



Deer Carrying Capacity: Too Few, Too Many, and for Whom?

by Barbara' McGuinness

Introduction

Management of white-tailed deer is one of Pennsylvania's most controversial issues. This dente, attractive mammal is a valuable and widely appreciated natural resource, yet the impact of the size of the current deer population on forest plant and animal communities and humans is significant.

All of us have some connection with deer. Many people derive considerable pleasure from photographing or simply observing deer in their natural environment. Non-resident and resident hunters pump more than \$1.3 billion into Pennsylvania's economy. Deer/car collisions cost insurers more than 31,000 per collision. Farmers involved in the PA Game Commission's hotspot programs are reporting average annual losses of \$6,400 due to deer damage. Foresters are unable to regenerate many of Pennsylvania's woodlands because of excessive deer browsing.

In this article, we consider the role of white-tailed deer in Pennsylvania. We'll look at the sequence of events leading to the current size of the deer herd in the state (History), the clash between biological¹ and

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cultural carrying capacities (Capacity), the impacts of the white-tailed deer on forest resources (Habitat), and the effect deer density has on the size and biology of the animal (Hunting).

The question is, how many deer are enough? That number depends on your perspective.

History of Deer On the Allegheny Plateau

The history of deer populations in northwestern Pennsylvania has much to do with public perception of what is a healthy size for the deer herd.

Before European settlement, average over-winter deer densities in northwestern Pennsylvania are estimated to have been 10-15 deer per square mile. Deer populations were moderated by predators, food availability, and Native American hunters. As European settlers moved into Pennsylvania, unregulated hunting of deer and its predators became common, and both were nearly eliminated by the turn of the century.

Around 1900, the PA Game Commission began a concerted effort to save Pennsylvania's deer. Hunting was controlled, and deer were imported from other states. At the same time, timber harvesting for construction and the tanning industry, followed by extensive clearcutting for the

wood chemical industry, dramatically changed the look of Pennsylvania's forests.

By the 1930s, nearly all of Pennsylvania's forests had been cut, and the millions of acres of regenerating seedlings meant millions of acres of food for deer. Deer populations soared, from nearly none at the turn of the century to an average over-winter density of more than 50 deer per forested square mile in some areas.

Cycles of boom and bust in deer populations followed in the 1940s through the 1970s. When the regenerating² seedlings grew out of reach of the deer, mass starvation resulted during hard winters. Later, as trees grew to merchantable size, renewed interest in timber harvesting led to more regenerating seedlings³, and conservative hunting seasons caused the deer population to increase again. Many of today's hunters grew up during these periods of high deer populations.

In 1979, the PA Game Commission took a new approach to managing Pennsylvania's deer herd based on over-wintering carrying capacity and availability of woodland habitat for food. The new approach included greater harvests of antlerless deer, resulting in less starvation through the winter.

Today there are approximately 1.2 mil

lion deer in Pennsylvania. Each year, about 400,000 are harvested through hunting and over 40,000 are killed in deer/car collisions. Leaving nearly 800,000 to overwinter each year. Statewide trends show that deer populations are generally rising in western Pennsylvania, stable in southcentral and southeastern Pennsylvania, and declining in northcentral and northeastern Pennsylvania.

Deer density varies greatly across the state, depending on habitat availability and hunting pressure. For the winter of 95-96, the average over-winter deer density statewide was 30 deer per forested square mile. In the four county area surrounding the Allegheny National Forest, average county-wide over-winter densities ranged from 26 in McKean to 33 in Forest County.

Even within a county, deer density is highly variable. Deer pellet group counts across the Allegheny National Forest in 1994 suggest that local over-winter deer densities can range from 13 deer per forested square mile to more than 50 deer per forested square mile, with only a few miles between populations.

