Appendices

Appendix A. Biographies of members of the Deer Management Forum

Merlin Benner

Merlin Benner is the Wildlife Biologist for the Pennsylvania Department of Conservation and Natural Resources' Bureau of Forestry, and has served in that role for the past 11 years. His responsibilities to D.C.N.R. include advising the agency on wildlife issues related to the management of the state forest system. Deer impact has been a major component of his duties.

Mr. Benner received his B.S. in Wildlife Science from Unity College in Maine, and his M.S. in Wildlife Biology from Tennessee Technological University. In the interim, he worked as Wildlife Technician at the Savannah River Ecology Laboratory of the University of Georgia.

Mr. Benner serves on a number of statewide committees concerned with the conservation of wild resources in the Commonwealth. He also serves as a director on the board of the Pennsylvania Institute for Conservation Education.

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

Jan Beyea is a regular member of panels and boards of the National Research Council of the National Academy of Sciences, and is thus familiar with the production of policy reports based on science. He is an advisor to the Division of Engineering and Physical Sciences of the National Research Council. Over the years, Dr. Beyea has researched, written, or testified on virtually every environmental issue. He is the author of over 100 articles and reports that span a diverse range of topics, including risk assessment, wildlife ecology, human epidemiology, and science/law issues. He was a co-founder of the Audubon-P. & G. research partnership on wildlife impacts of forest harvest options in northeastern Pennsylvania and is a co-author of the five resulting publications, including "Adequacy of natural hardwood regeneration on forestlands in northeastern Pennsylvania" (1998, *Northern Journal of Applied Forestry* **15**), which deals with deer impacts.

Dr. Beyea spent 15 years at the National Audubon Society as Senior Scientist, and ultimately as Chief Scientist and Vice President. Currently, he is Senior Scientist at Consulting in the Public Interest, Lambertville, New Jersey, providing scientific assistance to not-for-profits, universities, government, and injured plaintiffs.

Cindy Adams Dunn

Cindy Dunn is a former Executive Director of Audubon Pennsylvania, which has 28,000 members and 24 local chapters. Her work there was to facilitate the goals of Audubon in Pennsylvania, including the protection of 79 Important Bird Areas and the establishment of a

network of Audubon Centers and education endeavors. Audubon's primary policy work includes conservation funding and forest habitat.

In 2003 Ms. Dunn was appointed Director of the Office of Education, Communications and Partnerships at the Pennsylvania Department of Conservation and Natural Resources to oversee all communications, community relations activities, and education development. Prior to her position at Audubon, she worked for 10 years as the Pennsylvania Director of the Alliance for the Chesapeake Bay. She has also worked as Air Quality Specialist for the Department of Environmental Resources and Environmental Educator for the Chesapeake Bay Foundation.

Ms. Dunn served as a member of the Governor's 21st Century Environment Commission and the Natural Diversity Task Force and was Chair of the Community Watershed Task Force of the Chesapeake Bay Program. She serves on the boards of 10,000 Friends of Pennsylvania, Pennsylvania Organization for Watersheds and Rivers, Pennsylvania Environmental Council, and the Biodiversity Partnership. She was awarded Conservationist of the Year by the Pennsylvania Federation of Sportsmen's Clubs and the Pennsylvania Wildlife Federation.

Ms. Dunn holds an M.S. in Biology from Shippensburg University.

Mary Ann Fajvan, Ph.D.

Mary Ann Fajvan received a B.S. in Forest Management from Rutgers University, an M.F.S. degree from the Yale School of Forestry and Environmental Studies, and a Ph.D from the University of Maine. Both of her graduate degrees are in the areas of quantitative silviculture and forest stand dynamics. She was an instructor in forest resources extension at Penn State University and served for over 11 years as Associate Professor in the Division of Forestry at West Virginia University, teaching and conducting research in silviculture and forest stand dynamics. She is currently Research Silviculturist at the U.S. Forest Service, Northeastern Research Station, Morgantown, West Virginia.

Dr. Fajvan's research focuses on forest response to natural and human disturbance. She has examined the effects of gypsy moth defoliation on forest structure and development and the effects of harvesting practices on forest dynamics. She also has several long-term studies in place examining the effects of shelterwood harvests, prescribed fire, and diameter-limit harvesting on residual stand development and regeneration. She coordinated the West Virginia survey associated with a study assessing harvesting practices that was conducted simultaneously in Pennsylvania and New York.

Dr. Fajvan serves as an Associate Editor for the *Northern Journal of Applied Forestry*. In January, 2001, she received a Charles Bullard Fellowship in Forest Research from Harvard University and spent 6 months conducting research on forest disturbance with scientists at the Harvard Forest.

Ronald R. Freed

Ron Freed is a former Policy Analyst for Audubon Pennsylvania. He is the founder and former chairman of the Pennsylvania Habitat Alliance, a coalition of conservation, sportsmen and land trust organizations. Mr. Freed's extensive list of volunteer experience includes past Chairman of the Board of the Pennsylvania Wildlife Federation, former Pennsylvania affiliate representative to the National Wildlife Federation, and various positions within the Pennsylvania Federation of Sportsmen's Clubs. He currently serves on the Pennsylvania Biodiversity Partnership Policy Task Force and the Ralph Abele Conservation Scholarship Fund Board. Mr. Freed has also served on several special groups, including the Wildlife Management Institute and Pennsylvania Game Commission's Deer Management Working Group, the Forest Stewardship Committee, and the D.C.N.R. Habitat Advisory Committee. He retired after 30 years with Sprint, where he was the Director of Information and Administrative Services. He holds a B.S. in Education from Shippensburg University.

Marrett Grund, Ph.D.

Marrett Grund is the Deer Project Leader for the Minnesota Department of Natural Resources' Farmland Wildlife Research and Populations Group. He received a B.S. in ecology from Minnesota State University, an M.S. in fisheries and wildlife from the University of Missouri, and a Ph.D. in zoology (wildlife ecology) from Southern Illinois University. He was employed as a Wildlife Biologist for the Pennsylvania Game Commission from 2001 to 2004 and supervised the Deer Research and Management Section during his last year of service.

Dr. Grund's research focuses on deer population ecology and modeling and game harvest theory and management. He has studied white-tailed deer in urban, agricultural, and forested landscapes since 1992. His doctoral dissertation research focused on deer population modeling and estimation at the broad landscape level. Currently, his research includes validating population modeling estimates using distance sampling and aerial surveys and evaluating biological, ecological, social, political, and fiscal impacts of alternative deer management strategies in Minnesota.

Stephen B. Horsley, Ph.D.

Steve Horsley received a B.S. in Forestry from Penn State University, an M.S. in Forest Ecology from the Department of Forestry and Wildlife Management at the University of Massachusetts, and a Ph.D. in Plant Physiology from the Department of Forestry and Wildlife Management at the University of Massachusetts. Since 1972, Dr. Horsley has worked as Plant Physiologist at the U.S. Forest Service Northeastern Research Station. He has been located at the Northeastern Research Station in Irvine, Pennsylvania, since 1973.

During his career, Dr. Horsley has worked extensively on problems of forest regeneration, including plant-plant and herbivore-plant interference relationships and methods of vegetation management. Recently he and his collaborators have studied the factors contributing to sugar maple decline in Pennsylvania.

Dr. Horsley serves as an Associate Editor of the *Canadian Journal of Forest Research* and previously was an Associate Editor of *Forest Science*. He has served as national chairman of the Society of American Foresters Physiology Working Group and chairman of Division 2.08 of the International Union of Forestry Research Organizations. He is Adjunct Professor in the School of Forest Resources at Penn State University and Adjunct Professor at the State University of New York, College of Environmental Science and Forestry.

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

Roger Latham's career as an ecologist, conservation biologist, and environmental planner spans 31 years. His basic research is on plant diversity patterns, from micro- to global scales. He does applied research and planning as a consultant for The Nature Conservancy, Natural Lands Trust, National Park Service, and other organizations and agencies involved in wildland management.

Since earning his B.A. in biology at Swarthmore College and his Ph.D. in biology at the University of Pennsylvania, he has also served as Director of Science and Stewardship and Stewardship Ecologist for The Nature Conservancy in Pennsylvania; post-doctoral researcher in fire ecology and forest biogeochemistry at the Department of Geology, University of Pennsylvania; and Assistant Professor in the Department of Biology at Swarthmore College.

