, Moen 1978, Beier and McCullough 1990, Grund 1998). Deer activity is usually highest during fall due to their breeding behavior and their need to increase food consumption while preparing for winter. Deer tend to be least active during winter (Dahlberg and Guettinger 1956, Gill 1957, Hoskinson and Mech 1976, Beier and McCullough 1990, Grund 1998) and will typically become active later in the morning as temperatures increase (Beier and McCullough 1990) but other factors such as human activity can also affect winter activity patterns (Grund 1998). Several studies suggest deer decrease their activity in winter because food availability is limited during this season (Coblentz 1970, McCullough 1985, McCullough and Ullrey 1985). Thus, deer will reduce their metabolic demands to conserve energy and more closely match their energy intakes (Ozoga and Verme 1970, Moen 1976). A marked increase in deer activity occurs during the spring due to the high metabolic demands associated with the last trimester of pregnancy in females whereas the nutritional demands associated with antler growth in males

causes them to increase their activity patterns (Moen 1978, Beier 1987). Similarly, metabolic demands are high during summer as does produce milk for their fawns and males continue to develop antlers (Moen 1978).

The size and shape of a deer's home range varies with deer density, sex, landscape conditions, and season of the year (Sanderson 1966, Harestad and Bunnell 1979, Loft et. al 1984). Deer occupying better habitats can fulfill all their necessary requirements in smaller areas whereas deer residing in poorer ranges must travel further distances to find suitable food and cover (Sanderson 1966, Loft et. al 1984). Home range size and deer density tend to be inversely related (Sanderson 1966, Loft et al. 1984), as long as the number of deer does not adversely affect habitat conditions. Males generally have larger home ranges than females and home ranges tend to be largest in fall and spring (Nelson and Mech 1981).

IMPACTS DEER HAVE ON THE ECONOMY, ENVIRONMENT, AND PEOPLE OF PENNSYLVANIA

Positive Impacts of Deer

Deer are important to Pennsylvania's economy, particularly in rural regions where hunters typically travel to hunt deer. Based on the 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation survey, Pennsylvania's deer hunters spent approximately $344 million in 1996 (USFWS 1997). These costs included money spent on food, lodging, transportation, equipment, and licenses.

Some revenues generated from hunting support many wildlife programs. Passage of the 1937 Federal Aid in Wildlife Restoration Act, which created the Pittman-Robertson Program, marked the beginning of wildlife management as we know it today in the United States (often

referred as the "North American Wildlife Model"). Pittman-Robertson dollars are a result of a federal excise tax on firearms and ammunition. Pittman-Robertson money and revenues generated directly from deer hunting license sales are used to support a wide variety of wildlife-related activities including land acquisition and management activities to benefit wildlife, wildlife information and education programs, and law enforcement.

There are more than 800,000 deer hunters in Pennsylvania, this impressive number places Pennsylvania number two in the United States just behind Michigan (USFWS 1997; Appendix B). However, there are many non-hunters in Pennsylvania who also enjoy observing deer. The 1996 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation estimated that 3.7 million residents spent $858 million to observe, feed, or photograph Pennsylvania wildlife in 1996 (USFWS 1997). Although it is impossible to quantify how many people spent how much to observe specifically deer, deer are a popular species among wildlife observers (Conover 1997); thus, it is probably safe to assume that a good portion of those people spent time and money enjoying and observing deer.

Based on the information presented above, deer are clearly an important species in Pennsylvania. The money generated through the Pittman-Robertson Program and license sales fund many wildlife programs in the PGC. Further, many people just enjoy seeing deer for recreational purposes and the deer hunting season provides a unique opportunity for those who participate which a dollar value cannot be assigned. Undoubtedly, deer have enormous positive impacts to rural economies in Pennsylvania. However, there can always be too much of a good thing.

Negative Impacts of Deer

Deer—Vehicle Collisions

Among the myriad of factors that must be considered when managing deer herds are costs associated with deer-vehicle collisions (DVCs). This problem is unique compared to other factors in that DVCs carry the potential for human injury and death. Nationally, about 29,000 people are injured and more than 200 people die each year due to DVCs (Conover 1995). In Pennsylvania, State Troopers reported 21 human fatalities resulted from DVCs on Pennsylvania's state and federal highway system from 1996-2001. Other studies report that about 4-5% of all DVCs involve a human injury (Arnold 1979, Hansen 1983) and deer rarely walk away from a DVC unharmed. Nationally, the average vehicle repair bill caused by a DVC was about $1,500 (Conover et al. 1995) and repairing a vehicle in Pennsylvania may cost more than the national average ($2,200 in Pennsylvania [Witmer and deCalesta 1992]). In Pennsylvania, Wildlife Conservation Officers reported 40,000-50,000 DVCs occurred each year from 1990-1997 (Pennsylvania Deer Harvests and Road Kills 1915-2000) and these figures do not include deer picked up by the Pennsylvania Department of Transportation or other people that remove deer from highways. Further, usually only 50% of deer killed by vehicles are found and reported by state authorities because many deer are maimed by the vehicle but are capable to move away from the roadway (Decker et al. 1990, Romin 1994). Assuming Pennsylvania's DVCs reporting rate is comparable to other states, it is likely that at least 80,000-100,000 DVCs occur each year translating into about 3,200-5,000 human injuries and $176-220 million in vehicle damages annually.

The primary factors affecting the number of DVCs that occur in a given year are traffic volume (deCalesta 1990, Romin and Bissonette 1996), and landscape characteristics (Puglisi et

al. 1974, Bashore et al. 1985, Finder et al. 1999, Hubbard et al. 2000), which ultimately affects the distribution and number of deer (deCalesta 1990, Romin and Bissonette 1996). This is somewhat intuitive because deer need to encounter vehicles for a DVC to occur; thus, trends in DVCs reflect both deer density and vehicle density (i.e., traffic volume). Trends in DVCs adjusted for traffic volume would likely correlate well with deer population trends if the accuracy and specificity of DVC data matched the data collected for monitoring deer population trends and harvests. Methods to minimize the number of DVCs without reducing deer herd numbers have been developed but have limited application due to costs (e.g., fencing, deer crossing signs, and reflectors [Pojar et al. 1975, Reed et al. 1982, Bashore et al. 1985, Schafer and Penland 1985, Feldhamer et al. 1986, Wood and Wolfe 1988]). Implementing deer management strategies that control the density of deer is likely the most pragmatic and effective approach to minimize the number of DVCs in Pennsylvania (Bellis and Graves 1971). This is evident by comparing annual buck harvest figures (a general index to deer density) with PGC-reported DVCs in Pennsylvania; the number of DVCs increases as buck harvest numbers increase (Figs. 1 and 2). Finally, vehicular traffic is not the only type of commuter affected by deer, aircraft collide with deer on Pennsylvania airfields while taking-off and landing (Bashore and Bellis 1982).