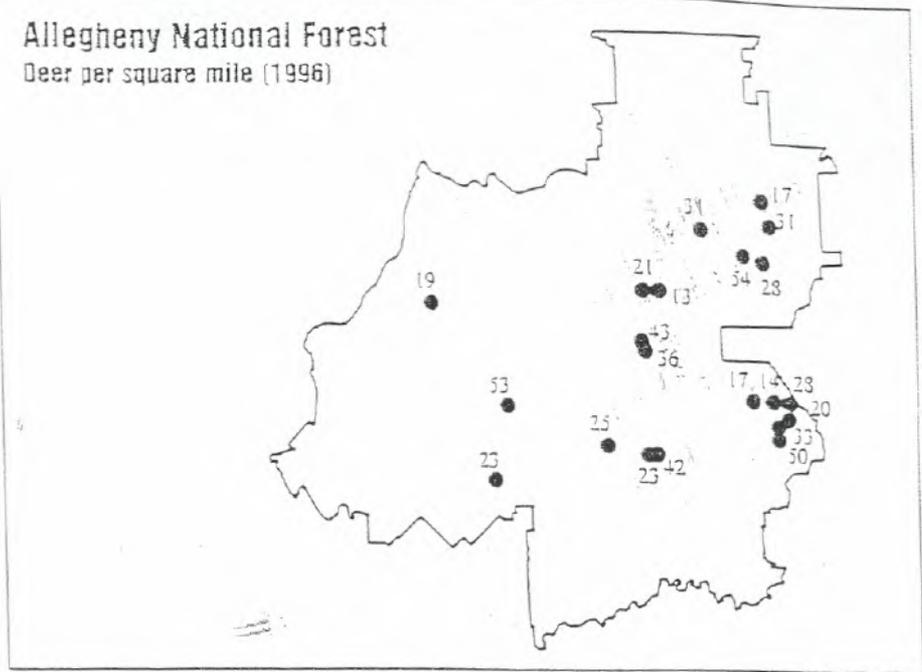
In ecology, the term 'carrying capacity' refers to the number of deer an area can support without degradation of habitat. Habitat refers to the natural resources that offer food, water, shelter and space to animals and plants. There are many kinds of carrying capacity. Deer bring into question two types of carrying capacity; biological and cultural.

In its most basic form, carrying capacity is defined in biological terms, and concerns the number of animals that can be supported by available habitat. The PA Game Commission determines biological carrying capacity by inventorying the types of habitat available across the state and the number of deer these habitats can sustain.

The PA Game Commission has determined that early successional, or young forests, with a lot of young trees and shrubs, can support 50 deer per forested square mile over winter. Pole-timber stands, or forests in which the trees are between 5 and 11 inches in diameter, provide very little habitat for deer, supporting as few as 5 deer per-forested square mile over winter. Mature forests, which provide good cover for deer and moderate amounts of browse and mast (food), can support about 20 deer per forested square mile over winter.

Cultural carrying capacity can be more complicated. It is determined by the density of deer different groups of people would like to have. For hunters and businesses supported by hunters, this number may be very high. Hunters may want to see a lot of deer, and for them, cultural carrying capacity may be 70 or 80 deer per forested

Allegheny National Forest
Deer per square mile (1996)



square mile over winter. Observers of wildlife, or people who like to photograph deer, may also want larger numbers of deer.

