

## EXECUTIVE SUMMARY

# Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective Pennsylvania Case Study

## Report of the Deer Management Forum

Roger Earl Latham, Jan Beyea, Merlin Benner, Cindy Adams Dunn,  
Mary Ann Fajvan, Ronald R. Freed, Marrett Grund, Stephen B. Horsley,  
Ann Fowler Rhoads, and Bryon P. Shissler

Convened by Audubon Pennsylvania and the Pennsylvania Habitat Alliance  
to compile and examine the pertinent research, enlist other expertise, weigh the issues,  
and set forth a vision of what ecosystem-based deer management might entail in large  
forested areas of the eastern United States, using Pennsylvania as an example.

100 Wildwood Way  
Harrisburg, Pennsylvania 17110

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White-tailed deer have been a symbol of wild eastern North America throughout the region's history. Deer glimpsed in the woods have thrilled people with their grace and stateliness and venison at the campfire and table has provided savor and sustenance. But the history of deer-human interaction in the last two centuries is one of overexploitation through unregulated hunting, followed by 100 years of overprotection, population increase, and consequent habitat destruction resulting from overbrowsing by growing deer herds.

This report, using Pennsylvania as an example, addresses the seriously degraded ecological condition of forests across much of the East, which has resulted in large part from high deer densities. Forested ecosystems are among the region's most valuable natural resources; they protect our water supply, regulate climate, house a large diversity of organisms, and provide recreational opportunities. Pennsylvania's forests were a major source of timber in the United States in the mid-1800s, and could always be counted on to regenerate naturally. Timber harvesting continues to be a vital industry in the state; however, today when trees die or are harvested, natural replacement no longer follows as a matter of course. In many parts of the state, even where seed supplies are available, regeneration of most tree species does not occur unless the affected areas are fenced to exclude deer.

Deer, a natural and highly valued part of our forested ecosystems, were nearly eliminated from Pennsylvania by the late 1800s due to unregulated hunting. The Pennsylvania Game Commission (P.G.C.) was established in 1895 in part to "bring back" the deer. They were so successful that as early as the late teens and early 1920s concern was expressed about the negative effects of too many deer on forests in some parts of the state. Over time, high deer populations in most of Pennsylvania and across nearby states have greatly altered forest understories. The abundance of native wildflowers and other forest-floor plants has been greatly diminished, shrub species have been dramatically decreased or eliminated, and the variety of tree species has declined. Birds and other wildlife that depend on forest vegetation have also been affected. To the casual observer the woods still look green, but they are much altered. In place of the diverse, multi-storied vegetation that was the norm, there are just a few species, either not preferred by deer or resilient to repeated browsing, for example, hay-scented and New York ferns, striped maple, American beech, and several introduced, invasive species. Once the few

tolerant or resistant species spread, their shade makes it difficult for most other members of the native flora to regenerate even if deer numbers are later reduced.

Recognizing that traditional management formulas have been major contributing factors to high deer populations, wildlife agencies are increasingly turning to approaches that focus on the whole ecosystem rather than a single species, taking into account forest structure, diversity of animal and plant species, ecological processes, and ecosystem function in management decisions.

In October 2001 a panel of scientists and experts in natural resource policy was convened by Audubon Pennsylvania and the Pennsylvania Habitat Alliance to review what is known about the impact of deer overabundance and craft a program for approaching deer management from an ecosystem perspective. The group, known as the Deer Management Forum, reviewed relevant scientific research, interviewed a wide range of experts from across the United States, visited field sites, and prepared this report on its findings and recommendations. A draft of the report was reviewed by 10 outside scientists and managers and was discussed with staff of the Pennsylvania Game Commission (P.G.C.). However, the reviewers were not asked to endorse the conclusions or recommendations, nor have they seen the final report before its release.

The major premise of the Deer Management Forum is that restoration and maintenance of fully functional forest ecosystems, containing a full component of native biological diversity at all levels, best serve the long-term interests of the people of Pennsylvania and the region. We recognize that the goal of bringing back the understory vegetation and ensuring the continuation of a rich overstory layer into the future is a values choice.