Crop Damage

Deer are responsible for much of the wildlife crop damage in Pennsylvania (Vogel 1989). Based on information compiled by Conover (1994) and Wywialowski (1994), Conover et al. (1995) estimated crop damages caused by wildlife cost the United States agriculture industry almost $500 million each year and deer are responsible for much of these damages (Conover and

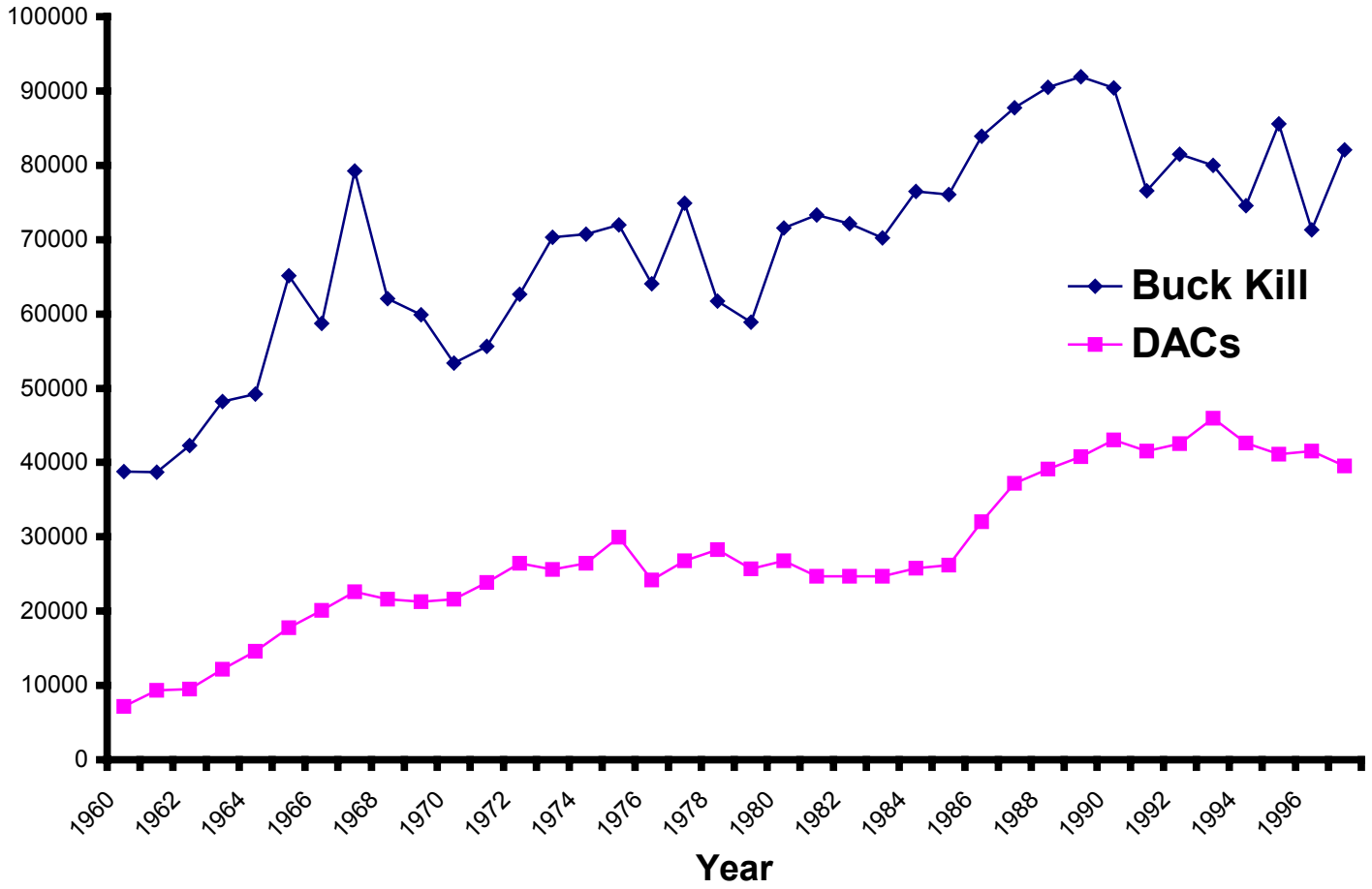

Figure 1. Number of deer-vehicle collisions reported by the Pennsylvania Game Commission and the number of bucks harvested based on report cards returned from hunters, 1960-1997.

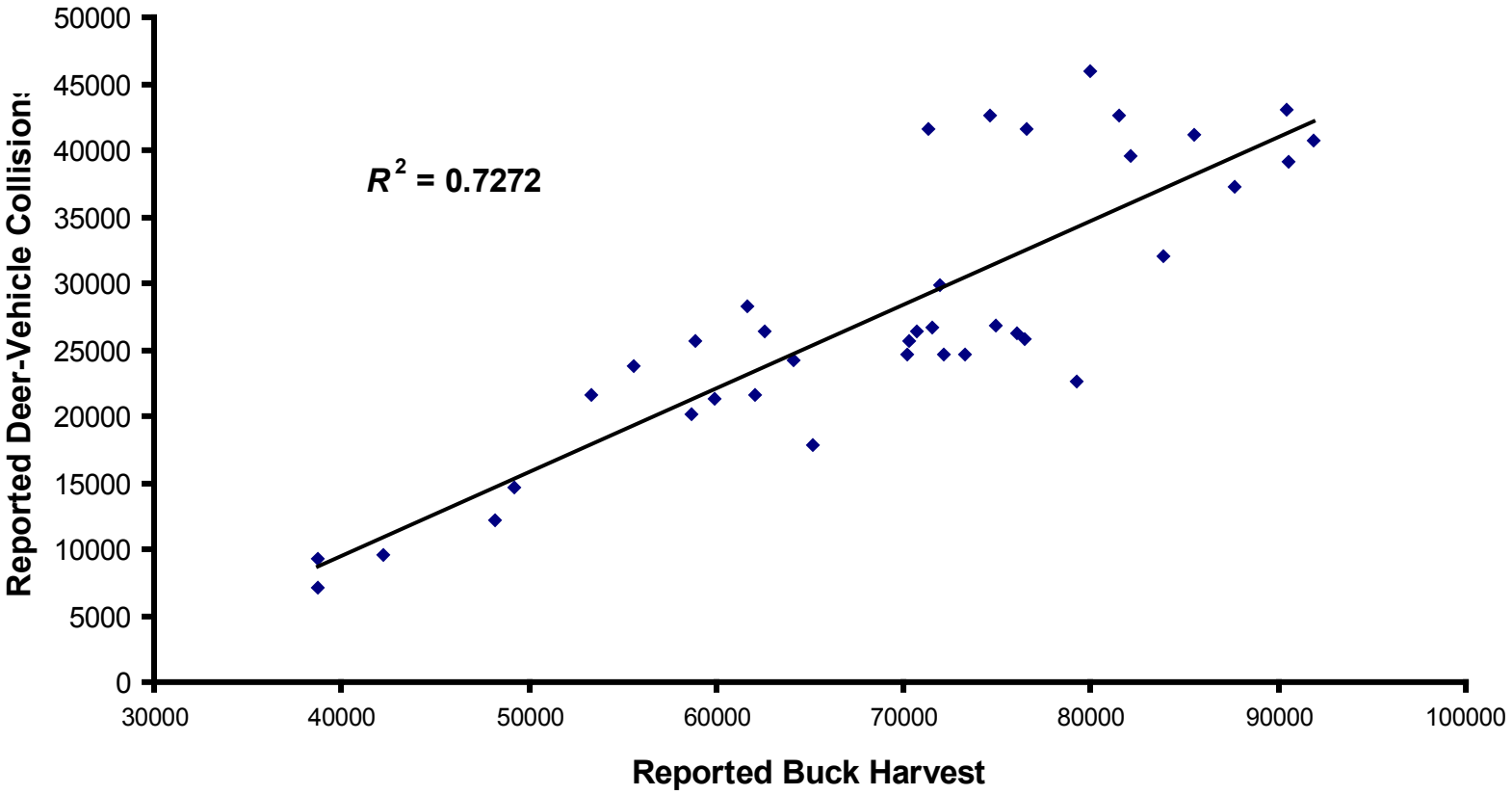

Figure 2. Number of deer-vehicle collisions reported by the Pennsylvania Game Commission versus numerical buck harvests, 1960-1997.

Decker 1991, Conover 1994). One survey conducted by the Pennsylvania Farm Bureau indicated that an average farmer loses >$9,000 per year to deer (M. Pechart, personal communication) and another study conducted more than a decade ago estimated total damages in Pennsylvania may exceed $86 million each year (Vogel 1989).

Wildlife Diseases

Bovine Tuberculosis (TB) is a contagious respiratory disease caused by the bacterium *Mycobacterium bovis*. Bovine TB infects warm-blooded animals, including humans and is most commonly transmitted by close contact between individual animals. The federal government has tested cattle herds across the United States to control bovine 1TB, but the disease still occurs in cattle, penned exotic livestock, and occasionally wild deer. Michigan has been actively monitoring Bovine TB in their free-ranging white-tailed deer herd since 1994. The presence of Bovine TB in a deer herd poses a significant problem. Michigan's deer herd, livestock industry, and most importantly, the health of Michigan's citizens are now at risk to Bovine TB.

