

1992 Eastern Native Plant Alliance Deer/Native Plant Interaction Survey

compiled by
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Eastern Native Plant Alliance

6th Annual General Meeting
Missouri Botanical Garden
St. Louis, MO

24-6 September 1993

INTRODUCTION

ENPA was formed in 1988 to foster general interest in native plant conservation and serve as a forum to share ideas and information. At the 4th annual meeting in 1991 ENPA meeting at University of North Carolina, Chapel Hill, NC, the working group on habitat issues expressed concern over potential impacts of the increasing populations of white-tailed deer (*Odocoileus virginianus*) on ecosystem function and biodiversity. Impacts might range from complete extirpation of species that have been a part of biotic communities for thousands of years to the reduction of those plant populations through the removal of vegetative or reproductive parts to the damage of mature woody plants such as that evidenced by browse lines. Beyond "ecological damage" that increasing deer populations might be causing, concern over the economic impact on botanic gardens and nurseries that are displaying, growing, and propagating native plants was expressed.

In order to gain a greater sense of the dimensions of deer/native plant interactions in the region which ENPA encompasses, a questionnaire was developed by a subcommittee of the ENPA Habitat Working group. The results are abstracted here in the hope that the survey will provide further stimulus to share ideas and information concerning deer/native plant interactions.

METHODS

The questionnaire was drafted by H.W. Art and revised at the 10-12 August 1992 ENPA annual general meeting at Connecticut College, New London, CT [see page 14] . In October 1992 the questionnaire was sent to 330 sites drawn from the membership and mailing lists of ENPA. During the following 6 months, 90 responses were returned, and 84 of those contained sufficient information to be compiled in the data base that is abstracted in Table 1. This represents a 25% response rate.

RESULTS

THE DATA

Table 1, which presents the response data by site is divided into 2 sections. The first 10 columns (A-J) on pages 17 to 22 and the remaining 7 columns (K-Q) on pages 23 to 28. The data is organized by rows, in alphabetical order by state/province, whether the respondent perceives a deer problem, and then in alphabetical order by site name. The columns are as follows:

- A. State or province postal code initial.
- B. Name of site.
- C. Type of site. BG= botanical garden, G=garden, N=nursery, NA= natural area, ZG=zoological garden.
- D. Size of site in acres.
- E. Ownership status.
- F. Setting of the site if information was provided or known.
- G. If the respondent perceives a deer impact "problem" at the site.
- H. The estimated annual damage to plants caused by deer. When a range was given, the average of the extremes is given.
- I. Species at the site that seem to suffer the greatest damage from deer browsing, trampling, or antler rubbing.
- J. Species at the site that seem to be most resistant to deer-caused damage.
- K. Whether deer hunting takes place on the site. "Limited" means that there is additional regulation beyond opening the site for state-regulated public hunting. "Prof." means that professional hunters are employed to reduce deer populations.

- L. Other (non-hunting) measures that are used to deter or repel deer, and their successfulness, if mentioned.
- M. The amount of money spent in deer control. "Ann." is the annual, operational expenditures and "Cap." is capital expenditures for items such as fences.
- N. Additional comments made by respondents.
- O. Respondent who returned the questionnaire.
- P. Address of the respondent.
- Q. Telephone number of the respondent.

TRENDS

In general the responses varied (figuratively and literally) all over the map. There is considerable variation within regions, within states, and even within municipalities, e.g. Raleigh, NC. Although the total sample is relatively small and cannot be considered a fully systematic sample of the entire ENPA region, there are some interesting trends that emerge from the responses in Table 1.

Deer populations. Perhaps most obvious and expected was the general response that where deer populations are perceived to be high, the impacts of deer on vegetation also appeared to be high and where populations appear to be low, the damage appears to be minimal. The few responses that deer populations were high, yet impacts on vegetation was low were from sites with strong deer deterrents such as perimeter fences or dogs. There is the general impression of respondents that deer populations and associated damage is less where there are active hunting programs in the vicinity of their sites.