A switch to ecosystem-based management would involve a program to maintain or restore ecosystem structures and processes, not just healthy populations of deer. It could be carried out using the decision-support concept of adaptive resource management (A.R.M.), which is a science-based way of “learning by doing” that involves five steps:

- (1) Set and quantify a resource management goal, based on a set of core values that most stakeholders can agree upon.
- (2) Identify competing biological theories that are pertinent to meeting the overall management goal, and the management recommendations that follow from each theory.
- (3) Based on past research and experience, pick what is initially believed to be the best combination of management actions (e.g., reducing deer density to 20 per square mile, avoiding the use of herbicides) and implement the combination in an experimental context.
- (4) Make quantitative predictions of the results of management actions for each competing biological theory or model and compare the predictions against field data at regular

intervals (e.g., every 3 years), tracking changes in indicator species and other environmental indicators in both managed areas and appropriate comparison areas.

- (5) Update the set of management actions, giving preference to the recommendations that flow from those theories (models) that performed best in the comparisons.

A.R.M. does not require consensus on the causes of current forest problems. Managers start by ranking existing theories, using the judgment of a range of experts. Once begun, the A.R.M. process is automatically self-correcting; weights of competing theories are adjusted by applying a formula to indicator data. Based on a comprehensive review of the scientific literature, the authors recommend giving an initial 90% weight to theories that point to deer as a major cause of forest alteration and a 10% weight to theories that say deer have a negligible effect.

Implementing A.R.M. in Pennsylvania depends on the Game Commission, the Department of Conservation and Natural Resources (D.C.N.R.), and private groups building a consensus on goals and assembling the necessary expertise. A.R.M. protocols would be chosen by agency staff with the advice of a broad-based, ad hoc, research advisory committee. An ad hoc, public advisory committee would be formed to represent public constituencies, keep abreast of scientific progress, and provide feedback to managers and researchers to help ensure that choices are made that will be supported by stakeholders and the general public. An example of an A.R.M. program is outlined, with acknowledgment that other approaches to ecosystem management are possible.

The authors further recommend that P.G.C. commissioners update their mission statement and written deer management policy to reflect current understanding of wildlife management principles and recognize the role of deer management in protecting ecosystems and stakeholder values. P.G.C. needs to provide all property owners whose goal includes restoring or sustaining forest structure, diversity, ecological processes, or ecosystem function the ability to manage deer in ways that will enable them to achieve those goals. While still using hunting as the primary management tool, P.G.C. needs to establish new funding sources that represent its broader constituencies and provide its full range of stakeholders an opportunity to participate in management decision processes. Expanding wildlife management from the present single-species approach to an ecosystem focus will require changes in P.G.C. policy, administration, organization, and staffing.

### ***Major Findings Regarding Science and Management of Forests and Wildlife***

- (1) Pennsylvania's forested ecosystems have been severely altered. Virtually all of the published literature on forest damage in Pennsylvania suggests a major role for high densities of white-tailed deer.

- (2) In the areas that have been affected the longest by high deer densities, the diversity of canopy tree species has decreased. Even in some areas that have sustained high deer densities for just a few decades or less, understory tree and shrub layers have been diminished in species diversity, height, and density or completely eliminated, and the formerly diverse ground layer has been reduced to ferns and a few other species that are either not preferred by deer or resilient to repeated browsing.
- (3) As a result of the elimination of large predators in the 1700s and 1800s, humans are the only species still present in Pennsylvania capable of maintaining the population density of white-tailed deer in balance with its habitat. Active intervention by humans to keep deer populations below levels that severely alter the composition and diversity of forests will have to be sustained forever, assuming that it is impractical to restore the full complement of predators across the entire range of white-tailed deer in the state. Hunters are critical to the success of deer population management because hunting is currently the only feasible method of regulating deer populations on a large scale.
- (4) Adaptive resource management (A.R.M.) is a science-based methodology that is well suited to managing deer from an ecosystem perspective while accommodating disagreements over models of forest dynamics or causes of forest alteration. The A.R.M. approach provides for testing competing scientific models or hypotheses about how forests and wildlife populations function while, at the same time, providing a framework for regular management decisions to be made and implemented based on the best available information.
- (5) Two major challenges exist in implementing A.R.M. for deer in Pennsylvania. First, management objectives must be determined in the political arena before A.R.M. can proceed. Second, recovery of the structure, diversity, and function of forest ecosystems may take years or decades. Evaluating progress over a multi-year time frame presents difficulties when deer harvest goals need to be set annually.
- (6) The initial commitments involved in preparing A.R.M. alternatives could be made within existing budget authorizations, provided agencies are willing to assign staff to the process. However, because of the great damage that has already been done to the structure of forests and the depletion of the seed supply in many parts of the state, a long-term commitment to the A.R.M. process is needed.
- (7) The sooner effective treatments are implemented, the sooner further deterioration will be prevented, saving larger areas of forested land in Pennsylvania from slipping below the threshold for fast recovery.