Chronic Wasting Disease (CWD) is a relatively new disease threat to deer herds in the United States. CWD is a brain disease related to Bovine Spongiform Encephalopathy, also known as *Mad Cow Disease*. CWD is known to affect elk (*Cervus elaphus*), mule deer (*O. hemionus*), and white-tailed deer (Miller et al. 2000). Very little is known about CWD and how it is transmitted within deer populations (Miller et al. 2000). The disease has been diagnosed in free-ranging deer and elk located in northeastern Colorado and southeastern Wyoming for more than two decades, and most recently in New Mexico, South Dakota and Wisconsin; CWD has also been detected in

captive elk in Colorado, Montana, Nebraska, Oklahoma, and Saskatchewan. Chronic Wasting Disease appears to be caused by an abnormal protein called a prion (Spraker et al. 1997). Usually, months to years pass from when the animal is infected to when it begins showing signs of disease. Thus, the disease could infect a large number of deer before the disease is actually discovered. Signs of the disease in deer and elk include poor body condition, tremors, stumbling, increased salivation, difficulty swallowing, and excessive thirst or urination.

Lyme disease is caused by the spirochete *Borrelia burgdorferi* and is transmitted to people via the deer tick (*Ixodes dammini*). If Lyme disease is left untreated during its early stages, it could lead to serious health problems including arthritis, and various neurologic diseases. Deer play a role in Lyme disease because they are a primary host for the adult deer tick (Davis et al. 1984, Habicht et al. 1987). The disease is transmitted among ticks when uninfected ticks take blood from infected deer or other already-infected animals (Habicht et al. 1987). The disease is most commonly transmitted to humans when the infected ticks are nymphs during the spring.

The United States Department of Agriculture is highly concerned about Foot-and-Mouth Disease (FMD). FMD is a highly infectious and economically important viral disease that severely affects all domestic and wild ruminants such as cattle, pigs, sheep, goats, and deer species. FMD causes blisters on the feet, mouth and teats. Other clinical signs include lameness, lethargy, loss of appetite, excessive salivation, and pregnant females infected with FMD may abort their fetuses. Some animals that are severely infected by the disease may die, but chronic debilitating infections are much more common. FMD has never been detected in Pennsylvania; however, several outbreaks

have occurred throughout the world since 2000 which raised the concern of personnel in many agricultural and wildlife agencies in the United States. The most serious impacts of FMD would be to the beef and dairy cattle industry, the USDA predicts FMD could cost the United States livestock industry billions of dollars in the first year. Deer would be important if FMD is detected in the United States because deer would likely become infected and would probably become a reservoir for the disease. This would allow livestock to become re-infected which would increase the probability of having the disease persist and become endemic.

Diseases such as Bovine TB, FMD, and possibly CWD (Miller et al. 2000), are transmitted when deer are in close contact to one another. Thus, transmission rates are increased when deer densities are high or artificial feeding causes animals to congregate. However, reducing deer numbers has been an inefficient technique for preventing Lyme disease (Duffy et al. 1994). Different levels of deer densities have little effect on preventing Lyme disease because deer are simply one reservoir for the disease (Duffy et al. 1994) and do not transmit the disease directly to other deer. Further, other diseases such as Epizootic Hemorrhagic Disease and Bluetongue, are not related to deer density but still can impact local deer herds.

Damages to the Forestry Industry, and Forest Habitat & Communities

Too many deer browsing on seedlings and saplings is a major concern for the timber industry. Deer browsing can kill trees or retard their growth, both scenarios represent economic losses to the timber industry. Further, many tree species that are valuable for commercial purposes are also preferred by deer, which can accelerate losses in revenue (Marquis and Brenneman 1981). Annual timber losses to the Allegheny

hardwood forest alone have been estimated at $367 million more than 20 years ago (Marquis 1981). These are direct economic losses to Pennsylvania's forest industry which results in less sawtimber produced, a decrease in tax revenue, and fewer jobs for Pennsylvanians.

Deer can have a major impact on the natural community in which they live. As the number of deer increases, plants that were preferred by deer will become less abundant or may disappear (Ross et al. 1970, Marquis 1981, Tilghman 1989, Healy 1997). Preferred plants (i.e., those that are highly palatable to deer) become scarce as deer densities increase because there are too many animals consuming a fixed amount of plants. The disappearance of highly palatable plants adversely affects other wildlife species that rely on these plants for food and cover which results in a dramatic reduction of biodiversity in forest ecosystems (Whitney 1984, McShea and Rappole 1992, deCalesta 1994, 1997). deCalesta (1994) found that deer altered the forest structure and composition by eliminating much of the intermediate canopy in northcentral Pennsylvania. Thus many intermediate canopy-nesting songbirds such as the eastern wood pewee (*Contopus virens*), indigo bunting (*Passerina cyanea*), least flycatcher (*Empidonax minimus*), yellow-billed cukoo (*Coccyzus americanus*), were not observed when deer densities exceeded 20 deer per square mile. Further, plants that are less palatable to deer may increase in abundance when deer densities are high; ferns are a good example in Pennsylvania (Horsely 1977). The abundance of less palatable plants may inhibit regeneration of other plant species, which further complicates natural succession in Pennsylvania forests. Stromayer and Warren (1997) suggested that forest succession may have been altered indefinitely in many Eastern forests. This could lead to

a completely different forest ecosystem with less biodiversity in plant and animal communities for future generations. Finally, deer over-browsing the forest habitat is not only a concern for other plant and wildlife species, but it is also a concern for their own populations. Previous studies have linked reduced recruitment and natural survival rates of deer to food availability and habitat conditions (McCullough 1979, DePerno et al. 2000). Thus, when habitat conditions decline, so will deer population numbers.

Damage to Ornamental Plants and Landscaping

Deer browsing on ornamental trees, shrubbery, and gardens can cost homeowners millions of dollars (Connelly et al. 1987, Witham and Jones 1987). Reported damages vary from small ($251 million nationwide; Conover 1997) to substantial ($9.5 million per 20,000 N.Y. residents, Connelly et al. 1987). The marked range in deer damage estimates is caused, in large part, by the costs of landscaping in various types of residential neighborhoods. For example, damages will be greater if only affluent neighborhoods are sampled during the survey (e.g., Connelly et al. 1987). In contrast, damages will be underestimated if inner-city households are included because many urban households never have interactions with deer and costs for landscaping are highly variable. Regardless, perceived economic losses, injuries, and diseases caused by deer are serious problems for many urban, suburban, and even rural residents (Cornecelli et al. 1993, Conover 1995).

SOME PRINCIPLES OF DEER MANAGEMENT

The maximum number of deer that can be supported in a given area is ultimately limited by habitat quality and climate. This number is generally referred to as the "biological carrying capacity". The biological carrying capacity will be the focus of this section because if deer numbers exceed this threshold, habitat quality deteriorates and in response, deer numbers decline. The biological carrying capacity is a useful concept because we know that the landscape can only sustain a certain number of deer. However, the biological carrying capacity is impossible to estimate because we have no means to measure it and it can vary annually depending on how much food is available to deer. Usually, the biological carrying capacity can only be determined after deer numbers have exceeded the carrying capacity resulting in poor habitat conditions and a declining deer herd (e.g., see DePerno et al. 2000). Further, much of Pennsylvania's landscape is managed for economic gain and thus, many Pennsylvania residents are negatively impacted by deer and will not tolerate deer densities anywhere near the biological carrying capacity. The deer density that is preferred by Pennsylvanians is generally referred to as the "cultural carrying capacity" (Minnis and Peyton 1995, West and Parkhurst 2002). In addition, harvest levels are maximized when deer densities are well below the biological carrying capacity because recruitment is maximized and mortality is minimized (McCullough 1987). Lastly, many Pennsylvanians would view the cultural carrying capacity as the number of deer the forest can sustain without losing structure and function or biodiversity within forest ecosystems. Thus, cultural carrying capacity models are complex because they include a plethora of subjective information based on

economic losses, human fatalities and injuries, or impacts deer have on forest ecosystems (Minnis and Peyton 1995).

