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ISSUES – FIGURE SET

Ecological Impacts of High Deer Densities

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White-tailed deer, © Kelly Bolton

THE ISSUE:

Increasing white-tailed deer populations are creating changes in forest ecosystems, conflicts for people, and challenges for wildlife management.

ECOLOGICAL CONTENT:

deer browse, tree demography, breeding bird abundance and diversity, human-wildlife conflicts, stakeholder involvement, and management alternatives

STUDENT-ACTIVE APPROACHES:

turn-to-your neighbor, pairs share, and citizen's argument

STUDENT ASSESSMENTS:

minute paper, short answer questions, concept map, reflective essay

ACKNOWLEDGMENTS:

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OVERVIEW OF THE ECOLOGICAL BACKGROUND

What Is the Ecological Issue?

Management of white-tailed deer (*Odocoileus virginianus*) in the eastern and midwestern United States is a success story gone awry. Once at the brink of extirpation throughout their range, deer populations have burgeoned over the last several decades. This has created unwelcome consequences for farmers, orchardists, homeowners, and motorists including crop damage and more vehicle accidents. Of greater concern to conservation biologists, however, is the possibility that high deer densities might have detrimental effects on the abundance and diversity of forest vegetation and wildlife.

This issue explores the complexity of forest ecosystems with particular emphasis on the effects of expanding deer populations on trees, birds, and people. Using the student active teaching approaches of turn-to-your-neighbor, pairs share, and citizen's argument, this issue addresses the questions: (a) How do deer impact the composition of forest vegetation? (b) How do deer influence habitat for other wildlife? and (c) What challenges exist in the management of white-tailed deer populations? The issue draws upon three primary papers (Rooney et al. 2000, McShea and Rappole 2000, Chase et al. 2002), which examine: (1) deer browse and other factors influencing hemlock regeneration, (2) effects of manipulating deer populations on the abundance and diversity of breeding birds, and (3) decision-making processes for resolving deer management controversies.

Background

By the end of the 19th century market and subsistence hunting had decimated deer populations throughout their range. In response in 1896 the U.S. Supreme Court declared wild animals property of the state. Regulations required hunters to obtain licenses and abide by hunting seasons, bag limits, and sex restrictions (i.e., spare does and fawns and concentrate on bucks) to help deer populations recover. Successful wildlife management through the regulation of hunting was a key factor in the rebound of deer herds. Other factors have also contributed to expanding deer numbers. Human elimination of wolves and mountain lions removed natural predators throughout much of white-tailed deer's range. Human manipulation of land for agriculture and silviculture also improved and expanded habitat for deer, an "edge species" with an affinity for forested landscapes fragmented by open fields. In addition, private landowner decisions to prohibit hunting limited hunter access to many areas, allowing deer populations to grow. Today, the problem of too few deer has in numerous cases become one of too many, posing new challenges for natural resource managers.

Ecological Effects of High Deer Densities

A growing body of ecological studies (see Waller and Alverson 1997 and Russell et al. 2001 for academic reviews or Ness 2003 for a popular review) suggests that high deer density is directly affecting the composition of woody and herbaceous vegetation and indirectly impacting wildlife. Tree species especially palatable to deer, such as

economically valuable oaks, are not regenerating while other species resistant to deer browse, like beech, flourish. The toll on herbaceous plants is also substantial. Local disappearances of numerous plants, such as orchids and lilies, have been documented in woodlands with abundant deer across the East and Midwest. These concerns are especially crucial in protected areas (e.g., nature preserves and national parks) where managers are often attempting to maintain a particular vegetative community.