Urban areas appear, as one would expect, to have little or no problem with deer impacts on native plants. The suburban/exurban sites vary considerably in respect to deer populations and impacts. The proximity to major urban human population centers does not appear to be an explanation for the lack of deer and their impacts in The Garden-in-the-Woods, Framingham, MA (near Boston) versus The Morton Arboretum, Lisle, IL, or the Chicago Botanic Garden, Glencoe, IL (an equivalent distance from Chicago). Green belts, agricultural activity, and recent changes in land use all probably are more important factors than mere human population density. Respondents often mentioned that the woodland/agricultural open field borders appeared to be an important habitat exploited by deer. Changes in deer populations in response

to shifting human land uses were frequently mentioned. Often respondent remarked that recent suburban development had shifted the habitat corridors utilized by deer, so that now deer were utilizing habitat patches not previously used.

While there are significant holes in the coverage of the response data, it appears that respondents working in rural/exurban sites in a band of states/province sweeping from Wisconsin and Illinois in the Midwest through Ontario and Ohio to New York, Pennsylvania, and parts of Connecticut in the East perceive significant deer problems. However, not all rural or forested areas had an abundance of deer or deer impacts. In the Southeast, particularly in Tennessee, North Carolina, and Georgia, many (but certainly not all) of the rural sites report few deer and/or deer impacts.

Types of damage. Nearly all those sites that report deer "problems" report that partial or complete browsing of certain species is an important form of damage. Of particular concern was the browsing of flowers of annuals and biennials, the result being a failure to reproduce by those plants impacted. The browsing of perennials often reduces flowering and in extreme cases certain species may be so heavily browsed that they are extirpated.

A large number of the sites reporting deer browsing impacts also reported that bucks rubbing their antlers on saplings and young trees was a significant source of damage. Antler rubbing appears to be less species specific than browsing, however angiosperm species appear to be selected by bucks more frequently than gymnosperm species. Several respondents also mentioned that trampling of young seedlings by deer hooves was a problem, although always of a magnitude less than browsing or antler rubbing.

Costs of deer damage. The estimates of annual deer damage to native plants (including exotic ornamentals as well in some responses) varied from \$0.00 to \$22,000. Furthermore, the Chicago Botanic Garden mentioned that were they to replace all the *Trillium* and *Erythronium* consumed by deer, the cost would exceed \$1.7 millions. It is not clear whether the time spent by propagators, gardeners, or grounds keepers has been included in these estimates, or whether it merely represents money spent in replacing stock.

There appears to be large differences in perceived relative economic impacts of deer damage among the respondents, even when the total damage estimates may be close. For example, for a large botanical garden a \$1000 damage cost might be viewed as rather minor, while \$1000 loss to a small nursery might be perceived as devastating.

Most of the respondents mentioned that it was extremely difficult for them to place a dollar-value on the amount of deer damage they incurred. While botanical gardens and nurseries may be able to calculate the replacement costs or values of damaged plant material, many natural areas cannot provide this type of information.

Species favored by deer. The local feeding preferences of deer can be quite eclectic and show spatial and seasonal variation. For example, deer browsing on gray dogwood (*Cornus racemosa*) appears to have negative impacts on that species at the U. Wisconsin Arboretum, while in many parts of the Northeast deer do not seem to be selecting that species at all. Many respondents mentioned that winter and early spring damage was greater than during the height of the growing season, but others made contrary observations. Native plants in the Liliaceae, Rosaceae, and Orchidaceae have been preferred by deer relative to plants in other families. Various spring ephemerals were frequently mentioned, especially those in the Liliaceae.

Few of the respondents have systematically surveyed deer impacts over a period of years, although several are intending to study deer/plant interactions in the future through regular survey or deer enclosure techniques. The Chicago Botanic Garden, Morton Arboretum, Holden Arboretum, University of Wisconsin Arboretum, and Fire Island National Seashore have the most complete series of studies conducted by the pool of respondents. These studies tend to have inventoried impacts on a species-by-species basis over a period of more than a single year.