Herd Management Options

The easiest part of deer management is deciding how to manage deer herd numbers during the next year. This is relatively simple because there are only a few options to select from: a decision must be made to have the deer population: 1) increase, 2) decrease, or 3) remain the same. That's it! Decisions are sometimes made to alter the age and sex structure of the herd (e.g., changes in antler restrictions), but usually deer herd sizes are managed from year to year.

Population Ecology of White-tailed Deer

Here is the difficult part, understanding the population ecology of deer and how deer herds respond to different levels of hunting harvests. It is widely accepted in the scientific community that recruitment (i.e., the number of fawns born in spring that survive until fall) in white-tailed deer populations show strong density dependent effects (McCullough 1979, 1984, 1987, 2001, White and Bartmann 1997). *What does this mean?* It means that the number of fawns recruited into the deer herd can decrease even though population numbers increase. *Why?* There is only so much food and cover available to a deer population. Therefore, the amount of food and cover per deer will decrease as deer numbers increase which results in less resources per animal. *How does this impact a deer population?* Each deer in a herd requires a certain amount of food (energy) and cover to survive and reproduce (Moen 1978). The impact deer densities

have on survival and reproduction is negligible provided that food and cover resources per deer are sufficient to their meet baseline metabolic requirements (McCullough 1987). The condition of deer deteriorates when the amount of food available to individual deer is insufficient. *What happens when the physical condition of deer decreases?* Deer will have lower body weights and bucks, particularly yearling males, will have antlers containing fewer points and smaller beam diameters. Further, deer are predisposed to starvation and disease due to their deteriorated physical condition. However, the effect on survival is usually negligible because deer are a long-lived species and most mortality can be attributed to hunting (McCullough 1987). But the effects of deer density on recruitment is much more apparent. *What is the relationship between fawn recruitment and deer density?* Fawn recruitment rates are maximized at low population densities, but recruitment begins to decline when the amount of food available to each deer is not sufficient which causes them to compete for food. Poor food availability reduces fawn recruitment rates because the lactating dam may not be able to adequately supply milk to her fawn. In addition, predation rates may be greater with high deer densities because predators develop a "search image" for newborn fawns and may focus much of their efforts on preying upon fawns. *How does the population ecology of deer relate to their population and harvest management?* Let's first review the principles that were just learned. First, recruitment rates are highest when deer numbers are low, and recruitment rates begin to decline when the deer herd begins to compete for a fixed amount of resources. So when the population is at biological carrying capacity, the deer density may be at its highest but recruitment of fawns will be at its lowest. It is imperative this is understood, because to maintain a population at a particular level, the same number of

deer recruited into a population must also be removed by hunting and natural mortality. The population will decrease if the number of deer that die exceeds the number of deer recruited into the population. Conversely, the population will increase if fawn recruitment exceeds the number of deer that die. The result of low fawn recruitment means that fewer bucks and does can be harvested when populations are high or near their biological carrying capacity. *What deer density will produce the maximum number of bucks to harvest?* The optimum deer density that produces the most fawns and thus the most bucks, is the maximum population level where competition for food is negligible (i.e., maximum sustained yield; McCullough 1987). Additional deer in the population would reduce the number of fawns recruited into the herd due to food limitations and fewer deer would reduce the number of fawns recruited into the herd due to fewer does giving birth to fawns.

Consequences of Harvest Management Options

The long-term consequences of most deer management strategies are very predictable based on what is known about the population ecology of deer and historical management practices. This section discusses deer harvest management strategies that are frequently suggested and/or endorsed by various stakeholder groups.

No Deer Hunting

Unless winter weather conditions frequently impact the deer population thereby regulating their population (this happens along the northern fringe of their range), hunting is absolutely necessary to keep deer herds from growing beyond their biological carrying

capacity (McCullough 1979). *Which stakeholders would probably benefit from this strategy?* People and groups that do not support hunting. *Which stakeholders would probably not approve of this strategy?* Farmers and foresters concerned about economic losses, all deer hunters, taxidermists, meat processors, and people concerned about DVCs or landscaping damage.

Bucks-only Deer Hunting

Similar to no deer hunting, bucks-only hunting results in the deer population growing to its biological carrying capacity (McCullough 1987). Does need to be harvested to control population growth rates. If only bucks were harvested, the deer herd would simply grow beyond its biological carrying capacity and would comprise of mostly females (McCullough 1987). Although hunters would see many antlerless deer, their success rates would be relatively low due to diminished fawn recruitment rates that occur when deer numbers are near or beyond their biological carrying capacity.

Regulated Deer Hunting

Regulated deer hunting, which includes harvesting both bucks and does, has been the primary tool used by wildlife agencies to manage deer populations (Woolf and Roseberry 1998). Regulated deer hunting provides a unique recreational opportunity for those who participate, and is the most fiscally-responsible, effective technique available for controlling deer herd sizes given the technology available and regulations in place today. Whether recreational hunting can control deer populations in the future is a major concern for many wildlife agencies (Brown et al. 2000). The primary concerns about the

future of recreational hunting as a pragmatic deer management tool are: 1) deer populations are on the increase, 2) fewer young hunters are being recruited into the hunting population so hunter numbers are decreasing or will decrease in the future, and 3) much of the land is not hunted which limits the effectiveness of recreational hunting seasons (Brown et al. 2000). In other words, there will be more deer to harvest using fewer hunters that have less land to access deer in the future. Pennsylvania is a classic example of this problem; the number of hunters in Pennsylvania declined more than any other state between 1991 and 1996 (USFWS 1997; Appendix C) and the deer herd has been on the increase (Fig. 3).

Summary

It's imperative to understand the consequences deer management strategies have on population size. Table 1 illustrates which stakeholders would most likely be satisfied based on what we know about their preferences and attitudes and the population ecology of deer. Stakeholder groups that are opposed to hunting would have no problem with a high deer density because the herd would grow to its biological carrying capacity without harvesting antlerless deer and any type of hunting is contradictory to their beliefs. Hunters that want bucks-only hunting or want to maximize the number of deer they see while hunting would also believe high deer densities were acceptable. Also, people wishing to easily observe deer for non-consumptive purposes would want a high deer density. However, these people should also expect to see less diversity in Pennsylvania's flora and fauna under this scenario as well. Hunters who want to maximize buck harvests, have high permit success rates, or practice quality deer management, would

prefer deer densities to be intermediate in size because the deer herd would be at optimal population levels to maximize yield. For the same reason, deer processors and taxidermists wishing to maximize their revenues would want an intermediate deer