## ***Major Findings Regarding Policy and Administration***

- (1) The goal of bringing back the understory vegetation and ensuring the continuation of a self-renewing and diverse forest overstory into the future is not a scientific choice but, instead, a values choice.
- (2) With the exception of a vocal minority of hunters, there is a broad consensus that deer densities in Pennsylvania are too high from an ecosystem perspective. In a 2003 survey of Pennsylvanians, the general public ranked managing deer to promote healthy and sustainable forests highest among potential goals (average 7.5 of 10, with 10 meaning complete agreement) and hunters and anglers ranked it even higher (7.8 of 10). Pennsylvania hunters and anglers ranked managing deer to promote healthy and sustainable forests higher than managing deer to promote hunting opportunities (7.8 vs. 7.1 of 10). The stakeholder group P.G.C. convened to recommend goals and objectives for its statewide deer management plan also ranked managing deer to promote healthy forests and ecosystems as its top goal.
- (3) P.G.C.'s Deer Management Assistance Program (DMAP) provides for increasing the number of deer harvest permits allocated on specific land units at the owner's request. It is intended as a tool for landowners to manage deer on their own property in line with their values.
- (4) In a reevaluation of D.C.N.R.'s state forest system in 2004, Scientific Certification Systems predicted that overabundant deer will continue to decimate the flora and fauna in Pennsylvania's state forests without:
  - (a) enhanced DMAP regulations that allow more liberal harvest of antlerless deer on state forest lands and are granted to the D.C.N.R. Bureau of Forestry on a continuing and contingency basis by the P.G.C. commissioners; or
  - (b) legislative fiat, whereby administration and control of deer hunting regulations on District Forests are transferred from P.G.C. to D.C.N.R.; or
  - (c) merger of P.G.C. with D.C.N.R. in a combined natural resource agency resulting in oversight of hunting regulations by a more balanced representation of natural resource interests. Note: both agencies are on record in opposition to such a merger and there appears to be no real political will to pursue it at this time.
- (5) The P.G.C. commissioners, in response to proposals by staff to bring the deer herd more in line with its habitat and to protect commercially valuable trees, set targets for lower deer densities in Pennsylvania in 1979; however, those goals have never been met. In a renewed effort to reduce deer population levels, numerous changes were made in the deer management program from 1998 through 2003. However, the deer herd continued to increase and remains today at 20% above the 1998 level.

