

A Plague of Deer

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Unchecked deer populations are causing a decline in forest diversity.
Overbrowsing by deer leaves only the few plant species deer can't digest as survivors.
Managing deer populations through revised hunting practices, however, meets strong resistance.

On the crest of a tall boulder grows a wild garden, bright with the blooms of trillium, mayflower, and Solomon's seal, and shaded by maple, birch, and hemlock trees. The plant life sheltering high on this rock in Pennsylvania's Allegheny National Forest (ANF) is a relic of the long-gone woodlands that once blanketed much of the eastern United States. Today such boulders, which are among the few spots that can't be reached by hungry deer, are diverse islands in a sea of monotony.

Much of the ANF is now dominated by black cherry trees, and the forest floor is covered in a thick mat of hay-scented fern. Both species have been part of the eastern woods for millennia. Now, because deer can't eat them, they've come to overwhelm nearly all their natural competitors. They are among the few successful survivors of a devastating plague of deer.

"The whole eastern US has been overbrowsed for many decades," says Walter Carson of the University of Pittsburgh, who with his students and colleagues has been using the plant refuges on boulder tops to gauge the impacts of deer in the ANF. Uncontrolled deer populations, he



Deer overbrowsing has dramatically reduced the plant diversity of eastern US forests. Grasses and sedges dominate the understory of this forest in Pennsylvania, which would make it difficult for many plant species to recover even if deer populations were eventually brought under control. Photograph: Tom Rooney.

says, have collapsed the diversity of the forest. The only surviving plants are shade tolerant and are either unpalatable to deer or able to regrow quickly after browsing.

Pennsylvania is the state most severely affected by the problem, which began in the early 20th century, when wolves and cougars had been hunted to extinction in the east. Their one-time prey, the white-

tailed deer, were facing the same fate. "It reached the point," Carson says, "where just seeing a deer rated a mention in a small town newspaper." So the Pennsylvania Game Commission brought in deer from Virginia and Wisconsin and put a moratorium on hunting those without antlers.

At the same time, forests across much of the Northeast were being clear-cut, a process that in Pennsylvania was completed by the mid-1930s. As any deer hunter knows, deer love a clear-cut. The new shrubs and grass that spring up in forest openings provide abundant browse. The deer population skyrocketed, and although limited hunting focused on bucks was reinstated, by the 1940s deer were radically changing eastern forests.

The hay-scented fern, for example, once covered less than 3 percent of the forest floor. Now, because it thrives in clear-cuts and deer devour its competitors, it dominates more than a third of the forested area in Pennsylvania and is abundant throughout much of the northeastern United States. Across more than half of the ANF, a carpet of hay-scented fern suppresses the growth of other native herbs and of tree seedlings in the understory. "If all the deer disappeared tomorrow," says Carson, "that dense layer of fern would continue to suppress the growth of new trees." In a recent review published in the *Canadian Journal of Forestry* (vol. 36), Carson and Alejandro Royo examined the formation of such "recalcitrant understory layers" worldwide. A similar pattern of logging and overbrowsing is affecting forests from New Zealand to Europe to North America. Some Pennsylvania clear-cuts where thick growths of fern and grass have taken hold remain empty of new trees 80 years after they were logged.

Understory plants are also hard hit. In a study published in *Science* in February 2005, James McGraw and Mary Ann Furedi of West Virginia University found that wild ginseng, a native herb that has long been collected for export to Asia, is being decimated by deer. Ginseng populations and individual plants have grown progressively smaller over the last century,



This white-tailed doe and calf belong to the large deer population on Anticosti Island. Since their introduction in 1895, deer on Anticosti have undergone a decrease in body size compared with the mainland population in response to the continuous degradation of their habitat.

Does on the island usually reach sexual maturity late and then give birth only once every two years; they also exhibit one of the lowest twinning rates for the species. The growth of fawns is delayed over two years to allow the accumulation of fat reserves required to survive their first solo winter. Photograph: Jean-Pierre Tremblay.

and the harvest has shrunk by a factor of three or four since the 1800s.