His work has been published in top ecological journals, including *Ecology*, *American Naturalist*, *Oikos*, *Quarterly Review of Biology*, *Biodiversity and Conservation, Landscape Ecology, Forest Ecology and Management*, and *Canadian Journal of Forest Research*. His scientific publications also include chapters in peer-reviewed books and proceedings: *Species Diversity in Ecological Communities: Historical and Geographical Perspectives* (R. E. Ricklefs and D. Schluter, 1993, U. of Chicago Press); *Global Biodiversity Assessment* (V. H. Heywood, 1995, Cambridge U. Press/U.N. Environmental Programme); and *Shrublands and Early-successional Forests: Critical Habitats Dependent on Disturbance in the Northeastern United States* (J. A. Litvaitis et al., 2003, Elsevier). He currently serves as Editor of *Bartonia*, the journal of the Philadelphia Botanical Club, and is working on a book about the vegetation of Pennsylvania and how earth history, geology, climate, hydrology, soil processes, fire, and human influences have shaped it.

Ann Fowler Rhoads, Ph.D.

Ann Rhoads received her Ph.D. from Rutgers, The State University of New Jersey. She has been a member of the staff of the Morris Arboretum of the University of Pennsylvania for 25 years where her present title is Senior Botanist. She is also Adjunct Professor of Biology at the University of Pennsylvania and a research associate in the Botany Department at the Academy of Natural Sciences of Philadelphia.

Her work has included the establishment of the Pennsylvania Flora Database, which contains records of the more than 3,300 different kinds of plants that grow in Pennsylvania. She also works on documenting the status of endangered, threatened, and rare plants for the Pennsylvania Natural Heritage Program. In 1999, Dr. Rhoads completed *Natural Areas Inventory of Bucks County, Pennsylvania*, in conjunction with the county open space initiative. Current projects include an inventory of state park natural areas for the Pennsylvania Bureau of State Parks and an inventory of aquatic plants of glacial lakes in northeastern Pennsylvania.

Dr. Rhoads was principal author of two recent books published by the University of Pennsylvania Press. *Trees of Pennsylvania, a Complete Reference Guide* (2004) includes drawings and color photographs, descriptions, keys, range maps, and information on uses by wildlife and humans, historical significance, and habitat relations of the state's native and naturalized tree species. *The Plants of Pennsylvania, an Illustrated Manual* (2000) contains keys, descriptions and over 2,500 illustrations of all the plants known to grow in the state. In 1993 the American Philosophical Society published her previous book, *The Vascular Flora of Pennsylvania: Annotated Checklist and Atlas*.

She serves on the Ecosystem Management Advisory Committee to the Pennsylvania Bureau of Forestry, is past President of the Pennsylvania Biological Survey, and was a member of the founding committee and, later, the Executive Board of the Pennsylvania Biodiversity Partnership.

Bryon P. Shissler

Bryon Shissler is a Certified Wildlife Biologist and the President of Natural Resource Consultants, Inc., a firm that provides a broad range of ecological services including assisting communities, park systems, and private landowners with the assessment and management of localized deer problems. Currently, Mr. Shissler is serving as a consultant to Audubon Pennsylvania on deer and forest ecology issues with a focus on assisting the Pennsylvania Game Commission and Department of Conservation and Natural Resources in the design and implementation of an ecosystem-based deer management program for the state of Pennsylvania. Other clients have included Scientific Certification Systems, which contracts with N.R.C., Inc. to provide third-party forest management evaluations under the International Forest Stewardship

Council's Principles and Criteria guidelines to municipalities, international corporations, utility companies, and private landowners with long-term conservation goals.

Mr. Shissler has published over 85 juried and popular articles on forest ecology, natural history, and natural resources management, served as a columnist for *Pennsylvania Wildlife* and as Conservation Editor for the *Pennsylvania Sportsmen Magazine*. He conducts public meetings as a consultant to municipalities on controversial issues such as deer management, goose control, and land-use issues and has served on such groups as the Lancaster County Growth Management Task Force, State Forest Stewardship Committee, D.C.N.R. Ecosystem Management Advisory Committee, Governor's Sportsmen Advisory Council, Wildlife Management Institute, the Pennsylvania Game Commission's Deer Management Working Group, and the Forest Stewardship Council, Certification Working Group, Central Appalachian Region.

Mr. Shissler received a B.S. in Biology from Penn State University and an M.S. in Wildlife Management from West Virginia University.

Appendix B. Forum presentations and interviews

Presentations

"Informed decision making: adaptive resource management," Dr. William L. Kendall, Research Biometrician, Patuxent Wildlife Research Center, U.S. Geological Survey, Laurel, Maryland

"Adaptive management of invasive exotic plants in Philadelphia's Fairmont Park system," Dr. James N. McNair, Head, Quantitative Population Biology Section, Patrick Center for Environmental Research, Academy of Natural Sciences of Philadelphia

"Plant indicators of deer browsing intensity," Dr. Roger C. Anderson, Professor of Ecology, Department of Biology, Illinois State University, Normal

"Deer management in the Southeast — recent changes in regulations and population/harvest responses," Dr. Karl V. Miller, Associate Professor, Warnell School of Forest Resources, University of Georgia, Athens

"Some thoughts on monitoring and managing deer herds," John L. Roseberry, Senior Scientist (Emeritus), Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale

"Regional bioconservation," Dr. Michael Soulé, Research Professor (Emeritus), Environmental Studies Department, University of California, Santa Cruz

"Human dimensions of deer management," Dr. Jody W. Enck, Research Associate, Department of Natural Resources, Cornell University, Ithaca, New York

"Deer hunting and deer hunters: what we have and what hunters want," Dr. Harry Zinn, Assistant Professor, School of Hotel, Restaurant and Recreation Management Program, Pennsylvania State University, University Park

"Ecosystem management," Dr. Malcolm L. Hunter, Jr., Professor, Department of Wildlife Ecology, University of Maine, Orono

Interviews

Subject: forest succession; Dr. Walter P. Carson, Associate Professor, Department of Biological Sciences, University of Pittsburgh

Subject: importance of soil acidity for growth of vegetation; Dr. David R. DeWalle, Professor of Forest Hydrology, School of Forest Resources, Pennsylvania State University, University Park

Subject: acid rain impacts on vegetation; Dr. William E. Sharpe, Professor of Forest Hydrology, School of Forest Resources, Pennsylvania State University, University Park

Appendix C. Forum field trips

Recent clearcut and deer exclosures on State Game Land 211, Dauphin County, Pennsylvania (15 May 2002)

J. Hassinger, S. B. Horsley, and R. E. Latham visited a recent clearcut in State Game Land 211 surrounded by a large area of dense oak-mixed hardwood forest. Regeneration consisted of small oak seedlings almost entirely overtopped by tall seedlings of non-oak species. The stop illustrated that even when some oak seedlings become established, they typically are outgrown by competitors that emphasize height growth in early life rather than below-ground root growth as oaks do. Oaks were judged unlikely to become a major component of the future stand.

Nearly all Forum members, together with guest speaker Dr. Michael Soulé, visited six deer exclosures in a 12-acre Bureau of Forestry forest management demonstration site in State Game Land 21. The small size and number of exclosures, the lack of an experimental design, and the availability of alternative forage made it difficult to draw any conclusions about deer impacts on the forest. The exclosures were more of a demonstration of the impacts of different forest cutting intensities on successional trajectories than a demonstration of the impacts of deer. Forum members decided to schedule additional field trips to look at sites where controlled experiments have been set up specifically to look at deer impacts on forests, particularly in non-residential areas.