The following is a list of taxa that were most frequently mentioned as being most susceptible to deer damage (the number in parentheses is the number of responses) :

Acer (2)	Euonymus (5)
Amelanchier	Gentiana crinita
Anthemis	Hamamelis
Aquilegia	Hellonias
Arabis serotina	Helonias bullata
Araesima	Hepatica
Aralia nudicaulis	herbaceous spp in general
Asarum	Hosta (7)
Asclepias quadrifolia	Ilex, deciduous
Asclepias tuberosa	Iliamna corei
Aster	Juniperus (2)
Asteraceae (2)	Juniperus
Betula aleghaniensis	Kalmia
Callirhoe	Kalmia latifolia
Carphephorus	Larix
Carya seedlings	Liliaceae (7)
Chelone (2)	Lilium (4)
Chimaphila	Lilium canadense
Cornus	Lobelia cardinalis
Cornus alternifolia	Low shrubs
Cornus florida	Lupinus
Cypripedium (4)	Magnolia
Maianthemum canadense	Rhododendron maximum
Mitchella repens	Rosaceae (11)
Monarda	Smilacina stellata
Nyssa sylvatica	Taxus (7)
Orchidaceae (2)	Thuja (4)
Pachysandra procumbens	Tiarella
Petalostemum	Trillium (4)
Phlox	Tsuga (5)
Pinus	Ulmus from antler rubbing
Pinus strobus (2)	Vaccinium corymbosum
Poaceae	Viburnum (4)
Podophyllum	Viburnum lentago
Polygonatum	Viola
Pyrus (2)	Woody plants from antler rubbing
Quercus (2)	woody seedlings (9)
Quercus by antler rubbing (2)	Spring ephemerals (3)
Rhododendron (7)	

Species least favored by deer. The question of which species at a site were least impacted by deer was frequently left blank. Some of the species not adversely impacted by deer at one site are the same as those selected by deer at another. Indeed deer feeding behavior is complex, and palatability is likely to vary among individuals of the same species. Some "deer resistant" taxa such as *Actaea* and *Caulophyllum* have high concentrations of secondary compounds that are general feeding deterrents. However, *Taxus*, which has high concentrations of biochemically "nasty" compounds is one of the generally favored browse species of deer.

The following is a list of taxa that respondents indicated were least favored, ore even resistant to deer impacts (the number in parentheses is the number of responses) :

Alnus	Apocynaceae
Arisaema	Aruncus
Asarum	Asclepias
Berberis	Cassia hebecarpa
Catalpa	Caulophyllum
Chamaecyparis	Chrysogonum
Cimicifuga	Cirsium
Conifers (3)	Coptis
Dentaria	Ericaceae- browsed but recover
Eupatorium rugosum	Fagus
Fraxinus	Hamamelis
Helleborous	Ilex opaca (3)
Juglans	Juniperus
Liatris	Lindera
Liriodendron	Lonicera
Magnolia	Monarda
Picea (2)	Pinus (3)
Poaceae (2)	Podophyllum
Polypodiaceae (2)	Populus
Prunus virginiana	Quercus
Rhamnus (5)	Scrophulariaceae
Tiarella	Tsuga
Vaccinium corymbosum	Violaceae
Vitis	

Hunting. Hunting, whether by rifle, shotgun, or bow, is the most emotionally and politically charged of all the controls methods. The management of deer populations is largely under the jurisdiction of state departments of fish and game or natural resources. Frequently sites are located in municipalities that further restrict the hunting of any sort through local ordinances that prohibit the discharge of firearms. Several of the sites have internal conflicts caused by the dual goals of being botanic gardens situated in wildlife preserves that have internal prohibitions against hunting, even when deer populations have reached a level that causes economic and/or ecological damage.

The controlled, permit hunting ("Limited" response in Table 1) by employees has been one means of reducing deer populations in natural areas and garden sites where public hunting might endanger ecologically or aesthetically sensitive landdsapes. Some sites have obtained permits from their state to harvest more than the usual limit of deer, while others have hired professional hunters to reduce deer populations in these areas.

Several of the respondents who perceive "deer problems" mention that hunting is limited in the vicinity of their site, or that they are encouraging more vigorous hunting in the immediate area. Other sites with little deer impact have mentioned that hunting has contributed to the reduction of the local deer populations.

While hunting undoubtedly does influence the size of the local deer populations, more than one respondent mentioned that there is a need for fine-tuning of deer herd management by states. In some cases it is felt that a state encourages higher than optimum deer populations to provide maximum recreational hunting opportunities for the public.

Other control measures. The control methods other than hunting that have been employed at the responding sites have been exceedingly diverse and have been accompanied by varying degrees of success. Physical barriers, feeding deterrents, repellents, and even dogs have been employed singly or in combinations. No respondents mentioned the use or effectiveness of sound devices in repelling deer or of employing sterilization techniques to limit deer population growth. None of the respondents mentioned that the live trapping and relocation of deer was a realistic control measure at their sites. The same is true for the reintroduction of predators such as wolves, bear, cougar, or coyote.