- (6) Adopting a program of managing deer from an ecosystem perspective would provide both advantages and challenges for P.G.C. Ecosystem considerations would lead to the conclusion that deer densities in some parts of the state should be reduced below levels that would be set solely by considerations of deer health and condition. This would require targets even lower than those P.G.C. has been unable to reach in the past. The reaction of some hunters to lower densities may be negative but the 2003 survey results indicate that the majority of hunters would support the goal of managing deer to promote healthy and sustainable forests.
- (7) With the reorganization in 1999 of the Wildlife Management Bureau (with Dr. Gary Alt named chief of the newly formed Deer Management Section) and the support of agency policy makers, P.G.C. is poised to pursue a more aggressive deer management program that, in theory, can effectively reduce deer densities in many parts of Pennsylvania. Its success depends critically on whether the changes are formalized in a way that enables them to last through the turnover of personnel on the staff and Board of Commissioners.
- (8) P.G.C. senior staff members argue that they have done all that is possible to manage deer under the current sociopolitical environment. While we find there are many more measures that the P.G.C. staff could and should implement, we do not minimize the sociopolitical forces under which P.G.C. staff members must operate.
- (9) The management of deer is a service provided to all citizens of Pennsylvania, yet P.G.C. is currently funded primarily by license dollars and timber-harvest revenues from game lands. Neither source is predicted to be sustainable in the long term. In the results of a 2003 survey of Pennsylvania residents, 71% of the respondents agreed that a greater proportion of resource agency budgets should go toward non-game wildlife and threatened and endangered species (11% disagreed). Sportsmen supported this concept also, with 70% of hunters and anglers agreeing and 11% disagreeing. A more stable and equitable funding base is required if P.G.C. is to meet broader conservation goals.
- (10) Of all the new measures initiated in recent years by P.G.C., the most intricate is DMAP, which shifts some responsibilities away from P.G.C. for choosing deer densities, transferring it to landowners who can apply for additional permits for use solely on their properties. However, most of Pennsylvania's land is privately owned and the vast majority of landowners do not understand the ecological impacts of deer overbrowsing. Thus, most of Pennsylvania's land will not benefit from any science-based application of DMAP.
- (11) P.G.C. gives mixed messages about the need for ecosystem considerations. This reflects a mix of *internal* stakeholders with differing views and is evidence of an ongoing debate within the staff and Board of Commissioners about the future of the agency. For instance, P.G.C.'s web site discusses forest damage caused by high deer populations, as does the current deer population management plan. However, P.G.C.'s main strategic planning

document, developed by senior staff members, does not acknowledge that high wildlife populations can be a problem for ecosystems nor does it concede that the agency has failed to bring the deer population in line with past targets.

- (12) Although the P.G.C. staff is strong in the areas of deer biology and in implementing and enforcing regulations to make hunting safe, the current staff has limited expertise in the field of general ecology. External reviews have found that P.G.C. operates primarily as a law enforcement agency, with its limited number of biologists isolated and, with few exceptions, not engaged in the core functions of the agency. With resources historically directed mainly at law enforcement, P.G.C. is struggling with making the transition from a law enforcement agency to a natural resource agency — a transition that most state agencies made many years ago.
- (13) There is an unusual three-way resource management structure in Pennsylvania with responsibility given by the legislature to P.G.C. for mammals and birds, to the Pennsylvania Fish and Boat Commission (P.F.B.C.) for aquatic animals, and to D.C.N.R. for forests. This situation tends to reinforce single-species management at P.G.C.
- (14) State agencies that are responsible for, affect, or have a stake in the management of natural resources in Pennsylvania are not collaborating to ensure that policies by one agency do not adversely affect another's ability to carry out its mission. For instance, at present D.C.N.R. cannot fully implement ecosystem management on its lands because it does not have the necessary authority to manage deer populations in state forests and state parks.
- (15) The prevailing wisdom about what the public will support is not always right. For example, there is a perception by some Pennsylvania residents that maintaining the separation between the state agencies managing Pennsylvania's natural resources is strongly supported by the general public. However, the statewide survey of randomly selected Pennsylvania households conducted in December 2003 indicated that 75% of respondents were in favor of combining P.G.C., P.F.B.C., and D.C.N.R. into a single agency provided that the single agency would result in a more efficient or cost-effective system for managing natural resources. Nonetheless the three agencies are on record in opposition to such a merger and, in any case, achieving a change of this magnitude would require an improbably large expenditure of political capital.

### ***Major Recommendations Regarding Science and Management of Forests and Wildlife***

- (1) Until proven otherwise, policy makers should assume that the consensus view on the impacts of the current high densities of white-tailed deer on forest ecosystems is correct.