Impacts of deer on regeneration in Allegheny Plateau forests, Warren, McKean, and Jefferson Counties, Pennsylvania (9 and 10 July 2002)

All Forum members made a 2-day trip to view the impacts of deer on regeneration of northern (and Allegheny) hardwoods and oaks in northwestern Pennsylvania. The first stop, on private land, featured a comparison of adjacent fenced and unfenced stands 3 years after the final overstory removal cut of a shelterwood harvest sequence in an oak-northern hardwood stand. The unfenced stand showed heavy browsing on seedlings of red maple, black cherry, sweet birch, *Rubus*, and American beech not protected by slash. Protected from browsing amid slash piles, seedlings were growing well. Between slash piles there were fern-covered “eat-outs” with few or no seedlings. The adjacent fenced stand had dense, tall seedlings of red maple, black cherry, sweet birch, and oaks.

The second stop was at the Hearts Content Natural Area in the Allegheny National Forest. Forum members saw regeneration of eastern hemlock, eastern white pine, and hobblebush, which occurred following a reduced impact of deer in the late 1980s and early 1990s resulting from a deer density decrease and a simultaneous increase in forage availability in the area. This

was the first cohort of these species to appear in the Hearts Content area since the 1920s. Two small fenced exclosures placed in the area in the late 1980s also showed regeneration of sweet birch, eastern hemlock, red maple, devil's-walkingstick, cucumbertree, and *Rubus* inside the fences. Most of these browse-sensitive species were not regenerating outside the fences.

The third stop was at the oak management strategies research site maintained by the U.S. Forest Service's Northeastern Research Station in the Allegheny National Forest. Forum members viewed a comparison of fenced (since 1989) versus unfenced areas in an oak stand managed by single-tree selection. The unfenced stand had many new germinants of northern red oak that resulted from the 2001 bumper seed crop. These seedlings were too small and their root systems not yet sufficiently developed for them to be considered as established. There is little other regeneration. The fenced stand had many large well-established northern red oak seedlings from two previous cohorts as well as large seedlings of sweet birch and other species.

The fourth stop was in an unfenced Allegheny hardwood stand in the Allegheny National Forest, clearcut in 1982 when deer density was 40 to 60 deer per square mile and there was little forage in the vicinity. The stand also had been treated with nitrogen and phosphorus fertilizer to force seedlings to grow their leaf canopies out of reach of deer quickly. The trees, now about 25 years old, were nearly all black cherry, a species not preferred by deer. A second, adjacent stand was a mixture of black cherry and sweet birch. This stand resulted from a 1997 clearcut together with the lower deer impact level prevailing at that time (30 to 40 deer per square mile with more alternative forage from other cuts in the vicinity). Many other species that are more highly preferred by deer than black cherry and sweet birch were not present. These species require lower levels of deer impact to regenerate.

The fifth stop was a thinned northern hardwood stand in the Allegheny National Forest with a moderately dense fern understory and heavy deer browsing on seedlings. The overstory appeared not to be an impediment to seedling development. It was projected that seedlings probably could grow into larger size classes if deer impact were to be reduced to a low level, but if it remains high ferns will close in and most of the species of seedlings present will not be able to grow through their dense shade.

The sixth stop was a fenced northern hardwood stand in the Allegheny National Forest where the final overstory removal cut had been made recently. Inside the fence many species of trees and *Rubus* were regenerating. Outside the fence regeneration was not occurring.

The next day Forum members journeyed to the Pennsylvania Department of Conservation and Natural Resources' Clear Creek State Forest to view the regeneration of oaks. Stops were made in three stands. The first was an oak stand that originated after a fire in 1905 and has not been cut. There were many new oak germinants from the 2001 seed crop, but these did not have deep roots and there were no older oak seedlings. At the second stand, members were able to

compare unfenced and fenced areas 4 years after a shelterwood cut. The unfenced area was heavily covered with hay-scented fern and there was little regeneration of any species. The fenced area had many large oak seedlings, *Rubus*, and established seedlings of about a dozen other hardwood species. Oaks generally were overtopped by the other hardwood species. The nearby third stand had been similar to the second stand prior to the use of a prescription burn to remove fire-sensitive non-oak species that compete with oak. During the visit, 2 years after the burn, there were many large, well-established oak seedlings that were growing well.

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Appendix D: Responses to review comments

The draft version of this report or portions of it were reviewed by the respected scientists and wildlife management specialists listed below. We are very grateful for their generous contribution of time and expertise. Naturally, we were pleased by the complimentary language,[1] but we were also grateful to reviewers for pointing out problems and shortcomings in the draft report, which enabled us to improve the final product.

Kip Adams
Director
Northeast Regional Office, Quality Deer Management Association
Hanover, Pennsylvania 17331

Dr. David R. DeWalle
Professor of Forest Hydrology
School of Forest Resources, Pennsylvania State University
University Park, Pennsylvania 16802

Dr. Malcolm Hunter. Jr.
Professor of Conservation Biology
Department of Wildlife Ecology, University of Maine
Orono, Maine 04469

Dr. William J. McShea
Research Scientist
Conservation and Research Center, Smithsonian Institution
Front Royal, Viriginia 22630

Ben Moyer
Editor, *Pennsylvania Sportsman* magazine; Outdoor Writer, Pittsburgh *Post-Gazette*
Farmington, Pennsylvania 15437

Dr. William F. Porter
Professor of Wildlife Ecology; Director, Adirondack Ecological Center; Director, Roosevelt Wild Life Station
Department of Environmental and Forest Biology
State University of New York
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Dr. Timothy D. Schaeffer
Central Pennsylvania Regional Director
Pennsylvania Environmental Council
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Dr. Susan L. Stout
Silviculturist; Research Project Leader
Forestry Sciences Laboratory, U.S. Forest Service
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Dr. Daniel Townsend
Associate Professor of Ecology
Department of Biology, University of Scranton
Scranton, Pennsylvania 18510-4625

Dr. Robert J. Warren
President of the Wildlife Society
Professor of Wildlife Ecology and Management
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Athens,Georgia30602-2152

The draft letter to the reviewers stated:

First and foremost, we are interested in the accuracy of the findings presented in each chapter you choose to review. Next, we would like your opinion as to whether or not the recommendations follow from the findings.

In addition to the findings and recommendations, there are interpretations of the scientific literature made throughout the report. You may well have comments on them.

We were able to incorporate the vast majority of suggestions made by the reviewers and to address shortcomings that they identified, either by modifying the content of the report, providing additional references, or explaining our intent and meaning more clearly. We made changes or clarifications in over 180 places in the draft report that were directly attributable to reviewer comments. However, the reviewers have not seen our responses, nor were they ever asked to endorse our recommendations.

Perhaps the most serious criticism rendered by a reviewer was the statement that in the draft report we had not separated values sufficiently from science. We thought we had done so in the original, but have made the distinction clearer in the final version. We have removed terms that might be construed as value-laden. We have explicitly stated that the goals of ecosystem management, such as the preservation of biodiversity, are value choices.

Certain suggestions made by the reviewers went beyond the scope of the report:

(1) We were urged to consider issues of landscape scale in the interaction of deer with vegetation. This is an important topic but it is still evolving in the scientific literature and would have required extensive discussion for us to do justice to it. Nevertheless, we have included some relevant material about landscape-scale issues in Chapter 11.

(2) One reviewer wanted us to flesh out our brief mention of cultural carrying capacity. We added a small amount of pertinent text, but time limitations made it impractical for us to comply more fully with this suggestion.

(3) It was suggested that the report "should, in fact, be of two parts, one directed at the policy makers and general public (a third audience that includes such diverse groups as hunters, private landowners and animal rights advocates), and the second a technical section that will satisfy those who require a more rigorous exposition." This comment came in too late to allow the major revisions that adoption of the recommendation would have entailed. Forum members are aware of the dichotomy of style in the report. Future documents based on this report could make the material more accessible to nonprofessional audiences. Furthermore, our report is scientifically general; future efforts will be required to work out all the details of our recommendations.

(4) One reviewer commented: "Hunting is a great tool that should be the primary tool, but hunters will never substitute for real predators. There are two components to deer foraging:

numerical and functional. Hunters can reduce the numerical abundance of deer but they will not be nearly as effective as predators in shifting their behavior to avoid areas and reduce foraging times. I would hope somewhere in the vast state could support a predator population." Although Forum members are sympathetic to the idea of supporting a large-predator population somewhere in Pennsylvania, it does not seem likely that it would have much of an impact on deer density statewide, given the limited potential size and range of a large-predator population in a state with 12 million human residents and nearly one-third of its land area in farms, suburbs, and other prime deer habitat where large predators may never be welcome. Nevertheless, we did add a small amount of text and supporting citations indicating that, although hunters can reduce the numerical abundance of deer, they are much less effective than predators in shifting deer behavior to avoid large portions of remote areas and reduce foraging time.