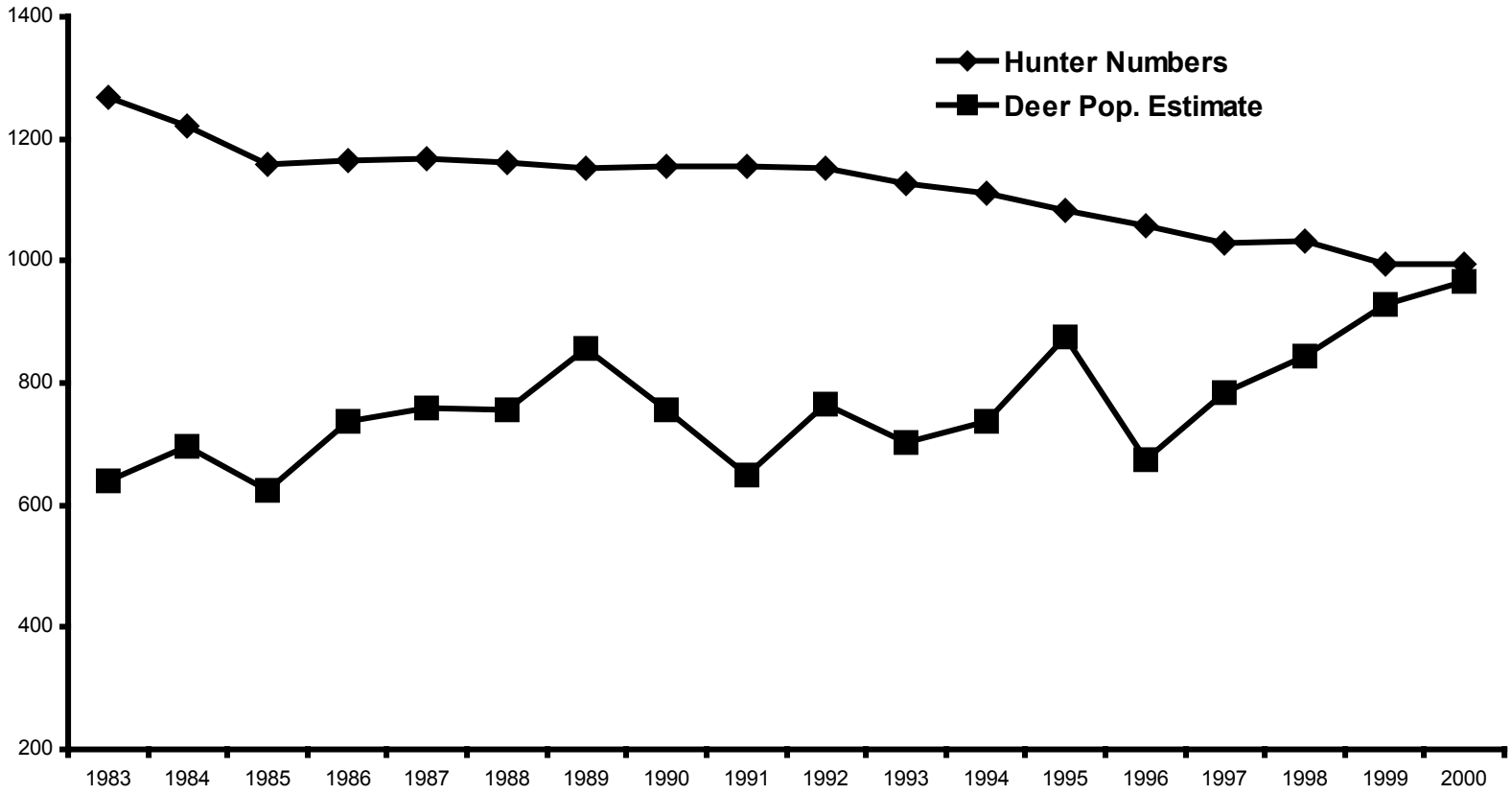

Figure 3. Posthunt deer population estimates based on a Sex-Age-Kill model and number of Pennsylvania hunting licenses purchased, 1983-2000.

Table 1. Deer densities that would likely be preferred by various stakeholders in Pennsylvania. Preferences are based on how each stakeholder is impacted by deer, and what is known about deer population ecology. Concept derived from Roseberry and Woolf (1991).

	Deer Density		
Stakeholder	Low	Intermediate	High
Anti-hunter opposed to recreational hunting	Unsatisfied	Unsatisfied	Satisfied
Hunters who want bucks-only hunting	Unsatisfied	Unsatisfied	Satisfied
People who want to see a lot of deer	Unsatisfied	Unsatisfied	Satisfied
Hunters who want high buck harvests	Unsatisfied	Satisfied	Unsatisfied
Hunters who want high success rates	Unsatisfied	Satisfied	Unsatisfied
Deer processors and taxidermists	Unsatisfied	Satisfied	Unsatisfied
People interested in a healthy deer herd	Satisfied	Satisfied	Unsatisfied
People who are concerned about the environment	Satisfied	Unknown	Unsatisfied
Commuters concerned about DVCs	Satisfied	Unknown	Unsatisfied
Farmers concerned about crop damage	Satisfied	Unknown	Unsatisfied
Foresters concerned about forest regeneration	Satisfied	Unknown	Unsatisfied

density. Pennsylvania residents interested in a safe commute to work would want a low deer density. Farmers, urban residents, and foresters interested in minimizing economic losses caused by deer would also want a low deer density. Also, groups that are concerned about the environment are typically interested in preventing damage to the flora and fauna in forested habitats would also want a low deer density.

Different stakeholders want different deer densities for different reasons; these reasons range from individual beliefs and self-gratification to economics and environmental concerns. Table 1 also depicts why the PGC cannot please everybody in the entire Commonwealth. So which stakeholder wins? This is a primary reason the PGC had stakeholders involved with the development of this deer management plan. The PGC wishes to have this group determine what the acceptable limits are for the various impacts deer have on the people, economy, and environment in Pennsylvania and establish goals and objectives based on these limits. The PGC realizes that not everyone will leave this meeting satisfied because only one deer density can occur at a given time and this will be based, in large part, on the goals and objectives established by this group. The PGC envisions an effective deer management program that aims at a deer herd size that will preserve, protect, and enhance the ecological community deer are in, while striking a balance between the positive and negative impacts deer have on Pennsylvania's economy and residents. We hope your input helps us achieve that goal.

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MANAGEMENT GOALS AND STRATEGIES FOR PENNSYLVANIA'S DEER MANAGEMENT PLAN

Terminology

Goals: The purpose of the deer management program. Six goals are identified in this plan, each one was developed by the stakeholder group to provide direction for the deer management plan.

Objectives: Specific management needs to accommodate the goals. Objectives were proposed by the stakeholder group then revised by the Deer Management Section.

Strategies: Specific management activities that were recommended by the Deer Management Section to accommodate the objectives.

MANAGEMENT VISION STATEMENT:

We will manage deer to restore and provide healthy and sustainable ecosystems with a healthy, viewable, huntable deer herd throughout the Commonwealth for the benefit of our citizens and natural resources compatible with other species and land uses.

GOAL 1:

IMPROVE THE HEALTH AND SUSTAINABILITY OF THE ECOSYSTEM

OBJECTIVE

1.1) Identify a suite of plant and animal species to serve as feedback loops for evaluating the impact white-tailed deer have on wildlife communities and establish achievable goals for the suite of species for each Deer Management Unit by 2004.

Strategy Recommendations 1.1

1.1.1) Identify potential plant and animal species (i.e., indicator species) that could serve as feedback loops via literature review by July 1, 2003.
1.1.2) Develop protocol for collecting baseline data by December 31, 2003.
1.1.3) Quantify indicator species current status by December 31, 2004.
1.1.4) Develop response goals for indicator species by December 31, 2005.
1.1.5) Conduct forest restoration area study (2003-2007) to quantify indicator species recovery at local level and determine feasibility in employing this approach at the statewide level for future deer management practices.

OBJECTIVE

1.2) Implement management strategies to achieve goals established in Objective 1.1 by 2007.

Strategy Recommendations 1.2

1.2.1) Develop a deer-ecosystem simulation model that can provide insight on expectations of indicator species response by December 31, 2005.
1.2.2) Monitor changes in indicator species through 2007 and compare model expectations to observed data.

OBJECTIVE

1.3) Seek and develop support by federal and state agencies, non-governmental organizations, and private landowners for implementing management strategies by 2007.

Strategy Recommendations 1.3

1.3.1) Develop educational materials and conduct educational workshops with public and private landowners to educate landowners about the role deer have in ecosystems.

OBJECTIVE

1.4) Evaluate the impact management strategies have on the suite of indicator species and continually revise management strategies until the suite of indicator species reach their goals established in Objective 1.1 in each Deer Management Unit through 2007.

Strategy Recommendations 1.4

1.4.1) Using the model developed in Strategy 1.2.1, compare expected responses to observed data. Revise management strategies (e.g., increasing antlerless license allocations and/or modifying seasonal framework) until indicator species achieve specified response goals outlined in Strategy 1.1.2.