The most successful, albeit the most expensive in terms of capital outlays, are physical barriers that prevent deer from gaining access to the site or sensitive areas. At one extreme are deer-proof 7-9-foot high chain link (with or without barbed wire) fences constructed around the perimeter of the site. At the other extreme are fences constructed from chicken wire, snow fence, or plastic netting that are constructed around individual plants of special importance. In between, and apparently equally effective are fences of various sizes that are of barbed wire, turkey wire, or plastic. Electrified fences have also been very effective, but are not free of public liability problems. As effective as fences are, there are some situations (such as river crossings, highly irregular topography, wetlands, and coastal beach/saltmarsh) in which their effectiveness is severely reduced or even negated. Furthermore the cost of constructing miles of deer-proof fencing around some of the larger sites may be economically prohibitive, even if deer-caused damage levels are high.

Compounds that are applied to sensitive vegetation to deter feeding or that are placed in the field and have odors that repel deer have varying effectiveness according to the respondents. Hot pepper sauce, rotten egg solution, HINDER, REPEL, Big Game Repellent fall into the feeding deterrent group, while mothballs, human hair, dog hair, mothballs, bars of deoderant soap, and lion dung have been used as repellents. Many seem effective in the short run, but have the problem of needing to be renewed following rainy periods. Deer also may become accommodated to the scents over time, or in the worst case come to associate the scent with a food source and be attracted to that particular odor or taste. One respondent mentioned that rotten egg preparation and Big Game Repellent at first protected plants, but that deer soon were browsing more heavily upon plants treated with these solutions than on control plants. Three of the respondents mentioned that the active presence of dogs at the site was an effective deterrent to deer (undoubtedly more effective than wads of dog hair packed into mesh bags and tied to sensitive plants.)

In sum, the use of deterrent/repellents is probably effective in small areas, especially if several are used in sequence rather than mixed as a cocktail. However the labor costs of applying these compounds may be significant, and it is not clear whether they were taken into account by respondents when asked to give the annual expenditures for deer control measures.

Other Comments. Frequently respondents mentioned that deer were not the only "animal problem" at a site. Many urban, suburban, and rural sites mentioned that rabbits and voles were having significant impacts. Beaver are a "problem" in several sites that have wet habitats. It is important to be able to clearly identify and separate the damages caused by each of these species in order to design appropriate control and plant protection methods.

Deer/motor vehicle interactions were mentioned by several respondents. In certain regions, such as the Alleghenies and Middle Atlantic states, it is the impression of the respondents that such fatal interactions have increased over the past several decades. It would be interesting to survey the state police in the East to see if this impression indeed is correct.

It is clear that many of the respondents feel that there is a need to educate the public on the impacts of deer on native plants. Several of the larger arboreta and botanical gardens have conducted public

education programs, including the publication of plant lists of deer-resistant plants. However public perceptions of a "deer problem" may lag far behind the deleterious impacts on natural systems and aesthetic/educational facilities.

CONCLUDING REMARKS

The responses to the ENPA questionnaire point to the need for data on deer-caused damage that can be correlated with deer populations. Often there is deer population information without associated assessment of impacts on vegetation or vice versa. It is hoped that those institutions that have started monitoring programs will continue and expand them. With the diversity in responses of deer to food species available to them more studies that systematically evaluate control measures would also be helpful, especially in native plant communities.

The lack of long-term information in changes in abundance of plants in biotic communities makes it difficult to assess the role of changing deer populations in floral dynamics. A literature review of exclosure studies and comparisons of floristic surveys at times of known deer densities may provide further insights into this issue.

The exercise of constructing, responding to, and interpreting the ENPA questionnaire brings forth the issue of the role of human activities in shaping the interactions between deer and native plants. It is clear that white-tailed deer have been interacting with the various species of native plants for thousands of years, if not longer, before the peopling of the North American continent. However during the past four centuries, since European settlement of North America, humans have been responsible for the elimination of major predator species, the mass clearing of forested lands for agriculture and urban development, and the subsequent waves of reforestation on one hand and urban/suburban expansion on the other. It is as necessary as it is difficult to examine the direct and indirect roles of human activities in causing the fluctuations in deer populations that have been witnessed over the past quarter century. The question remains as to whether deer are natural population fluctuation or result of landscape scale (or larger) changes brought about by humans.