(5) One reviewer thought there could be more attention to the local government decisions that are driving fragmentation. This is certainly an important issue, but dealing with the fragmentation of Pennsylvania's forests is beyond the scope of the report, as we now explicitly note in the section on limitations in the Introduction.

(6) This same reviewer felt that we did not go deeply enough into the possible resistance that might emerge to an A.R.M. approach. Our report is merely the beginning of a process and we had to choose an endpoint for this piece. Our charge was to lay out a vision of how managing deer from an ecosystem perspective could be achieved. It is beyond the scope of the report to go deeply into the issue of potential resistance, although, clearly, stakeholders and advisory groups will have to come on board for the program to be implemented.

(7) One reviewer questioned our reliance on plant indicators as a surrogate for animal species: "Most of the literature I have read says bioindicators rarely indicate much beyond that species. If you are interested in migratory birds then migratory birds should be measured." Certainly, in the long run data should be collected on the diversity of a range of organisms to verify that we are achieving the desired goals, but Forum members see no way to avoid the use of a relatively narrow set of surrogates in the short-term. Because animals are dependent on suitable habitat, we assume in the report that plants (including trees), which provide the basis for forested habitats, can be used as a surrogate measure for the recovery of the entire community (including animals and other organisms that are not plants). A further assumption, subject to ongoing verification, is that a suite of carefully chosen plant indicators will be sufficient as a surrogate for the plant community as a whole. Parenthetically, recovery of indicator species' populations alone would be a major victory for biodiversity and ecosystem management.

Some suggestions we leave to future committees that must take up where this report leaves off, if our recommendations are followed:

(1) A number of comments were made about improving the indicators to be used in A.R.M. For instance, it was suggested that indicators should be chosen that are relevant to stakeholders and that they need to be adapted to different regions of the state. One reviewer wanted a discussion of the variability of indicators and the precision possible in measuring them. We leave these tasks to those who follow us. In particular, future committees will need to choose a method of estimating deer density and assessing measurement variance within the 10-square-mile A.R.M. treatment and comparison areas.

(2) We leave a more detailed explanation of how A.R.M. would be applied to a future committee.

(3) We also leave to a future committee an exploration of how variability among forest stands across Pennsylvania can be incorporated into the model's application to deer management.

(4) One reviewer has this to say about measurements of deer densities: "Chapter 10 — Good review. I think that you could draw an additional conclusion, specifically regarding whether or not you believe that population estimates that are used as indices (as opposed to those intended to produce absolute population estimates) of change will be adequate for your study areas. I really think that you're copping out by not suggesting at least a narrowed range of population estimators, though." Perhaps we are indeed evading an important issue, but we had no choice because of time constraints. We leave this task to a subsequent committee.

(5) We also leave to a future committee the task of identifying and publishing a list of potential recovery research projects related to A.R.M. for deer but unlikely to be funded within our proposed A.R.M. program. In that way, researchers interested in conducting those studies could cite that list when applying for research grants.

In a small number of cases, reviewers were split on their recommendations. In such cases, we usually kept our original approach, while modifying the language in the report to acknowledge or accommodate as much as possible the criticisms or suggestions that we did not accept. For example, two reviewers thought it would be better to drop the chapter that included criticisms of the Pennsylvania Game Commission (P.G.C.). Other reviewers thought it was essential to include such criticism, which is the approach adopted by Forum members for the reasons stated in the Preface.

If a few cases, Forum members did not agree with a reviewer on an issue and did not modify the report to accommodate the criticism. However, in almost all such cases, we noted in the text, endnotes, or this appendix that there exist different points of view on the subject, often including language taken directly from the reviewer. The topics where we disagreed with reviewers (other than purely editorial suggestions) included:

(1) Advocacy by several reviewers, or suggestion that we discuss the feasibility, of using other means of restoring balance between deer and habitat than recreational hunting. Although we did add (in Chapter 11) a discussion of immunocontraception and its lack of usefulness at the current state of technology in the large forest tracts that are the subject of the report, we did not include discussion of other methods except in passing mention. We left the task of devising alternate methods to the professionals at P.G.C., should expanded recreational hunting prove inadequate. Forum members concluded that it is premature to give up on recreational hunting until and unless additional or extended hunting seasons, increased bag limits, and other tools are put in place and shown to be inadequate.

(2) One reviewer suggested that high deer populations and corresponding damage to vegetation could be part of normal fluctuations over hundreds or thousands of years. Although this is theoretically possible, large-scale human intervention in forest processes in the form of hunting, forestry, adjacent agriculture, eradication of large predators, road building, air pollution, greenhouse-gas induced climate change, and other practices make the effects of non-anthropogenic processes on the current high deer densities ambiguous at best. Forum members maintain that continuous active management is now necessary to preserve the values that we and other stakeholders support, such as the preservation of biodiversity. White-tailed deer have reduced populations of certain species dramatically. If we want those species to be sustained, the simplest approach, and the only one we have evidence will work, is reduction of deer populations. To build in ongoing future checks on whether our analysis is correct, we embed our recommendations in an adaptive resource management framework.

(3) It was suggested that indicators need to clearly represent broader ecosystem processes. Although this is a desirable ideal to bear in mind, Forum members do not know how to guarantee that such indicators can be identified unambiguously; nor do we think a subsequent committee will necessarily be able to guarantee their inclusion. In the report, we recommend that a range of indicators be measured concurrently on the assumption that a breadth of indicators will reflect a combination of ecosystem processes, including those that are most critical for sustaining the indicator species' establishment, growth, and reproduction. No doubt, the individual indicators chosen to comprise the suite of indicators to be employed can be optimized to increase the probability that broader ecosystem processes are represented; we pass such advice on to succeeding committees.

(4) One reviewer thought that "Chapter 4 seems an afterthought and an unnecessary splitting of focus — why not incorporate its content into the historical overview of Chapter 3?" Forum members felt that the material in Chapter 4 has a significantly different focus from (and is perhaps somewhat more speculative than) the material in Chapter 3 and warrants a clean separation.

(5) One reviewer felt that statements in the report might lead readers to think that by reducing deer populations, one might be able to decrease tick abundance and reduce the risk of Lyme disease. Although we clarified the wording to respond to this reviewer using some of his language, Forum members concluded after a more detailed reexamination of the literature that Lyme disease almost certainly does increase as deer populations increase, although there is some ambiguity in study results. Expanded discussion on this topic was included in an endnote.

(6) One reviewer suggested that we should be more consistent in the list of 116 native "tree" species (Table 4), which, he pointed out, includes canopy/subcanopy trees as well as several shrubs. "If the intent is to include 'tree species with commercial value' then get rid of the shrubs (or small trees that cannot be considered to have commercial value). If your intent is to indicate both commercial value and what is known about browsing preferences, then include all reasonably common small tree/shrub species, including such species as witch-hazel, maple-leaved viburnum, elderberries (both species), mountain-laurel, and rosebay rhododendron." The table reproduces the 116 native tree species listed in the Flora of Pennsylvania Database (exclusive of subspecies, varieties and hybrids); of these, 13 are cross-listed as shrub species. We wanted to keep the focus of the table on trees. In the final report, a clarifying sentence was added to the table for purposes of consistency to indicate that the list includes 13 species that can have either a tree or shrub growth form. The remainder of the table was kept unchanged. The database lists 179 native shrub and 22 native woody vine species (exclusive of subspecies, varieties and hybrids). Thus, a combined list of native woody plants would have 304 species. Were we to have included all 304 species, "browsing preference" would be blank for most of them. Furthermore, had we picked species to list based on criteria such as "reasonably common," we would be departing from our biodiversity focus. Also, it is our assumption that the more common species would not be chosen as potential indicators for testing predictions of deer impact in an A.R.M. program. We agree with the reviewer that, at a later date, it would be useful to prepare a separate table for native shrub and woody vine species and see to what degree published research and expert opinion can be used to evaluate their relative browsing preference ranks.