OBJECTIVE

1.5) Evaluate the impact deer have on the richness and evenness of plant and animal species and manage deer populations to minimize these impacts in each Deer Management Unit by 2007.

Strategy Recommendations 1.5

1.5.1) Using deer exclosures, conduct a biodiversity study that quantifies differences in diversity indices between treated and untreated areas by December 31, 2004.
1.5.2) Monitor changes in diversity indices in untreated areas through 2007.
1.5.3) Incorporate diversity index data into management recommendations by December 31, 2005.

GOAL 2:

PROVIDE PUBLIC AND PRIVATE LANDOWNERS WITH THE DEER MANAGEMENT TOOLS NEEDED TO ACHIEVE THEIR LAND USE OBJECTIVES

OBJECTIVE

2.1) Develop seasons, bag limits, and hunting methods that enable landowners to achieve their deer management and/or land-use objectives through 2007.

Strategy Recommendations 2.1

2.1.1) Continue offering "Red Tags" to farmers experiencing agricultural losses caused by deer through 2007.
2.1.2) By December 31, 2003, evaluate the effectiveness of the "Red Tag" Program and modify the program to maximize its effectiveness in reducing economic losses to tolerable levels for agriculturalists.
2.1.3) By April 2003, develop a Deer Management Assistance Program (DMAP) that will allow all landowners to achieve their land-use objectives.

OBJECTIVE

2.2) Provide technical assistance for administering deer management programs to interested landowners by 2004.

Strategy Recommendations 2.2

2.2.1) After developing a DMAP (Strategy 2.1.3), provide technical assistance to landowners through reviewing deer management plans.
2.2.2) Develop educational materials and workshops for implementing Controlled Hunts by December 31, 2003.

OBJECTIVE

2.3) Develop an effective management program for managing deer in urbanized landscapes by 2004.

Strategy Recommendation 2.3

2.3.1) Where deemed appropriate, modify special regulation counties to special regulation deer management units by April 2003.
2.3.2) Develop educational materials about indirect management strategies (e.g., repellents, fencing, habitat manipulation) and direct management strategies (e.g., recreational and controlled hunting programs, and trap-and-kill and sharpshooting programs) by June 30, 2003. Educational materials will include the pros and cons regarding management efficiency, safety, and costs associated with each management option.

2.3.3) By December 31, 2003, develop an urban deer management program that allows cities, suburban dwellings, and communities/residential associations to select a deer management option that is appropriate for their respective area to achieve their goals and objectives.
2.3.4) Conduct human dimensions study on landowners in special regulation areas to determine preferences for legal tackle in special regulations deer management units by December 31, 2005.

GOAL 3:

IMPROVE AND MAINTAIN A HEALTHY DEER HERD

OBJECTIVE

3.1) Develop a suite of population condition indices for evaluating health of deer populations and establish goals for the suite of indices in each Deer Management Unit by 2005.

Strategy Recommendations 3.1

3.1.1) Develop a deer population model to estimate abundance, describe future trends in abundance, and calculate antlerless license allocations by April 2003.
3.1.2) Identify population and physiological indicators via literature review by July 1, 2003.
3.1.3) Develop protocol and collect condition data on potential indicators by October 1, 2003.
3.1.4) Assess population and physiological indicators current status by December 31, 2003.
3.1.5) Develop response goals for indicators by December 31, 2003.
3.1.6) Collect necessary data to monitor deer abundance and vital statistics in deer populations each year.
3.1.7) Develop deer management modeling system with deer-ecosystem simulation model constructed in Strategy 1.2.1, the simulation model constructed in Strategy 3.1.1, and population/physiological indicators (Strategies 3.1.3 and 3.1.4) and provide management recommendations from this deer management modeling system by December 31, 2007.

OBJECTIVE

3.2) Implement surveillance programs to detect diseases that potentially could threaten the health of statewide deer populations, humans, or livestock in Pennsylvania and implement strategies to minimize disease transmission by 2004.

Strategy Recommendation 3.2

3.2.1) Conduct annual surveillance programs for diseases that affect white-tailed deer when deemed appropriate.

3.2.2) Discourage recreational and supplemental feeding of deer and develop educational materials explaining why feeding deer is not a good practice. Educational materials should be developed and made available by July 1, 2004.

OBJECTIVE

3.3) Develop an effective deer management program that requires only minor changes to achieve goals and objectives established in this plan.

Strategy Recommendations 3.3

3.3.1) Implement all management strategies in this plan.
3.3.2) Recommend additional management strategies only if prescribed management strategies are not meeting goals and objectives outlined in the plan.

GOAL 4:

INCREASE RECREATIONAL OPPORTUNITIES INVOLVING DEER

OBJECTIVE

4.1) Evaluate, develop, and implement effective programs that will increase the number of young deer hunters and minimize desertion of all hunters by 2005.

Strategy Recommendation 4.1

4.1.1) Conduct human dimensions study on adult hunters to assess characteristics and examine potential incentive programs that the PGC could offer to increase hunter retention.
4.1.2) Implement incentive programs based on findings from Objective 4.1.1.
4.1.3) Evaluate management strategies that may increase recruitment and retention of young hunters through literature review and examine youth hunting incentives offered by other wildlife agencies by December 31, 2003.
4.1.4) Continue maximizing hunting and harvesting opportunities for juvenile hunters by offering special seasons (e.g., October Rifle Season) through 2007.
4.1.5) Conduct human dimensions study on youth to improve the understanding about characteristics of juvenile hunters in various regions of Pennsylvania (e.g., urban vs. rural, farmland vs. big woods) by June 30, 2004.

OBJECTIVE

4.2) Evaluate, develop, and implement management programs that maximize access to land for hunters interested in pursuing deer by 2004.

Strategy Recommendation 4.2

4.2.1) Conduct human dimensions study of landowners to address hunting situations by April 2003.

4.2.2) Implement a Deer Management Assistance Program (DMAP; Strategy 2.1.3) that provides incentives for landowners to allow hunters on their property and facilitates relationships between hunters and landowners by April 2003.
4.2.3) Review policies adopted by other wildlife agencies to increase hunter access on private property. Technical report to be complete by December 31, 2003.

OBJECTIVE

4.3) Evaluate impacts season lengths, bag limits, and hunting methods would have on deer populations and maximize number of days afield, bag limits, and hunting methods that will ultimately achieve goals and objectives established in this plan.

Strategy Recommendation 4.3

4.3.1) By December 31, 2006, evaluate the effectiveness of existing statewide hunting regulations in each Deer Management Unit for achieving Goal 1 of this plan.

OBJECTIVE

4.4) Increase non-consumptive recreational opportunities by maximizing deer viewing and related opportunities, and maximizing biodiversity in Pennsylvania ecosystems by minimizing impacts deer have on their habitat.

Strategy Recommendation 4.4

4.4.1) Implement management strategies under Goal 1 to maximize biodiversity thereby improving recreational opportunities for non-consumptive users through 2007.
4.4.2) Promote non-consumptive recreational opportunities and provide educational materials to the public to educate people about deer viewing opportunities by December 31, 2007.

GOAL 5:

INCREASE CITIZEN UNDERSTANDING OF HEALTHY ECOSYSTEMS AND HEALTHY DEER HERDS

OBJECTIVE

5.1) Inform and educate all interested Pennsylvanian's about deer management issues, the roledeer have in Pennsylvania ecosystems, and the importance of regulated hunting in managing deer herds throughout the Commonwealth.

Strategy Recommendations 5.1

5.1.1) Develop educational materials and conduct educational workshops to educate the public-at-large about deer ecology and the role of deer in ecosystems by December 31, 2004.

OBJECTIVE

5.2) Conduct scientific research and inform the public about research results and explain the implications for wildlife management practices to media outlets, in seminars, and educational workshops throughout the Commonwealth.

Strategy Recommendation 5.2

5.2.1) Increase public outreach efforts and inform the public about findings of ongoing research activities through 2007.