Political and ecological levelheadedness is needed in dealing with this emotionally charged issue. It is my feeling that we need to chart a course that avoids pitting "Plant Lovers" vs. "Bambi lovers." Collectively we need to embrace common goals of maintaining healthy, diverse, well-functioning ecosystems; be they human-dominated such as botanic gardens (and nurseries) or biotic communities with less direct human intervention. The compass for navigating this course undoubtedly lies in public education programs, efforts that will require coordination of ENPA with other public and private institutions.

A FEW REFERENCES

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7 October 1992

Dear Native Plant Enthusiast:

The Eastern Native Plant Alliance (**ENPA**) and I are attempting to survey ENPA member organizations and other appropriate institutions in eastern North America concerning their experiences with managing arboreta, botanic gardens, native plant nurseries, parks, and "natural area" habitats that are impacted by populations of eastern white-tailed deer. It is our hope to both gain an understanding about the dimensions of a potential management issue and to disseminate information concerning deer-native plant interactions to both professionals concerned with native plant management and the public at large.

We would appreciate your taking the time to fill out the enclosed questionnaire and mail it to me at the above address. I will compile the results and forward them to both the **ENPA** membership and all those who had responded. Thank you for your attention to this matter.

Yours Sincerely,

Henry W. Art
S. F. Clarke Professor of Biology

ENPA Deer/Vegetation Survey

1. Name of Organization: _____
Address: _____

Phone: _____

Name of Respondent: _____

Title: _____

Responsibilities: _____

2. Size of garden/nursery/park/natural area: _____ acres.

3. Is the site public or private?

4. Do you feel that there is a "deer problem" on your site?

If yes, please describe (and include the relationship between your site and the area surrounding it).

5. What is your estimate of the dollar value of plant materials annually consumed by deer at your site?

6. In your experience, what species or groups of species have been most vulnerable to deer browsing? Have any species been lost through deer browsing?

7. What species are to be least vulnerable to deer browsing?

8. What is your organizations official policy regarding deer.
9. What local, regional, or state legislation impacts your ability to manage deer-vegetation interactions?
10. What measures has your institution has taken to lessen deer impacts?
Have they been effective?
11. What are your annual expenditures (in \$) for these measures?
12. Do you have any historical data on the impacts of deer on the vegetation of your site that you can share with us?
10. What have been your primary sources of information in managing deer-vegetation interactions?
13. Please describe any public information programs concerning deer-vegetation interactions that your institution has sponsored:
14. Other Comments: [please write on a separate sheet]

ENPA Deer-Vegetation Survey

	A	B		C	D	E	F	G	H	I	J
	State	Site	Type	Acreage	Status	Setting	Deer Problem?	\$ Damage	Species Impacted Locally	Species Resistant Locally	
1	AK	Jewell Moore Nature Reserve	NA	8	Public	Campus	No				
2	AL	Birmingham Botanical Gardens	BG	67	Public	Urban	No				
3	CT	Woodstock Wildflower Nursery	N	2	Private	Suburb/ rural	No				
4	CT	Bartlett Arboretum	BG	63	Public	Suburb/ Exurb	Yes		Rhododendron, Taxus, summer annuals	Tsuga, Pinus	
5	CT	Connecticut College Arboretum	BG/NA	440	Private	Suburb/ Forested	Yes				
6	CT	Dolbia Hill Farm	NA	50	Private	Rural/ Forested	Yes		Lilium, Chimaphila, Orchidaceae, Viola, woody seedlings.		
7	CT	Heisinger Mem. Wildflower Garden	BG		Public	Suburb/ Exurb	Yes		Viburnum lentago, many herbaceous perennials.	Vaccinium corymbosum, Picea, Pinus	
8	DC	U.S. National Arboretum	BG	444	Public	Urban	No				
9	DC	National Wildlife Federation	NA	43	Private	Urban/ Suburb	Yes		Podophyllum, Euonymus, Chelone, Cyprededium, spring ephemerals		
10	DE	Delaware Nature Society	NA	110	Private		No		Lilium canadense		
11	DE	Mt. Cuba Center	BG	240	Private	Rural	Yes	\$110	Helonias bullata, Trillium, Liliaceae	Juglans	
12	DE	Winterthur	BG	982	Private	Rural/Ag	Yes			Ilex opaca, Chamaecyparis, Picea	
13	FL	Selby Gardens	BG	16	Public	Urban	No				
14	GA	Atlanta Botanical Garden	BG	30	Private	Urban	No				
15											