(7) One reviewer suggested that the A.R.M. program try to account for the multi-factor nature of the potential causes of recent changes in forest vegetation. Although we have included soil acidity in the proposed A.R.M. program, we have not included experiments with other non-deer potential impact factors. Barring controversy over the appropriate model to use in predicting vegetation impact, the multi-factor experimental approach suggested by the reviewer seems to cross the line between basic research and A.R.M. True, there is a possibility, however small, that all of the models picked for an A.R.M. program will be wrong or the chosen measurements insufficiently broad to allow model correction. In light of this possibility, it would probably be wise to request additional funding from agencies or foundations supporting forest research, so

that supplementary multi-factor experiments could be included as add-ons to the A.R.M. program. Research agencies might find it very efficient to piggy back onto an A.R.M. program.

(8) Forum members did not agree with a suggestion to avoid the term model to refer to competing quantitative predictions of forest recovery. A definition of model has been added to the text. Theory is a more widely understood word than model, but theory as used by scientists usually implies a well established body of work with more general applicability than the much more specific predictions that may be made for forest recovery in particular areas of the landscape.

Endnote

[1] Complimentary comments from reviewers included the following:

"I will start by complimenting the authors on the wealth of information contained in the report. It is a good reference source for a range of ecosystem topics."

"First and foremost, I want to congratulate all of you on this wonderful document. I know how incredibly hard you worked to produce this, and that work is richly and sometimes eloquently reflected on each page of this document. It is quite unusual in both its breadth and depth, its degree of interdisciplinarity, its readability (no, it's not casual reading, but interested parties from nearly any discipline or interested lay people will gain a great reward for the effort that they put into perusing this volume, and it is accessible to the willing from across that range), and its specific adaptive resource management framework."

"The report of the Deer Management Forum is a fascinating and superb effort to capture deer management in a comprehensive context. The report is an impressive document written by a group of biologists who have rich experience with the issues of deer in eastern forest ecosystems. The adaptive management approach provides the framework for a managing both deer and forests in manner that can build consensus for multiple objectives and incorporate the best scientific knowledge. The synthesis of existing knowledge presented here makes this a valuable document to many readers beyond the intended audience."

"First, I would like to say it was a great read. The task force is to be congratulated on pulling together an amazing amount of information. I have tried to write several chapters like the ones in this plan and I know how scattered the information is. Excellent job."

"I have just spent the last couple hours reading your draft report and I wish to commend you all on a job very well done. I came away from my visit with the [Deer Management] Forum feeling overwhelmed with the complexity of the task before you but somehow you seem to have got your arms around it and come up with a credible way forward. Congratulations!"

"In general, I think that this is an excellent publication. I was particularly impressed by the logical, organized presentation of information in the book. I also think that the sections at the end of each chapter on 'Findings' and 'Recommendations' will greatly improve the utility of the publication."

Appendix E. Names of plants, animals, and other organisms mentioned in the report

Nomenclature for plants follows Rhoads and Block (2000); for other organisms, various current sources were consulted including the Integrated Taxonomic Information System (www.itis.usda.gov) and the National Center for Biotechnology Information taxonomy database (www.ncbi.nlm.nih.gov/Taxonomy/tax.html).

Trees

ailanthus* (tree-of-heaven)	*Ailanthus altissima* (Mill.) Swingle*
Allegheny chinkapin	*Castanea pumila* Mill.
Allegheny plum	*Prunus alleghaniensis* Porter
Allegheny serviceberry	*Amelanchier laevis* Wieg.
alternate-leaved dogwood	*Cornus alternifolia* L.f.
American basswood	*Tilia americana* L.
American beech	*Fagus grandifolia* Ehrh.
American chestnut	*Castanea dentata* (Marshall) Borkh.
American elm	*Ulmus americana* L.
American holly	*Ilex opaca* Aiton
American hornbeam (blue-beech, musclewood)	*Carpinus caroliniana* Walter
American mountain-ash	*Sorbus americana* Marshall
American plum	*Prunus americana* Marshall
American sycamore	*Platanus occidentalis* L.
Atlantic white-cedar	*Chamaecyparis thyoides* (L.) Britton, Stearns & Poggenb.
balsam fir	*Abies balsamea* (L.) Mill.
balsam poplar	*Populus balsamifera* L.
bigtooth aspen	*Populus grandidentata* Michx.
Biltmore hawthorn	*Crataegus intricata* Lange
bitternut hickory	*Carya cordiformis* (Wangenh.) K.Koch

* Introduced or escaped and naturalized in Pennsylvania

Trees

black ash	*Fraxinus nigra* Marshall
black cherry	*Prunus serotina* Ehrh.
black locust	*Robinia pseudoacacia* L.
black maple	*Acer nigrum* Michx.f.
black oak	*Quercus velutina* Lam.
black spruce	*Picea mariana* (Mill.) Britton, Stearns & Poggenb.
black walnut	*Juglans nigra* L.
black willow	*Salix nigra* Marshall
blackgum (black tupelo)	*Nyssa sylvatica* Marshall
blackhaw	*Viburnum prunifolium* L.
blackjack oak	*Quercus marilandica* Münchh.
boxelder	*Acer negundo* L.
Brainerd hawthorn	*Crataegus brainerdii* Sarg.
broadleaf hawthorn	*Crataegus dilatata* Sarg.
bur oak	*Quercus macrocarpa* Michx.
butternut	*Juglans cinerea* L.
chestnut oak	*Quercus montana* Willd. (= *Q. prinus* L.)
Chickasaw plum	*Prunus angustifolia* Marshall
chinkapin oak (yellow oak)	*Quercus muhlenbergii* Engelm.
coastal plain willow	*Salix caroliniana* Michx.
cockspur hawthorn	*Crataegus crus-galli* L.
common chokecherry	*Prunus virginiana* L.
common persimmon	*Diospyros virginiana* L.
cucumbertree (cucumber magnolia)	*Magnolia acuminata* (L.) L.
devils-walkingstick	*Aralia spinosa* L.
dotted hawthorn	*Crataegus punctata* Jacq.
downy hawthorn	*Crataegus mollis* (Torr. & A.Gray) Scheele

Trees

downy serviceberry (juneberry, shadbush)	*Amelanchier arborea* (Michx.f.) Fern.
eastern cottonwood	*Populus deltoides* Marsh.
eastern hemlock	*Tsuga canadensis*
eastern hophornbeam	*Ostrya virginiana* (Mill.) K.Koch
eastern redbud	*Cercis canadensis* L.
eastern redcedar	*Juniperus virginiana* L.
eastern white pine	*Pinus strobus* L.
fanleaf hawthorn	*Crataegus flabellata* (Spach) G.Kirchn.
fireberry hawthorn	*Crataegus rotundifolia* Moench (= *C. chrysocarpa* Ashe)
fleshy hawthorn	*Crataegus succulenta* Schrad. ex Link
flowering dogwood	*Cornus florida* L.
fringetree	*Chionanthus virginicus* L.
frosted hawthorn	*Crataegus pruinosa* (H.L.Wendl.) K.Koch
Georgia hackberry (dwarf hackberry)	*Celtis tenuifolia* Nutt.
gray birch	*Betula populifolia* Marshall
green ash (red ash)	*Fraxinus pennsylvanica* Marshall
hackberry	*Celtis occidentalis* L.
honeylocust	*Gleditsia triacanthos* L.
Japanese larch*	*Larix kaempferi* (Lamb.) Carr.*
Kentucky coffeetree	*Gymnocladus dioicus* (L.) K.Koch
mockernut hickory	*Carya tomentosa* (Lam. ex Poir.) Nutt.
northern red oak	*Quercus rubra* L. (= *Q. borealis* Michx.)
oaks	*Quercus* spp.
Ohio buckeye	*Aesculus glabra* Willd.
paper birch	*Betula papyrifera* Marshall
pawpaw	*Asimina triloba* (L.) Dunal
peachleaf willow	*Salix amygdaloides* Andersson