GOAL 6:

REDUCE HUMAN/DEER CONFLICTS

OBJECTIVE

6.1) Assess agricultural, urban, ecosystem, vehicular, and forestry damages caused by deer by 2005.

Strategy Recommendation 6.1

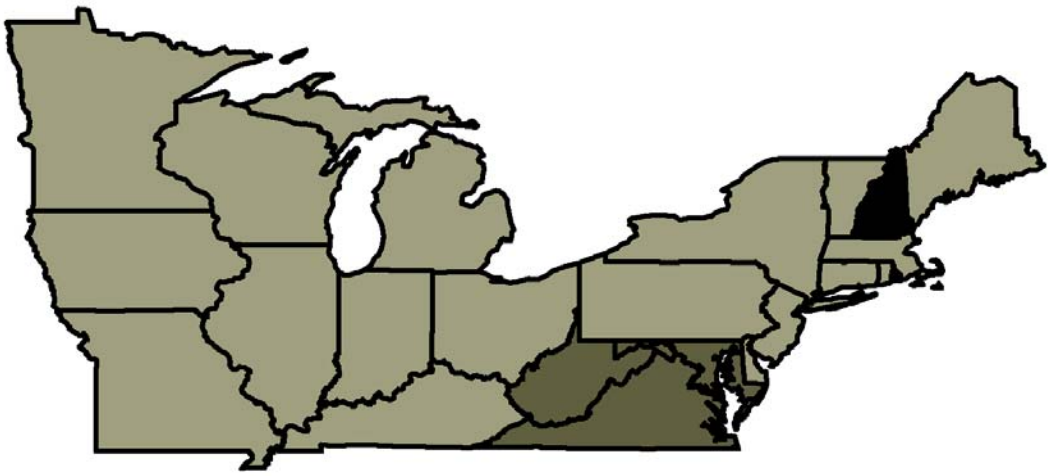
6.1.1) Conduct research to scientifically assess the number of DVCs that occur in each DMU by December 31, 2005.
6.1.2) Collaborate with appropriate state and federal agencies to determine deer damages to agricultural and forestry industries.

OBJECTIVE

6.2) Identify factors that enhance disease transmission in deer herds and implement management strategies that minimize the probability of disease occurrence and transmission rates.

Strategy Recommendation 6.2

6.2.1) Conduct epidemiological research and literature review to identify factors that enhance transmission rates by December 31, 2006.
6.2.2) Implement management strategies to minimize the likelihood of disease occurrence and transmission rates through 2007.

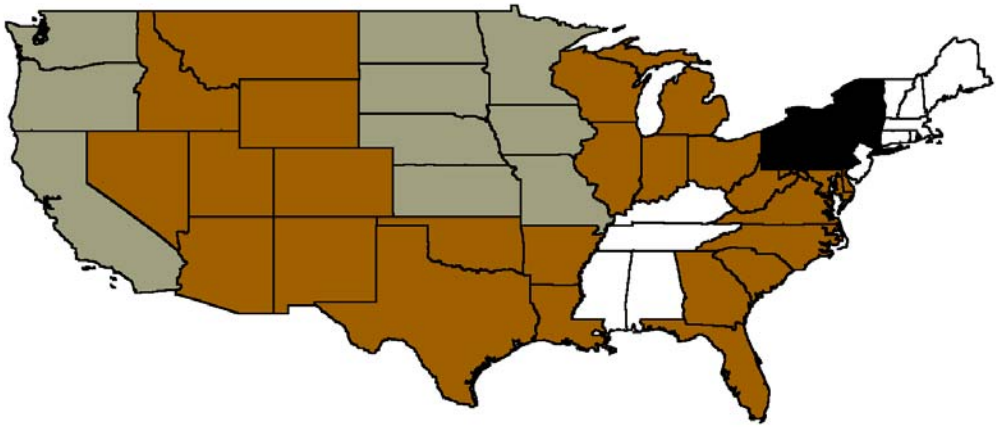


Appendix A. States holding concurrent “buck and doe” seasons statewide (light gray), in parts of the state (dark gray), and separate buck and doe seasons (black) during 2001.

Appendix B. Number of hunters and residents (in thousands) for each state, 1996.

State	Deer Hunters	Rank	Population	Percent of residents that hunt deer	Rank
Alaska	15	49	627	2.4	39
Alabama	269	15	4376	6.1	20
Arkansas	296	13	2552	11.6	8
Arizona	74	38	4830	1.5	43
California	239	21	33867	0.7	50
Colorado	243	20	4060	6	21
Connecticut	42	45	3288	1.3	45
Delaware	28	46	743	3.8	31
Florida	130	31	15317	0.8	49
Georgia	322	11	7739	4.2	30
Hawaii	11	50	1192	0.9	47
Iowa	187	27	2867	6.5	19
Idaho	183	28	1239	14.8	4
Illinois	256	19	12112	2.1	40
Indiana	262	17	5923	4.4	28
Kansas	100	34	2641	3.8	31
Kentucky	271	14	3958	6.8	15
Louisiana	228	22	4376	5.2	24
Massachusetts	76	36	6159	1.2	46
Maryland	109	32	5162	2.1	40
Maine	169	29	1251	13.5	5
Michigan	839	1	9859	8.5	13
Minnesota	473	6	4750	10	10

Mississippi	345	8	2766	12.5	7
Montana	135	30	882	15.3	2
North Carolina	259	18	7600	3.4	35
North Dakota	58	43	638	9.1	12
Nebraska	74	38	1667	4.4	28
New Hampshire	65	41	1189	5.5	23
New Jersey	75	37	8148	0.9	47
New Mexico	56	44	1742	3.2	36
Nevada	28	46	1889	1.5	43
New York	576	4	18212	3.2	36
Ohio	312	12	11238	2.8	38
Oklahoma	224	24	3370	6.6	18
Oregon	221	25	3300	6.7	16
Pennsylvania	810	2	12054	6.7	16
Rhode Island	20	48	990	2	42
South Carolina	228	22	3863	5.9	22
South Dakota	68	40	734	9.3	11
Tennessee	266	16	5470	4.9	26
Texas	752	3	19975	3.8	31
Utah	109	32	2118	5.1	25
Virginia	326	10	6836	4.8	27
Vermont	89	35	593	15	3
Washington	214	26	5797	3.7	34
Wisconsin	552	5	5276	10.5	9
West Virginia	343	9	1820	18.8	1
Wyoming	62	42	482	12.9	6



Appendix C. Regional changes in hunter numbers, 1991-1996. Regions shaded in white reported increases in hunter numbers that exceeded 5%; regions shaded in light gray reported increases in hunter numbers up to 5%; regions shaded in dark gray showed hunter numbers decreased from 0-5%; regions shaded in black reported decreases in hunter numbers exceeding 5%.

Appendix D.

ESTABLISHING GOALS AND OBJECTIVES FOR PENNSYLVANIA'S DEER MANAGEMENT PLAN

Introduction

The Pennsylvania Game Commission (PGC)—Bureau of Wildlife Management currently uses internal and external stakeholders to obtain input on management goals and objectives for all Wildlife Management Plans. Twenty-nine key stakeholders were invited to a meeting to identify goals and objectives for the Deer Management Plan; eighteen were external stakeholders and eleven were internal stakeholders. External stakeholders represented interests of: Sportsmen, Agricultural, Forestry, Environmental-Conservation, Federal and State Agencies, and Urban-Suburban Municipalities. Two legislative and nine PGC representatives were invited as internal stakeholders. An invitational letter was sent to each participant (Appendix A) and the educational portion of the plan (pages 1-42 of this document) was included so each member was provided with the same information about deer biology, ecology and management; and the positive and negative impacts deer have on Pennsylvania's economy, environment, and people.

The meeting was held at the C. Ted Lick Conference Center on the Wildwood Campus of the Harrisburg Area Community College on July 16th, from 10:00 a.m. through 3:00 p.m. Participants for the legislative representatives did not attend, thus, twenty-seven participants were present at this meeting. Franca D'Agostino and William Martin, management consultants from the Bureau of Management Consulting in the Governor's Office of Administration, facilitated the meeting. In large part, the facilitators developed the agenda for this meeting (Appendix B).