- (2) Deer management should focus on managing the ecosystems of which deer are a part. Deer densities in Pennsylvania's major forested areas should be brought down to levels that will allow the restoration of full forest structure, diversity, ecological processes, and ecosystem function.
- (3) Adaptive resource management (A.R.M.) should be chosen as the framework for implementing management of deer from an ecosystem perspective. The science-based approach of A.R.M. will allow agencies to begin applying remedies based on the best available information while updating their operational theories as new data become available.
- (4) Forum members propose a two-tiered A.R.M. program. The first tier would apply to the state as a whole. Its initial treatments would take into account factors that go beyond ecosystem management, for example, budgetary constraints and local traditions. The second tier would apply A.R.M. at a smaller scale, to multiple 10-square-mile forest treatment and comparison areas in all of the major forest regions of the state. In contrast to the first tier, treatments on these forest recovery-monitoring tracts would include a range of deer densities, as well as tests of alternative theories on causes of forest degradation and recovery. The focus would be exclusively on ecosystem management. Lessons learned from these smaller-scale manipulations could be applied to forested areas across the state as a whole in subsequent years.

### ***Major Recommendations Regarding Policy and Administration***

- (1) The Governor and the General Assembly, in collaboration with P.G.C., should identify a funding base that is more stable and equitable than funding derived exclusively from sources such as license dollars and timber sales on game lands, in order to facilitate the shift from single-species management to ecosystem management.
- (2) To identify the most effective way for P.G.C. to achieve its mission, the commissioner system should be reviewed by the Governor and the General Assembly. If the system is retained, it should be changed to ensure that the commissioners represent all the citizens of Pennsylvania, not just those who hunt. Although the Governor now has the power to do this through the appointment process, the General Assembly also should give its approval to broad representation on the Board of Commissioners.
- (3) The General Assembly should modify P.G.C.'s enabling legislation to make it unambiguously clear that part of the agency's mission is to resolve wildlife-human conflicts and protect forest ecosystems.
- (4) P.G.C. should formally review its staffing capabilities and in-house training. The management of wildlife in Pennsylvania from an ecosystem perspective requires P.G.C. and perhaps other natural resource agencies to employ more wildlife biologists, ecologists, and

other scientifically trained staff members in key positions within central and regional office structures. P.G.C. should also improve training of all staff members on ecosystem issues. To facilitate effective dialogue with hunters, P.G.C. should bring into core positions more people with both strong biological backgrounds and good communication skills.

- (5) Until such time as P.G.C. can successfully bring deer densities down to previously approved targets and be well on its way to implementing ecosystem management, an annual review of P.G.C.'s mission, organization, skill mix, policies, funding adequacy, funding sources, and priorities, along with the sociopolitical obstacles it faces, should be conducted by an independent entity appointed by the Governor and the General Assembly. These reviews would build on past reports by the Management Assistance Team, Legislative Budget and Finance Committee, and others, together with input from P.G.C. staff members on recent changes and difficulties.
- (6) Public agencies need to lead by example in managing forestlands. P.G.C., in conjunction with D.C.N.R. and with assistance from the Governor, should address the conditions that must be met to maintain continued certification of the state forest system, particularly regarding the adverse effects of deer. In addition, P.G.C. should ensure sustainability of forests on state game lands by developing and implementing an ecologically based forest inventory and forest management plan. When necessary, sections of state game lands should be entered into DMAP.

### ***Looking Forward***

The Deer Management Forum hopes that this report and our findings and recommendations will serve to facilitate a partnership between Pennsylvania's natural resource agencies and their public and private stakeholders to bring about significant changes in the way deer are managed in the Commonwealth. Forum members also hope that the report will be useful in other parts of eastern North America where uncontrolled growth of white-tailed deer populations has adversely affected forest structure, diversity, ecological processes, and ecosystem function.

Management on an ecosystem basis is essential to address the threats and stresses on our forests. Resolving the deer impacts will enable us to move forward on effective resolution of other forest health issues. We have shown that ecosystem-based management is feasible and that scientific methodologies exist to achieve it; however, it will require substantial commitment and willingness to adopt new approaches. A partnership among agencies, landowners, and other stakeholders, based on a common vision and goals, is the key to achieving success.