* Introduced or escaped and naturalized in Pennsylvania

Trees

pear hawthorn	*Crataegus calpodendron* (Ehrh.) Medik.
pignut hickory	*Carya glabra* (Mill.) Sweet
pin cherry	*Prunus pensylvanica* L.f.
pin oak	*Quercus palustris* Münchh.
pitch pine	*Pinus rigida* Mill.
poison-sumac	*Toxicodendron vernix* (L.) Kuntze
post oak	*Quercus stellata* Wangenh.
pumpkin ash	*Fraxinus profunda* (Bush) Bush
quaking aspen	*Populus tremuloides* Michx.
red maple	*Acer rubrum* L.
red mulberry	*Morus rubra* L.
red pine	*Pinus resinosa* Aiton
red spruce	*Picea rubens* Sarg.
redbud	*Cercis canadensis* L.
river birch	*Betula nigra* L.
sassafras	*Sassafras albidum* (Nutt.) Nees
scarlet hawthorn	*Crataegus coccinea* L. (= *C. pedicellata* Sarg.)
scarlet oak	*Quercus coccinea* Münchh.
shagbark hickory	*Carya ovata* (Mill.) K.Koch
shellbark hickory	*Carya laciniosa* (F.Michx.) Loudon
shingle oak	*Quercus imbricaria* Michx.
shortleaf pine	*Pinus echinata* Mill.
showy mountain-ash	*Sorbus decora* (Sarg.) Schneid.
Shumard oak	*Quercus shumardii* Buckley
silver maple	*Acer saccharinum* L.
slippery elm	*Ulmus rubra* Muhl.
sourwood	*Oxydendrum arboreum* (L.) DC.
southern red oak	*Quercus falcata* Michx.

Trees

striped maple (moosewood)	*Acer pensylvanicum* L.
sugar maple	*Acer saccharum* Marshall
swamp white oak	*Quercus bicolor* Willd.
sweet birch (black birch)	*Betula lenta* L.
sweet crab apple	*Malus coronaria* (L.) Mill.
sweet pignut hickory (red hickory)	*Carya ovalis* (Wang.) Sarg.
sweetbay (sweetbay magnolia)	*Magnolia virginiana* L.
sweetgum	*Liquidambar styraciflua* L.
Table-Mountain pine	*Pinus pungens* Lamb.
tamarack	*Larix laricina* (DuRoi) K.Koch
tuliptree (yellow-poplar)	*Liriodendron tulipifera* L.
umbrella magnolia	*Magnolia tripetala* (L.) L.
Virginia pine (scrub pine)	*Pinus virginiana* Mill.
white ash	*Fraxinus americana* L.
white oak	*Quercus alba* L.
willow oak	*Quercus phellos* L.
yellow birch	*Betula alleghaniensis* Britton
yellow buckeye	*Aesculus flava* Sol. (= *A. octandra* Marsh)
yellow oak (chinkapin oak)	*Quercus muhlenbergii* Engelm. (= *Q. muehlenbergii*)
yellow-poplar (tuliptree)	*Liriodendron tulipifera* L.

Shrubs, vines, and herbaceous plants

American hazelnut	*Corylus americana* Walter
American yew	*Taxus canadensis*(L.) Carr.
arrow-leaved tearthumb	*Polygonum sagittatum* L.

Shrubs, vines, and herbaceous plants

asters	*Doellingeria* spp., *Eurybia* spp., *Oclemena* spp., *Sericocarpus* spp., *Symphyotrichum* spp. (= *Aster* spp.)
barren chickweed	*Cerastium velutinum* Raf. (= *C. arvense* L. var. *villosum* (Muhl.) Hollick & Britt. and var. *villosissimum* Pennell)
beaked hazelnut	*Corylus cornuta* Marshall
bearberry	*Arctostaphylos uva-ursi* (L.) Spreng.
bellwort	*Uvularia perfoliata* L or *U. sessilifolia* L.
big bluestem	*Andropogon gerardii* Vitman
bird's-foot violet	*Viola pedata* L.
bishop's-cap	*Mitella diphylla* L.
blackberries	*Rubus allegheniensis* Porter (common blackberry), *R. canadensis* L. (smooth blackberry), *R. pensilvanicus* Poir. (blackberry)
black huckleberry	*Gaylussacia baccata* (Wang.) K.Koch
black snakeroot	*Cimicifuga racemosa* (L.) Nutt.
bladdernut	*Staphylea trifolia* L.
bloodroot	*Sanguinaria canadensis* L.
blue cohosh	*Caulophyllum thalictroides* (L.) Michx.
blue lupine	*Lupinus perennis* L.
bluebead lily	*Clintonia borealis* (Aiton) Raf.
blue-eyed-Mary	*Collinsia verna* Nutt.
bluestem goldenrod	*Solidago caesia* L.
bog-laurel	*Kalmia polifolia* Wangenh.
bog-rosemary	*Andromeda polifolia* L.
bracken fern	*Pteridium aquilinum* (L.) Kuhn
brambles	*Rubus* spp. (see blackberries, raspberries, dewberries)
burning-bush*	*Euonymus alatus* (Thunb.) Siebold*
bush-honeysuckle	*Diervilla lonicera* Mill.
Canada mayflower	*Maianthemum canadensis* Desf.
cinnamon fern	*Osmunda cinnamomea* L.

* Introduced or escaped and naturalized in Pennsylvania

Shrubs, vines, and herbaceous plants	
clearweed	*Pilea pumila* (L.) A.Gray
climbing fern	*Lygodium palmatum* (Bernh.) Swartz
coast violet	*Viola brittoniana* Pollard
common blackberry	*Rubus allegheniensis* Porter
cranefly orchid	*Tipularia discolor* (Pursh) Nutt.
declined trillium	*Trillium flexipes* Raf.
dewberries	*Rubus enslenii* Tratt. (southern dewberry), *R. flagellaris* Willd. (northern dewberry), *R. hispidus* L. (swamp dewberry), *R. recurvicaulis* Blanch. (dewberry)
dragon's-mouth	*Arethusa bulbosa* L.
Dutchman's-breeches	*Dicentra cucullaria* (L.) Bernh.
dwarf chinkapin oak (dwarf chestnut oak)	*Quercus prinoides* Willd.
dwarf cornel (bunchberry)	*Cornus canadensis* L.
dwarf ginseng	*Panax trifolius* L.
dwarf larkspur (wild delphinium)	*Delphinium tricorne* Michx.
dwarf sand cherry	*Prunus pumila* L. var. *pumila*
false-gromwell	*Onosmodium molle* Michx.
Solomon's-plume	*Smilacina racemosa* (L.) Desf.
fly-honeysuckle	*Lonicera canadensis* Marshall
foamflower	*Tiarella cordifolia* L.
fragrant sumac	*Rhus aromatica* Aiton
Fraser's sedge	*Cymophyllus fraserianus* (Ker Gawl.) Kartesz & Ghandi
frost grape	*Vitis riparia* Michx.
garlic mustard*	*Alliaria petiolata* (M.Bieb) Cavara & Grande*
giant knotweed*	*Polygonum sachalinense* F.W.Schmidt ex Maxim*
glade spurge	*Euphorbia purpurea* (Raf.) Fernald
golden puccoon	*Lithospermum caroliniense* (J.F.Gmel.) MacMill.