Review of the Meeting

Introduction

Deputy Executive Director Michael Schmit welcomed the participants and introduced Dr. Gary Alt, Dr. Marrett Grund, and Wildlife Management Bureau Director Calvin DuBrock to the participants. Michael Schmit also explained the purpose of meeting.

Setting the Stage

Franca D'Agostino provided an overview of the agenda then she conducted an "icebreaker" session. She asked each participant to tell a brief story about their first hunting experience. Twenty-four of twenty-seven members spoke about memorable hunting experiences, three participants who never hunted spoke about other nature-based experiences. Franca then outlined several ground rules which facilitated and expedited

the meeting. The ground rules were: 1) Participate fully, 2) Listen thoughtfully, 3) Disagree openly and constructively, 4) Seek common ground, and 5) One person speaks at a time (Appendix C).

Getting up to Speed

Dr. Gary Alt briefly described the history of deer management in Pennsylvania and some of his experiences as supervising Pennsylvania's Deer Management Program. In addition, he briefly informed the group about some changes in deer management practices that have been made during his tenure and his vision of developing the best deer management program in the country. Marrett Grund asked the stakeholder group if there were questions about the informational component of the Deer Management Plan; no questions were asked.

Shaping the Vision: Characteristics of a Successful Plan

Franca D'Agostino asked the full group to identify primary characteristics of an award-winning Deer Management Plan (Appendix C). After this discussion, the full group broke up into five small groups; each group was asked to develop a vision statement (Appendix C). The full group then reviewed each vision statement developed by the five small groups. The full group unanimously supported the concept of one vision statement. The group then made revisions to this statement and the vast majority of the group agreed to:

We will manage deer to restore and provide healthy and sustainable ecosystems with a healthy, viewable, huntable deer herd throughout the Commonwealth for the benefit of our citizens and natural resources compatible with other species and land uses.

Identifying our Goals

Franca D'Agostino briefly defined and characterized the term "goal," she also provided goal statements developed for other governmental agencies throughout the country. The group then identified categories for "goals" that should be developed to guide the PGC in managing white-tailed deer herds in Pennsylvania (Appendix C). The group then developed eight goals but agreed that two of the goals could serve as objectives for other goals; thus the group unanimously agreed to six goals:

1) To provide public and private landowners with the deer management tools they need to achieve their land use objectives

2) To increase recreational opportunities involving deer

3) To reduce human/deer conflicts

4) To improve the health and sustainability of the ecosystem

5) To increase citizen understanding of healthy ecosystems and deer herds

6) To improve and maintain a healthy deer herd

Prioritizing the Goals

The group was then asked to prioritize these six goals. Each participant was provided with three stickers and each participant was instructed by Franca D'Agostino to place their stickers next to the goal(s) they believed was most important to them and/or their interests. Eighty-one stickers were used by the twenty-seven participants. The priority of the goals were (highest priority to least priority): 4) To improve the health and sustainability of the ecosystem—36 stickers, 1) To provide public and private landowners with the deer management tools they need to achieve their land use objectives—21 stickers, 6) To improve and maintain a healthy deer herd—14 stickers, 2) To increase recreational opportunities involving deer—6 stickers, 5) To increase citizen understanding of healthy ecosystems and deer herds—4 stickers, and 6) To reduce human/deer conflicts—0 stickers.

Identifying the Objectives for Each Goal

Franca D'Agostina defined "objective" and how objectives differed from goals and strategies in the planning process. The full group then broke into small groups to develop objectives for the top five goals; the group was informed they were to develop objectives for the sixth goal as a full group following the development of objectives for the first five goals (goals are rearranged based on highest to lowest priority).

GOAL 1:

TO IMPROVE THE HEALTH AND SUSTAINABILITY OF THE ECOSYSTEM

OBJECTIVES:

A) A list of plant & animal indicator species is developed within the first year to be used for evaluating the health of the ecosystem
B) Adaptive strategies for ecosystem restoration are in place by 2004
C) Ecosystem restoration strategies are fully integrated among all appropriate agencies and organizations by 2005
D) Manage deer herds so that all key indicator species are able to thrive in appropriate habitats by 2007
E) To eliminate the need for fencing for species diversity

GOAL 2:

TO PROVIDE PUBLIC AND PRIVATE LANDOWNERS WITH THE DEER MANAGEMENT TOOLS THEY NEED TO ACHIEVE THEIR LAND USE OBJECTIVES

OBJECTIVES:

A) Increase flexibility in seasons, bag limits and hunting methods to achieve landowner deer management objectives
B) Increase communication and technical assistance on deer management tools available to public and private landowners
C) Provide deer management plans to 80 percent of interested landowners by 2007
D) By 2007, achieve 90 percent of landowner deer management objectives
E) For urban and suburban landowners, provide methods or options in addition to hunting

GOAL 3:

TO IMPROVE AND MAINTAIN A HEALTHY DEER HERD

OBJECTIVES:

A) Determine and manage deer herds based on area-specific herd and habitat conditions rather than overall deer numbers
B) Measure herd health by herd characteristics such as buck:doe ratio, male age class distribution, fawn:doe ratio, mortality, and recruitment. Specifically, improve buck:doe ratio (move closer to 1) and increase percentage of males that are greater than 1 ½ years old
C) Develop & implement monitoring programs for early detection and "prevention" of deer diseases
D) Avoid wild swings in management approach

GOAL 4:

TO INCREASE RECREATIONAL OPPORTUNITIES INVOLVING DEER

OBJECTIVES:

A) Increase hunter retention
B) Increase rate of hunter recruitment by age cohort focusing on youth with a goal of 10 percent
C) Increase total license sales by 100,000
D) Increase the number of non-resident license sales by 10,000
E) Increase average age of deer harvested from 1½ to 3½
F) Complete comprehensive hunter profiles

G) Improve access to lands for hunting
H) Maximize hunter opportunity within sound biological principles
I) Extend hunting seasons
J) Increase non-consumptive recreational experiences
K) Establish baseline data to determine future direction
L) Improve recreational opportunities now limited by deer including other forms of hunting

GOAL 5:

TO INCREASE CITIZEN UNDERSTANDING OF HEALTHY ECOSYSTEMS AND HEALTHY DEER HERDS

OBJECTIVES:

A) Raise "public" awareness of "issues" surrounding deer management in Pennsylvania ("public" – hunting and non hunting; "issues" – safety, ecology, economics, health, etc.)
B) Increase public awareness of the joys of hunting and the value of hunting to control (manage) the deer herd
C) Raise public awareness of current condition of Pennsylvania's ecosystems and the need for restoration
D) Raise public awareness of deer biology & natural history
E) Raise public awareness of wildlife management principles
F) Increase media attention devoted to deer
G) Increase our understanding of deer biology through scientific research
H) Popularize research results to inform citizens
I) Assess baseline of public understanding of deer biology, management and issues
J) Conduct surveys to measure changes in public understanding of deer biology, management and issues
K) Increase participation in hunting
L) Increase awareness of public safety issues

GOAL 6:

TO REDUCE HUMAN/DEER CONFLICTS

OBJECTIVES:

A) To reduce deer-vehicle collisions
B) To reduce transmission of diseases
C) To reduce landscape damage
D) To develop flexible strategies to manage deer in urban/suburban settings
E) Increase public awareness of deer issues, e.g. chronic wasting disease, Lyme disease, backyard feeding
F) To reduce agricultural and forest damage caused by deer

Summary

Franca D'Agostina reviewed goals and objectives outlined during the meeting. Calvin DuBrock then informed the group that the PGC would review the goals and objectives and would begin developing management strategies. Calvin DuBrock and Marrett Grund thanked the participants and the facilitators for their time and efforts. Calvin DuBrock informed the group that they would be able to review the results of the meeting and a document would be prepared to share with the public and seek additional input. The meeting concluded at 3:15 p.m.