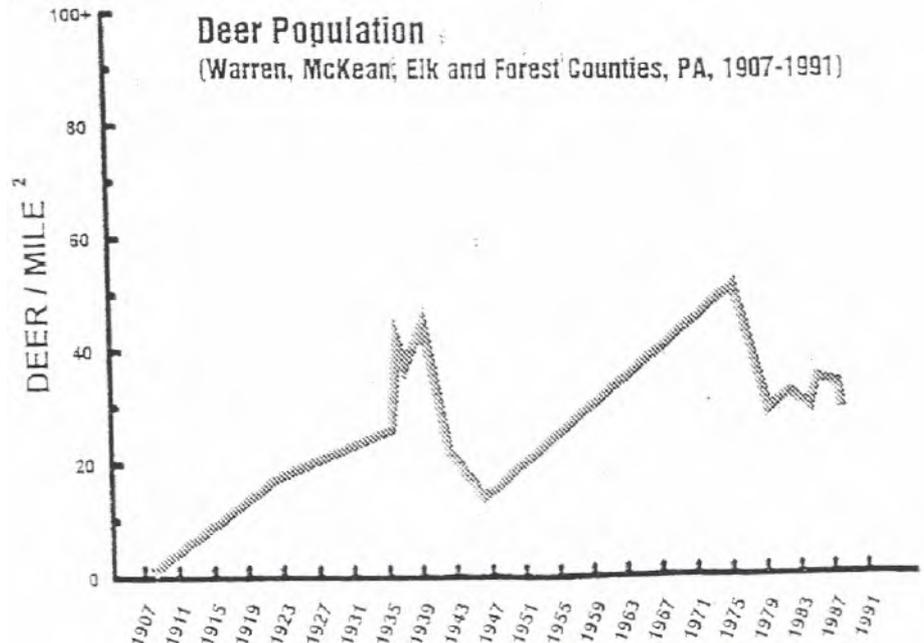
On the other hand, residents of suburban areas may want fewer deer, because deer can do extensive damage to landscaping shrubs and trees. Foresters and farmers also may want lower densities because too many deer eat too much regenerating forest vegetation and crops, and damage wildlife habitat. Wildflower enthusiasts may call for as little as 10-15 deer per forested square mile over winter, because too many browsing deer can decimate areas of wildflowers.

The conflict of white-tailed deer management in Pennsylvania is a question of striking

a balance between biological carrying capacity across a landscape and cultural carrying capacity wants and needs.

Impact of Deer On Forest Resources and Habitat

Studies at the Forestry Sciences Lab in Irvine, PA, show that average over-winter deer densities higher than 20 deer per forested square mile have significant negative impacts on Allegheny hardwood forest communities. The impact of white-tailed deer on forest communities is a function of deer density and habitat availability. Deer need abundant browse, or food, and plenty of cover for protection. When good habitat is readily available, the land can support



higher overwintering deer densities without suffering much damage.

Long-term field studies show that high deer densities directly decrease the number and abundance of tree, shrub, and wildflower species in the forest community. Deer feed preferentially, choosing maple, poplar, hemlock, viburnums, blackberries and orchids, to cite a few examples, over other plant species. These preferred species can actually be eliminated from the forest understory over time. Gradually the diversity and species composition in an area will decline, and deer habitat will be

High deer density can cause forest regeneration failures. In the 1970s, when deer populations were high and biological carrying capacity was moderate, scientists at the Forestry Sciences lab in Warren demonstrated that deer were directly responsible for over 55 percent of forest regeneration failures. Since the 1970s, seedlings from second growth forests in the Allegheny National Forest are being eaten by deer at such a rate that seedlings of preferred tree species are being eliminated, and in many areas only grasses, ferns and few non-preferred species are left.

Grasses and ferns, in particular, create heavy shade on the forest floor, which is not what the seedlings of many species of trees need to become established and thrive. To overcome problems caused by this interfering vegetation, foresters have to use herbicides to kill the interfering vegetation. They also need to install deer exclusion fence to keep the browsing deer away from the young trees. Spraying herbicide and building or maintaining fences are expensive activities.

Deer also directly affect the vertical structure of a forest, and therefore habitat for other wildlife species. A healthy forest has abundant and diverse vegetation from the ground level to the canopy, or highest level, of the trees. Different species of wildlife, especially songbirds, thrive in these different vertical layers.

For example, least flycatchers, indigo buntings, and eastern wood peewees prefer the intermediate layer for nesting and feeding. When heavy deer browsing prevents seedlings from growing into this layer, these wildlife species lose their habitat, and their populations decline.

Wildlife species in the ground layer are also affected. Grouse, rabbits, snowshoe hares and others lose habitat when too many deer browse the forest heavily.