In the field, Furedi soon learned to identify plants that had been browsed: They showed a distinctive tear on the stem, and telltale deer tracks or scat were often nearby. A browsed plant won't regrow until the following year, and it will come back smaller, producing fewer flowers and seeds. Based on a survey of 36 ginseng populations spread across eight states, McGraw and Furedi conclude that the species is on the brink of extinction. Most remaining populations are small, worsening the odds of survival. According to McGraw and Furedi's model, even the largest population, comprising 406 plants, has only a 57 percent chance of surviving this century.

"Ginseng is not particularly targeted by deer," says McGraw. "Deer eat it along with many other forest herbs. Trillium species, for instance, are heavily browsed by deer, with similar demographic consequences. I'm concerned that deer overpopulation will result in a desertification

of the forest understory as herbaceous plants become fewer and less diverse."

"Anaemic desuetude"

The impacts of overpopulated deer on plants cascade through whole ecosystems: They've been shown to cause declines in the abundance and diversity of all kinds of forest creatures, from insects to mice to canopy-nesting birds. Perhaps the most dramatic illustrations of the power of deer to overwhelm an ecosystem come from Quebec's Anticosti Island, a landscape that had been empty of deer until 1896, when about 220 of them were brought there. The island's deer population boomed in the late 1920s, probably reaching more than 150,000. Aerial surveys since the late 1960s have produced population estimates ranging from 60,000 to 120,000 deer on the island's 7943 square kilometers.

When Jean-Pierre Tremblay of the Université Laval recently revisited a series of Anticosti study sites that had been sampled in the 1970s, he was startled to

find that deer numbers remain high, although the shrubs that deer prefer to eat had completely disappeared. The animals had been eating balsam fir, ordinarily a food of last resort, taken only in times of starvation. Every fir seedling within reach of a deer had been devoured. The browsing pressure on balsam fir was so intense that the forest was shifting, being taken over by white spruce, which deer cannot eat at all.

Yet the deer endured. Tremblay discovered that they were feeding on balsam fir twigs, along with lichens, that fall out of the forest canopy during winter storms. This manna from above won't last forever, he says. "As the balsam fir forests become mature and die, they are replaced by white spruce that do not offer food for deer. But before starvation reduces the deer population, damage to the native forest occurs that may be difficult to reverse."

Other recent studies on Anticosti reveal deer as creatures that hold power most people may never have imagined. Steve Côté, also of the Université Laval in Quebec, has documented the disappearance of both berry-producing shrubs and

black bears on Anticosti Island since the arrival of deer. Black bears were once abundant there and fattened on a cornucopia of native berries in fall, allowing them to survive their winter hibernation. But during the first half of the 20th century, as deer browsed shrubs into oblivion, bear became rare and finally vanished altogether. The island has no alternative fall food source that can sustain a bear population through the winter. Côté believes this is the first recorded instance of a large carnivore being extirpated by an introduced herbivore.

Deer hunting is the basis of Anticosti Island's economy; people living there have no wish to purge their home of introduced deer. Yet the deer, in the absence of efficient predators, are creating a plant community hostile to their own survival. Even if Anticosti is to be managed as a large deer farm, the numbers of deer must be reduced.

As early as the 1940s, Aldo Leopold, one of the founders of the conservation movement, was documenting the impacts of the human-engineered explosion of deer numbers. He recognized what was happening as a disaster, one

that he and other wildlife managers who participated in the snuffing out of wolves and cougars had helped to create. He described the moment of this realization in his famous essay *Thinking Like A Mountain*: "We reached the old wolf in time to watch a fierce green fire dying in her eyes.... I was young then, and full of trigger-itch; I thought that because fewer wolves meant more deer, that no wolves would mean hunters' paradise. But after seeing the green fire die, I sensed that neither the wolf nor the mountain agreed with such a view. Since then, I have lived to see state after state extirpate its wolves. I have watched the face of many a newly wolfless mountain, and seen the south-facing slopes wrinkle with a maze of new deer trails. I have seen every edible bush and seedling browsed, first to anaemic desuetude, and then to death."

Managing the hunt: A cautionary tale

Over the past 15 years, a wave of new studies has documented a renaissance of plant and animal diversity in Yellowstone National Park following the reintroduction of wolves there in 1995. The top dogs are affecting both the behavior and number of elk in the park, making possible a rebirth of aspen, willow, and other plants that were heavily browsed before.