* Introduced or escaped and naturalized in Pennsylvania

Shrubs, vines, and herbaceous plants

goldenclub	*Orontium aquaticum* L.
grasses	Poaceae
grass-pink	*Calopogon tuberosus* (L.) Britton, Stearns & Poggenb.
great nettle (stinging nettle)	*Urtica dioica* L.
greenbrier	*Smilax rotundifolia* L.
halberd-leaved tearthumb	*Polugonum arifolium* L.
hay-scented fern	*Dennstaedtia punctilobula* (Michx.) T.Moore
hepatica	*Hepatica nobilis* Mill.
highbush blueberry	*Vaccinium corymbosum* L.
hoary puccoon	*Lithospermum canescens* (Michx.) Lehm.
hobblebush (witch-hobble)	*Viburnum lantanoides* Michx. (= *V. alnifolium* Marshall)
honeysuckles* (species that are introduced and invasive in Pennsylvania)	*Lonicera bella* Zabel,* *L. japonica* Thunb.,* *L. maackii* (Rupr.) Maxim.,* *L. morrowii* A.Gray,* *L. tatarica* L.*
Indian cucumber-root	*Medeola virginiana* L.
Indian grass	*Sorghastrum nutans* (L.) Nash
jack-in-the-pulpit	*Arisaema triphyllum* (L.) Schott
Japanese barberry*	*Berberis thunbergii* DC.*
Japanese honeysuckle*	*Lonicera japonica* Thunb.*
Japanese knotweed*	*Polygonum cuspidatum* Siebold & Zucc.*
Japanese stilt grass*	*Microstegium vimineum* (Trin.) A.Camus*
jumpseed	*Polygonum virginianum* L.
Labrador-tea	*Ledum groenlandicum* Oeder
large round-leaved orchid	*Platanthera orbiculata* (Pursh) Lindl.
large white trillium	*Trillium grandiflorum* (Michx.) Salisb.
leafy white orchid	*Platanthera dilatata* (Pursh) Lindl. ex Beck
lesser celandine*	*Ranunculus ficaria* L.*
little bluestem	*Schizachyrium scoparium* (Michx.) Nash

* Introduced or escaped and naturalized in Pennsylvania

Shrubs, vines, and herbaceous plants

lowbush blueberry (late low blueberry)	*Vaccinium pallidum* Aiton
maple-leaf viburnum	*Viburnum acerifolium* L.
marginal wood fern	*Dryopteris marginalis* (L.) A.Gray
Maryland meadow-beauty	*Rhexia mariana* L.
mayapple	*Podophyllum peltatum* L.
Morrow's honeysuckle*	*Lonicera morrowii* A.Gray*
moss-pink	*Phlox subulata* L.
mountain maple	*Acer spicatum* Lam.
mountain winterberry (mountain holly)	*Ilex montana* (Torr. & A.Gray) A.Gray
mountain-laurel	*Kalmia latifolia* L.
multiflora rose*	*Rosa multiflora* Thunb. ex Murray*
New York aster	*Symphyotrichum novi-belgii* (L.) Nesom (= *Aster novi-belgii* L.)
New York fern	*Thelypteris noveboracensis* (L.) Nieuwl.
nodding trillium	*Trillium cernuum* L.
northern arrowwood	*Viburnum recognitum* Fernald
painted trillium	*Trillium undulatum* Willd.
pale jewelweed (yellow touch-me-not)	*Impatiens pallida* Nutt.
Pennsylvania sedge	*Carex pensylvanica* Lam.
perfoliate-leaved bellwort	*Uvularia perfoliata* L.
pilewort (fireweed)	*Erechtites hieracifolia* (L.) Raf. ex DC.
pink lady's-slipper	*Cypripedium acaule* Aiton
pinxter-flower azalea	*Rhododendron periclymenoides* (Michx.) Shinners (= *R. nudiflorum* [L.] Torr.)
pipsissewa (striped wintergreen)	*Chimaphila maculata* (L.) Pursh
pitch pine	*Pinus rigida* Mill.

* Introduced or escaped and naturalized in Pennsylvania

Shrubs, vines, and herbaceous plants

pitcher plant	*Sarracenia purpurea* L.
poison-ivy	*Toxicodendron radicans* (L.) Kuntze
prairie dropseed	*Sporobolus heterolepis* (A.Gray) A.Gray
privets*	*Ligustrum obtusifolium* Sieb & Zucc.,* *L. ovalifolium* Hassk.,* *L. vulgare* L.*
purple trillium (wakerobin)	*Trillium erectum* L.
raspberries	*Rubus idaeus* L. (red raspberry), *R. occidentalis* L. (black raspberry), *R. odoratus* L. (purple-flowering raspberry), *R. pubescens* Raf. (dwarf raspberry)
rattlesnake fern	*Botrichium virginianum* (L.) Sw.
red-berried elder	*Sambucus racemosa* L.
rhodora	*Rhododendron canadense* (L.) Torr.
rose mandarin	*Streptopus roseus* Michx.
rose pogonia	*Pogonia ophioglossoides* (L.) Ker Gawl.
rosebay rhododendron	*Rhododendron maximum* L.
round-leaved sundew	*Drosera rotundifolia* L.
Rubus spp.	(see blackberries, raspberries, dewberries)
Russian-olive*	*Elaeagnus angustifolia* L.*
sagebrush‡	*Artemisia* spp.‡
scrub oak (bear oak)	*Quercus ilicifolia* Wangenh.
sedges	*Carex* spp.
sensitive fern	*Onoclea sensibilis* L.
serpentine aster	*Symphyotrichum depauperatum* (Fern.) Nesom (= *Aster depauperatus* (Porter) Fern.)
sessile-leaved bellwort	*Uvularia sessilifolia* L.
shale-barren ragwort	*Senecio antennariifolius* Britton (= *Packera antennariifolia* [Britton] W.A.Weber & A.Love)
sharp-lobed hepatica	*Hepatica nobilis* var. *acutiloba*
sheep-laurel	*Kalmia angustifolia* L.

* Introduced or escaped and naturalized in Pennsylvania
‡ Not present in the wild in Pennsylvania

Shrubs, vines, and herbaceous plants

shining clubmoss	*Huperzia lucidula* (Michx.) Trevis. (= *Lycopodium lucidulum* Michx.)
showy lady's-slipper	*Cypripedium reginae* Walt.
showy orchis	*Galearis spectabilis* (L.) Raf.
side-oats gramma	*Bouteloua curtipendula* (Michx.) Torr.
silky dogwood	*Cornus amomum* Mill.
silverrod	*Solidago bicolor* L.
skunk-cabbage	*Symplocarpus foetidus* (L.) Salisb. ex Nutt.
smooth alder	*Alnus serrulata* (Drand. ex Aiton) Willd.
solomon's-seal	*Polygonatum biflorum* (Walter) Elliot
southern arrowwood	*Viburnum dentatum* L.
speckled alder	*Alnus incana* (L.) Moench
spicebush	*Lindera benzoin* (L.) Blume
spotted jewelweed (orange touch-me-not)	*Impatiens capensis* Meerb.
spring-beauty	*Claytonia virginica* L.
squirrel-corn	*Dicentra canadensis* (Goldie) Walp.
starflower	*Trientalis borealis* Raf.
swamp azalea	*Rhododendron viscosum* (L.) Torr.
swamp dog-hobble	*Leucothoe racemosa* (L.) A.Gray
sweet-cicely	*Osmorhiza claytonii* (Michx.) C.B.Clarke
sweet low blueberry (early low blueberry)	*Vaccinium angustifolium* Aiton
sweet pepperbush	*Clethra alnifolia* L.
sweetgale	*Myrica gale* L.
Tatarian honeysuckle* (Tartarian honeysuckle*)	*Lonicera tatarica* L.*
teaberry (checkerberry wintergreen	*Gaultheria procumbens* L.

* Introduced or escaped and naturalized in Pennsylvania

Shrubs, vines, and herbaceous plants

toadshade	*Trillium sessile* L.
trailing-arbutus	*Epigaea repens* L.
turk's-cap lily	*Lilium superbum* L.
turtlehead	*Chelone glabra* L.
twinleaf	*Jeffersonia diphylla* (L.) Pers.
variable sedge	*Carex polymorpha* Muhl.
violets	*Viola* spp.
Virginia bluebell	*Mertensia virginica* (L.) Pers. ex Link
white fringed orchid	*Platanthera blephariglottis* (Willd.) Lindl.
white monk's-hood	*Aconitum reclinatum* A.Gray
white snakeroot	*Eupatorium rugosum* Houtt.
white wood aster	*Eurybia divaricata* (L.) Nesom (= *Aster divaricatus* L.)
white wood lily	*Clintonia umbellulata* (Michx.) Morong
whorled loosestrife	*Lysimachia quadrifolia* L.
wild blue phlox	*Phlox divaricata* L.
wild currants	*Ribes* spp.
wild hydrangea	*Hydrangea arborescens* L.
wild leek	*Allium tricoccum* Aiton
wild sarsaparilla	*Aralia nudicaulis* L.
wild strawberry	*Fragaria virginiana* Mill.
wild-ginger	*Asarum canadense* L.
winterberry	*Ilex verticillata* (L.) A.Gray
witch-hazel	*Hamamelis virginiana* L.
wood anemone	*Anemone quinquefolia* L.
wood ferns	*Dryopteris* spp.
wood geranium	*Geranium maculatum* L.
wood nettle	*Laportea canadensis* (L.) Wedd.
yellow fringed-orchid	*Platanthera ciliaris* (L.) Lindl.