Wherever you see few seedlings, shrubs

or saplings in the weeds. and lots of dresses and ferns, you' now you are in an area with higher deer densities tan the area can support. These are also areas where many different species of wildlife are losing habitat and having a difficult time thriving.

Hearts Content is a good example of the impact deer have on an area. Historic documentation shows that in 1929 Hearts Content had a rich understory of hobblebush and some 100 other species which averaged over 1,600 weedy stems over one foot tall per acre. This amount of vegetation diversity would have supported many species of birds, mammals and other animals. By 1979, when deer populations were high, the same area was nearly devoid of all understory vegetation, with an average of only 13 stems per acre. Nearly all of these stems were beech root suckers, which have no value as deer browse. Wildlife diversity would be low, too, in this habitat condition.

Today, regeneration is reappearing in Hearts Content. What made the difference? Since 1979, the PA Game Commission has been working to bring the deer population down to goal densities averaging 21 deer per forested square mile over winter across the state by increasing the number of female deer harvested each year. Hearts Content is in the center of a local area in which average over-winter deer densities are now 16 deer per forested square mile.

The average on the Allegheny Plateau is now about 20 deer per forested square mile over winter, far less than the 50 deer per forested square mile over winter of the 1970s but still significantly higher than the goal densities. The steady decline in population has allowed forest regeneration to appear, at least in Hearts Content. But elsewhere, the deer densities are still higher than the biological carrying capacity for the land.

Deer have indirect impacts on forest resources, too. Over 20 percent, or 100,000 acres, of the Allegheny National Forest has suffered defoliation from insects or disease since 1990. When heavy deer browse removes regenerating seedlings in a forest hard hit by insect pests or disease, it slows the return of the forest community to a healthy state.

These problems are not specific to Pennsylvania. State foresters in Michigan, Virginia, New Jersey, Wisconsin, West Virginia, Maryland, Iowa and Ohio report emerging problems.

Hunting Concerns

Let's talk about how lowering deer densities would impact hunters in the Allegheny National Forest region. Again, it de-

ends on your perspective—and cultural carrying capacities.

If a hunter only wants to see lots of deer all the time, lower densities are not

capacity would be higher numbers of deer. So consider the impacts of lower densities on quality of deer harvested.

Data from Potter County suggest that both antler development and dressed weight of deer harvested is higher when

the data show that as deer density increases, the number of points on bucks harvested steadily declined. Since 1979, when deer management efforts focused more on bringing overwintering deer densities into balance with available habitat, the number of antler points has risen. The same trends can be seen with dressed buck weight, which only increased when overwintering deer densities decreased.

Some hunters worry that lot

jeopardy in years with severe weather or excessive hunting. But, biology disputes this.

The average doe in good habitat fawns for the first time between 1. and 2 years of age, giving birth to one fawn the first year, and twins in each successive year. When competition for food is high because of poor habitat or high overwintering density, does will either forgo fawning or give birth to only one fawn. When competition is low, or good habitat is particularly abundant, does may give birth to as many as three or, on rare occasions, four fawns in one year.

So, we have a choice: maintain high densities of deer year round, which naturally decreases fawn production and maintains a high number of deer overwintering each year. Or, decrease deer densities, allowing does to have more fawns each year, making them available for that year's hunting season, and lowering the amount of deer overwintering each year.

Either way, deer are available for harvest. But in the latter case, fewer deer are being forced to overwinter with inadequate food supplies. Fewer deer overwintering allows forest wildflowers, shrubs and trees a chance to survive and regenerate a healthy forest, which in turn provides habitat for a wide variety of wildlife.

Pennsylvania's white-tailed deer is a majestic, beautiful animal—a resource for all Pennsylvanians to enjoy. If white-tailed deer can be managed at population levels that are compatible with the biological carrying capacity of the land, we can ensure a sustainable population of deer—and a sustainable and diverse habitat—for generations to come.