Beyond the impact on specific trees or other plants, deer can significantly influence wildlife habitat by altering the forest's composition and structure. For example, in a forest where the understory has been largely eaten by deer, habitat for birds requiring a thick understory will decline. On the other hand, birds that prefer an open understory will benefit. Some ecologists have argued that white-tailed deer are a keystone herbivore because they have such large impacts on forest communities (Waller and Alverson 1997). Waller and Alverson (1997:218) define a keystone species as one that: "(1) affects the distribution or abundance of many other species, (2) can affect community structure by strongly modifying patterns of relative abundance among competing species, or (3) affects community structure by affecting the abundance of species at multiple trophic levels." It can be argued that deer fit this description because in high densities they affect trees, shrubs, herbaceous plants, birds, and small mammals. In this issue students will examine two studies: one investigating the relationship between deer densities and hemlock regeneration in the Upper Great Lakes region of the U.S. and the other examining deer's impact on the abundance and diversity of breeding bird populations in northern Virginia.

Although many people assume that deer densities today are far above historical norms, it is surprisingly difficult to know whether this is the case. Addressing this question, McShea et al. (1997) state that: "Deer populations are above densities that existed over large portions of the continent at the turn of the century …, when deer had been extirpated from many parts of their historical range. However, the hypothesis that deer are more abundant now than they were prior to European colonization is equivocal at best. It is extraordinarily difficult to obtain an accurate estimate of pre-colonial population sizes … There is intensive debate about how to obtain accurate counts of existing populations …, let alone how to determine numbers of deer from periods before the counting of deer had even begun."

Anthropogenic Effects

While deer numbers might not exceed biological carrying capacity, in some places they have exceeded human tolerance for deer-related conflicts. In many rural and suburban areas, residents complain that deer damage crops, orchards, and home landscaping. Another complaint is the rise in deer related vehicle accidents. People also fear increased risk of Lyme disease because deer are a host for black-legged or deer ticks (*Ixodes scapularis*), the disease vector. Therefore while many people continue to view deer positively, others perceive deer as a nuisance, like vermin or oversized rats. Finally, some take the perspective that it is not deer but humans that are the problem. For example, increased deer-related vehicle accidents (DRVA's) could equally be

blamed on rising numbers of cars driving on increasing miles of roads as on growing deer populations.

Management Challenges

Decision-making for deer management involves many challenges beyond insufficient data and incomplete understanding of the role deer play in complex ecosystem interactions. A major issue is that interpretation of deer numbers and impacts varies with scale: impacts over a wide spatial scale do not necessarily reflect what is happening at a finer scale. Thus broad-scale regional management strategies are unlikely to adequately address deer impacts within specific refuges. Unacceptable deer impacts on forest communities at a local scale, on the other hand, might be tolerable if species impacted are sufficiently protected on a regional scale. However, even within a determined scale of focus, no “ideal” or “correct” deer density exists. For one thing, flux and change are natural phenomena in forest ecosystems. Attempts to maintain a stable population of deer may be incongruent with goals to maintain ecosystem health.

Resource managers also face political challenges in identifying management alternatives that are acceptable to a wide range of stakeholders interested in deer. In the absence of non-human predators, the main sources of deer mortality are winter die-off and hunting. Hunting, the traditional management tool for regulating deer populations, remains the most common management strategy. Regulations originally designed to help deer herds grow have been revised to reduce populations through the harvest of more does. But the necessary changes in hunter behavior require education and time. In addition, in many locations where problems associated with deer have been identified, local safety ordinances prohibit firearms use or private lands do not allow hunter access. Thus, in some cases, legal changes are necessary for hunting to be an effective management tool.

In suburban areas with intolerable deer-human conflicts, sharpshooting is often the most efficient method of deer control. Sharpshooting involves attracting deer with corn, for example, to a bait site where trained personnel selectively shoot animals in order to cull the herd. Ideally, the deer meat is then donated to a local food pantry. Like hunting, however, sharpshooting elicits moral objections from animal welfare and rights supporters. Other alternatives have demonstrated limited success. Trapping and relocating deer simply moves the problem to another location and stresses the animals. Contraception can help control isolated populations but is expensive and requires repeated treatments for maintenance of deer infertility over time. Researchers and residents are also experimenting with various repellents to deter deer from home landscaping. In this issue students will think critically about trade-offs between deer management alternatives in a citizen’s argument.