## The Deer Management Forum

In April 2001, the Pennsylvania office of the National Audubon Society and the Pennsylvania Habitat Alliance asked a group of professionals to look at deer management from an ecosystem perspective. The resulting Deer Management Forum, first convened in October 2001, was asked to set forth a vision of what ecosystem-based deer management might entail. In particular, the group was asked to describe how deer management might differ from current practices if deer were managed within an ecosystem framework that aims to conserve native biodiversity. Only with such a vision in hand could decision makers, should they be so inclined, take the steps that will be needed to move deer management in Pennsylvania from a single-species approach to ecosystem management.

Roger Earl Latham, Ph.D. (Editor and contributor)

Ecologist/Conservation Biologist  
Continental Conservation

Jan Beyea, Ph.D. (Facilitator and contributor)

Senior Scientist  
Consulting in the Public Interest

Merlin Benner

Wildlife Biologist  
Pennsylvania Department of Conservation and Natural Resources

Cindy Adams Dunn\*

Director, Office of Education, Communications and Partnerships  
Pennsylvania Department of Conservation and Natural Resources

Mary Ann Fajvan, Ph.D.

Research Silviculturist  
U.S. Forest Service, Northeastern Research Station

Ronald R. Freed

Former Chairman  
Pennsylvania Habitat Alliance

Marrett Grund, Ph.D.†

Deer Project Leader, Farmland Wildlife Populations and Research Group  
Minnesota Department of Natural Resources

Stephen B. Horsley, Ph.D.

Plant Physiologist  
U.S. Forest Service, Northeastern Research Station

Ann Fowler Rhoads, Ph.D.

Senior Botanist  
Pennsylvania Flora Project, Morris Arboretum of the University of Pennsylvania

Bryon P. Shissler

Wildlife Biologist/Consultant to Audubon Pennsylvania  
N.R.C., Inc.

\* Position during the Deer Management Forum process: Executive Director, Audubon Pennsylvania, Harrisburg

† Position during the Deer Management Forum process: Wildlife Biologist, Deer Management Section, Pennsylvania Game Commission

## Reviewers

The draft version of this report or portions of it have been reviewed by 10 experienced scientists and managers. However, the reviewers were not asked to endorse the conclusions or recommendations, nor have they seen the final report before its release.

Kip P. Adams

Director

Northeast Regional Office, Quality Deer Management Association

David R. DeWalle, Ph.D.

Professor of Forest Hydrology

School of Forest Resources, Pennsylvania State University

Malcolm Hunter, Jr., Ph.D.

Professor of Conservation Biology

Department of Wildlife Ecology, University of Maine

William J. McShea, Ph.D.

Research Scientist

Conservation and Research Center, Smithsonian Institution

Ben Moyer

Editor, *Pennsylvania Sportsman* magazine

Outdoor Writer, *Pittsburgh Post-Gazette*

William F. Porter, Ph.D.

Director, Adirondack Ecological Center

Director, Roosevelt Wild Life Station

Professor of Wildlife Ecology

Department of Environmental and Forest Biology, State University of New York

Timothy D. Schaeffer, Ph.D.

Central Pennsylvania Regional Director

Pennsylvania Environmental Council

Susan L. Stout, Ph.D.

Silviculturist; Research Project Leader

Forestry Sciences Laboratory, U.S. Forest Service

Daniel Townsend, Ph.D.

Associate Professor of Ecology

Department of Biology, University of Scranton

Robert J. Warren, Ph.D.

President of the Wildlife Society

Professor of Wildlife Ecology and Management

School of Forest Resources, University of Georgia

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## **Availability**

The full report is available for downloading in portable document format (PDF) at the Audubon Pennsylvania web site ([pa.audubon.org](http://pa.audubon.org)). Paper copies may be obtained on request while supplies last, with prepayment of \$5 to cover postage, from:

Audubon Pennsylvania  
100 Wildwood Way  
Harrisburg, Pennsylvania 17110.

## **Contact information**

For further information or to contact any of the authors, write to [facilitator@woodsandwildlife.org](mailto:facilitator@woodsandwildlife.org).