Leopold's home state of Wisconsin now has its own small wolf population—about 400 animals, descendants of pioneers who made their way back from Minnesota and Michigan, without human assistance, decades after the species had been extirpated farther south. Don Waller of the University of Wisconsin–Madison is working with Wisconsin Department of Natural Resources biologists to measure the effect of the wolf's return: Their data show that where wolves live, the impacts of deer on cedar forests are being mitigated. But most of the state, like the majority of the areas in the eastern United States now heavily affected by deer overpopulation, is not wild enough to allow wolves to survive.

"Deer are changing plant communities dramatically," says Waller. "They eliminate seedlings of hemlock, cedar, and yellow birch and devour most understory plants with conspicuous flowers and fruits." In



Black cherry trees and hay-scented fern dominate Pennsylvania's Allegheny National Forest. They are among the few plant species that can persist in the face of uncontrolled deer populations. Photograph: Alex Royo.

the wake of overbrowsing, grasses, sedges, and balsam fir have become dominant in Wisconsin forests. As in Pennsylvania and Quebec, these changes may be difficult or impossible to reverse.

The best way to control burgeoning numbers of deer, says Waller, is to get people to hunt more like wolves. "We should be shooting does, not bucks," he says. "We should have longer hunting seasons and ask hunters to shoot more than one deer." This kind of approach has been working well on Indian reservations in Wisconsin, which set their own hunting policies, and where hunters focus more on subsistence than on bagging a buck with an impressive rack. But for many hunters, the whole idea of shooting does clashes with traditions that go back to the early 20th century.

Back then, when deer in Wisconsin and most of the eastern United States were recovering from near-extirpation, a brief hunt focused only on bucks made sense. But a century later, this kind of management appears deeply flawed. Changing the pattern is an uphill struggle. Some hunter groups continue to believe that the more deer, the better. They refuse to acknowledge the negative impacts of uncontrolled deer numbers, which include an increase in deer-related car accidents and a growing incidence of Lyme disease, in addition to the devastating effects on forests.

An influential minority of Pennsylvania hunters has stymied efforts to change deer management there. "We now have several generations of deer hunters who've grown up with deer at 40 to 60 animals per square mile," says Carson. "The advocates for keeping deer populations well above sustainable levels are incredibly vocal, well organized, and they win every time." The Pennsylvania Game Commission is controlled not by biologists but by deer hunters, whose license fees provide virtually all the commission's funding. "They think of deer as you would soybeans—the game com-



This enclosure was built in 1983, two years after a mature balsam fir and white birch forest stand were clear-cut. The original stand dominated by balsam fir can be seen in the background. Following deer exclusion, shade-intolerant trees such as white birch have become successfully established. The balsam fir seedling bank, although suppressed by chronic browsing before fencing, now thrive in the understory and will eventually gain dominance again. Outside the enclosure, grasses and white spruce gain a competitive advantage over species preferred by deer and now dominate the field and tree layer. Photograph: Jean-Pierre Tremblay.

mission should produce a lot of it," Carson observes.

Gary Alt, former chief deer biologist for the Pennsylvania Game Commission, tried to change hunting practices. In 1999, Alt, who had worked as the commission's bear biologist for years, was given a new job: fixing the state's deer overpopulation problem. He increased the harvest of does and restricted shooting of bucks, a strategy designed to lower the overall numbers of deer while increasing the availability of large adult bucks most prized by hunters. The new management tactics began to work—but Alt resigned from his job in December 2004, after it became clear that the commissioners, under intense political pressure, were not going to let him stay the course. Although many hunters supported Alt, some who believe with

fundamentalist fervor in their right to abundant deer complained loudly that prey were becoming harder to find.

Alt, who has received awards from the Pennsylvania Wildlife Federation, Audubon Pennsylvania, Safari Club International, and the Quality Deer Management Association for his skills as a public educator, believes that while spreading the word about the realities of overpopulated deer herds is important, it is not enough. Wildlife management agencies like the Pennsylvania Game Commission should be funded by public money, not just by hunters, so that everyone with a stake in the future of forests and wildlife will have a meaningful say in their policies.

Until the politics of deer management change, say biologists like Alt, Waller, and Carson, researchers will be documenting an ongoing catastrophe rather than finding practical solutions to the problem.

Visit these Web sites for more information:

- www.qdma.com (Quality Deer Management Association)
- http://pa.audubon.org/deer_report.html (Audubon Society)

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