Additional Reading

The following articles can be given as reading assignments to enhance students' understanding of this issue:

- Diamond, Jared. 1992. Must we shoot deer to save nature? *Natural History* 101(8):2-6.
- Ness, Eric. 2003. Oh, deer. *Discover*. 24(3):66-71.
- Revkin, Andrew C. 2002. Out of control, deer send ecosystem into chaos. *The New York Times*, Science Times, November 12, Section F, Pages 1, 4.
- Walsh, Robb. 1997. When venison isn't so rare. *Natural History* 106(9):74-76

References

- Chase, L. C., Siemer, W. F. and D. J. Decker. 2002. Designing stakeholder involvement strategies to resolve wildlife management controversies. *Wildlife Society Bulletin* 30(3):937-950.
- Decker, D. J., Brown, T. L. and W. F. Siemer. 2001. *Human Dimensions of Wildlife Management in North America*. Bethesda, MD: The Wildlife Society. 447p.
- McShea, W. J., Underwood, H. B., and J. H. Rappole, eds. 1997. *The Science of Overabundance: Deer Ecology and Population Management*. Washington and London: Smithsonian Institution Press. 402 p.
- McShea, W. J. and J. H. Rappole. 2000. Managing the abundance and diversity of breeding bird populations through manipulation of deer populations. *Conservation Biology* 14(4):1161-1170.
- Ness, Eric. 2003. Oh, deer. *Discover*. 24(3):66-71.
- Rooney, T. P., McCormick, R. J., Solheim, S. L. and D. M. Waller. 2000. Regional variation in recruitment of hemlock seedlings and saplings in the Upper Great Lakes, USA. *Ecological Applications* 10(4):1119-1132.
- Russell, F. L., Zippin, D. B. and N. L. Fowler. 2001. Effects of white-tailed deer (*Odocoileus virginianus*) on plants, plant populations and communities: a review. *American Midland Naturalist* 146:1-26.
- Waller, D. M. and W. S. Alverson. 1997. The white-tailed deer: a keystone herbivore. *Wildlife Society Bulletin* 25(2):217-226.

FIGURE SETS

These are published figures from peer-reviewed research journals and monographs that engage students in data analysis and critical thinking organized by teaching approach, Bloom's Taxonomy cognitive skills, and class size. The student-active approaches listed here are suggestions and examples; modify them as appropriate for your teaching.

Figure Set and Ecological Question	Student-Active Approach	Cognitive Skills	Class Size/Time
(1) Deer Browse and Hemlock Regeneration (Rooney et al. 2000)	turn-to-your-neighbor	comprehension interpretation	any/ moderate
(2) Deer and Birds: Which Species Do Deer Favor? (McShea and Rappole 2000)	pairs share	comprehension interpretation application	any/ moderate
(3) Conflicting Stakes in Deer Management (Chase, Siemer and Decker 2002)	citizen's argument	comprehension interpretation application	small/long

RESOURCES

- "Oh, Deer" feature by Eric Ness in March 2003 issue of *Discover* (http://www.discover.com/issues/mar-03/features/featdeer/)
- Cayuga Heights Deer Project (http://wildlifecontrol.info/chdp/chdp1.htm)
- CDC page on Lyme disease (http://www.cdc.gov/ncidod/dvbid/lyme/)
- Map of Southeastern Deer Populations 1950, 1970, 1980 by Univ. of Georgia (http://www.uga.edu/scwds/dist_maps/wtdeer507080.htm)
- U.S. Map of White-tailed Deer Populations, 1982 by Univ. of Georgia (http://www.uga.edu/scwds/dist_maps/wtdeer82.htm)
- U.S. Map of White-tailed Deer Populations, 1988 by Univ. of Georgia (http://www.uga.edu/scwds/dist_maps/wtdeer88.htm)