Shrubs, vines, and herbaceous plants

yellow trout-lily	*Erythronium americanum* Ker. Gawl
zigzag aster	*Symphyotrichum prenanthoides* (Muhl. ex Willd.) Nesom (= *Aster prenanthoides* Muhl. ex Willd.)

Animals

acorn moth	*Valentina glandulella* (Riley)
acorn weevils	*Curculio* spp. and *Conotrachelus* spp.
American cheetah†	*Acinonyx trumani* Orr†
American robin	*Turdus migratorius* L.
Armbruster's wolf†	*Canis armbrusteri* Gidley†
beech scale*	*Cryptococcus fagisuga* Lindinger*
black bear	*Ursus americanus* Pallas
black-and-white warbler	*Mniotilta varia* (L.)
blue jay	*Cyanocitta cristata* (L.)
bobcat	*Lynx rufus* (Schreber)
brown bear† (grizzly bear)	*Ursus arctos* L.†
cherry scallopshell moth*	*Hydria prunivorata* Ferguson*
chipmunk	*Tamias striatus* (L.)
chipping sparrow	*Spizella passerina* (Bechstein)
deer mouse	*Peromyscus maniculatus* (Wagner)
deer tick (black-legged tick)	*Ixodes scapularis* Say (= *I. dammini* Spielman, Clifford, Piesman & Corwin)
dire wolf†	*Canis dirus* Leidy†
eastern cougar†	*Puma concolor* L. *couguar* Kerr† (= *Felis c.* L. *c.* Kerr)
eastern phoebe	*Sayornis phoebe* (Latham)
eastern tent caterpillar (moth)	*Malacosoma americanum* (F.)
eastern towhee	*Pipilo erythrophthalmus* (L.)

* Introduced or escaped and naturalized in Pennsylvania
† Extirpated in Pennsylvania or extinct

Animals

eastern wood-pewee	*Contopus virens* (L.)
elk (eastern elk†, Rocky Mountain elk*)	*Cervus elephas* L. *canadensis* Erxleben† (eastern elk†); *Cervus elephas* L. *nelsoni* Bailey* (Rocky Mountain elk*)
elm spanworm (moth)	*Ennomos subsignaria* (Hübner)
fallow deer‡	*Dama dama* (L.)‡
filbertworm	*Melissopus latiferreanus* (Walsingham) (= *Cydia latiferreana* [Walsingham])
forest tent caterpillar (moth)	*Malacosoma disstria* Hübner
giant short-faced bear†	*Arctodus simus* Cope†
gray squirrel	*Sciurus carolinensis* Gmelin
gray wolf†	*Canis lupus* L.†
grizzly bear† (brown bear)	*Ursus arctos* L.†
gypsy moth*	*Lymantria dispar* (L.)* (= *Porthetria dispar* L.*)
hemlock woolly adelgid* (aphid)	*Adelges tsugae* Annand*
hooded warbler	*Wilsonia citrina* (Boddaert)
human	*Homo sapiens* L.
indigo bunting	*Passerina cyanea* (L.)
jaguar†	*Panthera onca* L.†
Karner blue butterfly†	*Lycaeides melissa samuelis* Nabokov†
least flycatcher	*Empidonax minimus* (Baird & Baird)
lesser short-faced bear†	*Arctodus pristinus* Leidy†
mountain lion†	*Puma concolor* L. *couguar* Kerr† (= *Felis c.* L. *c.* Kerr)
ovenbird	*Seiurus aurocapillus* (L.)
pear thrips*	*Taeniothrips inconsequens* (Uzel)*
pip gall wasp	*Callirhytis operator* (OS)
redback salamander	*Plethodon cinereus* (Green)

* Introduced or escaped and naturalized in Pennsylvania
† Extirpated in Pennsylvania or extinct
‡ Not present in the wild in Pennsylvania

Animals

red deer‡	*Cervus elaphus* elaphus L.‡
ring-necked pheasant*	*Phasianus colchicus* L.*
stony gall wasp	*Callirhytis fructuosa* Weld
Studer's cheetah†	*Acinonyx studeri* Savage†
white-footed mouse	*Peromyscus leucopus* (Rafinesque)
white-tailed deer	*Odocoileus virginianus* (Zimmermann)
wild turkey	*Meleagris gallopavo* L.
wolf coyote†	*Canis priscolatrans* Cope†
yellow-billed cuckoo	*Coccyzus americanus* (L.)

Fungi

beech bark disease*	*Nectria coccinea* Desm. var. *faginata* Lohman, A.M.Watson & Ayres* and *Nectria galligena* Bres.
cherry leaf-spot fungus* (cherry shot hole fungus*)	*Blumeriella jaapii* (Rehm) Axe.*
chestnut blight*	*Cryphonectria parasitica* (Murrill) Barr.*
dogwood anthracnose*	*Discula destructiva* Redlin*
Dutch elm disease*	*Ophiostoma ulmi* (Buisman) Nannf.*
maple anthracnose*	*Discula campestris* (Pass.) Arx*
sudden oak death fungus*	*Phytophthora ramorum* Werres & A.W.A.M. de Cock*

Bacteria

Lyme disease spirochete*	*Borrelia burgdorferi* R.C. Johnson, G.P. Schmid, F.W. Hyde, A.G. Steigerwaldt, D.J. Brenner*

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‡ Not present in the wild in Pennsylvania

Appendix F: The Pennsylvania Game Commission's 1976 deer management policy

5000 BUREAU OF GAME MANAGEMENT

5100 -- POLICIES

5101 -- Deer Management

Under Game Commission stewardship since just before the turn of the century, Pennsylvania's whitetail deer population has been brought from near-extinction in the early 1900's to today's era of abundance. Whitetails are now found in all sixty-seven counties of the State, and they annually provide over four million man-days of recreation for approximately one and one quarter million hunters. Moreover, the resource provides countless hours of outdoor recreation in such non-consumptive uses and wildlife photography and nature appreciation.

In formulating and implementing deer management programs, the Commission must consider not only the overall goal of perpetuating the whitetail for this and future generations, but also the broad spectrum of needs and desires of an increasing human population.

DEER POLICY STATEMENT

The Commission recognizes that deer belong to all citizens of the Commonwealth and that recreational hunting is a privilege, not a right.

The Commission recognizes its legislative mandate to manage deer on a sustained yield basis for the benefit of the resource and the consumptive as well as the non-consumptive user.

The Commission recognizes that recreational hunting is the major use of deer. Consistent with its responsibilities to the resource and the people, the Commission will endeavor to manage deer on the basis of: (a) compatibility with other land uses, (b) maximum overall recreational opportunity, (c) maximum sustained harvest and, (d) maximum esthetic appeal.

The Commission recognizes that responsible deer management must be based on sound information obtained through continuous research and inventory.

The Commission recognizes that an informed public is an enlightened public; therefore, it will continue to pursue its educational efforts concerning deer and deer management.

POLICY IMPLEMENTATION

Management techniques may include, but are not limited to, regulatory control of hunting and/or harvest by time, space, sex and/or age characteristics of animals, type of sporting arm and number of hunters. Management programs using these techniques must be sufficiently flexible to meet ever changing conditions and priorities.

In recognition of the singular importance of food and cover to deer and other wildlife species, the Commission will continue its active habitat development and maintenance activities on State Game Lands and other lands under its control. Where feasible, industry and the private sector will be encouraged to manage their lands in a similar manner.

Situations may arise necessitating the removal of deer or reduction of deer numbers in response to unique problems. In these cases control will be exerted only after an investigation by Commission personnel reveals a valid need exists. When control by the agency is justified, it will be accomplished as expeditiously and humanely as possible. In all but exceptional cases, control will be effected by sport hunting.

The Commission adopted the foregoing deer management policy Oct. 22, 1976 replacing the one approved in April 1960.