ENPA Deer-Vegetation Survey

	A	B	C	D	E	F	G	H	I	J
1	State	Site	Type	Acreage	Status	Setting	Deer Problem?	\$ Damage	Species Impacted Locally	Species Resistant Locally
	GA	Chattahoochee Nature Center	NA	128	Private	Suburb	No			
16	GA	Eco Gardens	N	6	Private	Urban/ Suburb	No			
17	GA	Transplant Nursery	N	10	Private	Rural	No			
18	GA	Zoo Atlanta	ZG	30	Public	Urban	No			
19	GA	C.M. Adams	N	25	Private	Rural	Yes	\$2,000	Viburnum, Rosaceae	Pinus, Rhamnus, Aesculus, Catalpa
20	GA	Piccadilly Farm	N	20	Private	Rural	Yes	\$1,000	Hosta	Helleborous
21	GA	State Botanical Gardens of GA	BG	313	Public	Rural/Ag	Yes		Rosaceae, Liliaceae, herbaceous spp. in general	Conifers in general
22	IL	Washington Park Botanical Garden	BG	20	Public	Urban	No			
23	IL	Chicago Botanic Garden	BG	300	Public	Suburb	Yes	\$22,000	Spring ephemerals; Liliaceae, Asteraceae, Poaceae, Taxus, Thuja, Tsuga, Rhododendron	Podophyllum, Cirsium, Dentaria
24	IL	Morton Arboretum	BG	1700	Private	Suburb	Yes		Woody plants from antler rubbing; 437 plants browsed; Rosaceae, Quercus	
25	IL	Rivendell Botanic Garden	BG	12	Private	Rural	Yes	\$7,500	Pinus, Magnolia, Quercus by antler rubbing	
26	LA	Hilltop Arboretum	BG	14	Public	Urban	No			
27	MA	Mt. Holyoke Bot. Garden	BG	800	Private	Rural/ Exurb	Maybe		Small woody plants.	
28	MA	Bot. Garden. of Smith College	BG		Private	Urban/ Suburb	No			
29										

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1	State	Site	Type	Acreege	Status	Setting	Deer Problem?	\$ Damage	Species Impacted Locally	Species Resistant Locally
	MA	Garden in the Woods	BG	45	Private	Suburb	No			
30	MA	Norcross Wildlife Sanctuary	BG	15	Private	Rural	Yes		Chelone, Monarda, Lilium, Gentiana crinita, etc. lost; many other browsed heavily	Actaea, Coptis, Liatris, Aruncus, Caulophyllum
31	MD	Naturalist Audubon Society	NA	40	Private	Urban/ Suburb	No			
32	MD	Patuxent River Park	Park	2000	Public		No		Pyrus	
33	ME	Wild Gardens of Acadia	BG	0.75	Public	Wild	Yes	\$200	Lilium, Juniperus, Rhododendron, Thuja.	
34	MI	Whitcomb Conservatory	BG	10	Public	Urban	No			
35	MI	Fernwood Botanic Garden	BG	105	Public	Rural/Ag	Yes	\$100	Rhododendrons, young woody plants.	Juniperus, Vitis.
36	MI	Hidden Lake Gardens	BG	670	Public	Rural/Ag	Yes		Taxus, Thuja, Euonymus by antler rubbing and browsing.	
37	MO	Missouri Wildflowers Nursery	N	3	Private	Rural	No	\$40	Callirhoe.	
38	MO	Shaw Arboretum	BG/NA	2400	Private	Rural	Yes	\$5,000	Liliaceae, Asclepias quadrifolia, Araesima, Asteraceae, Rosaceae, Viburnum.	Asclepias, Monarda, Scrophulariaceae, Violaceae, Apocynaceae, Poaceae, Polypodiaceae.
39	NC	Boothe Hill Wildflowers	N	3	Private	Urban/ Suburb	No		Lobelia cardinalis, Asclepias tuberosa.	
40	NC	H.L. Blomquist Garden	BG	6.5	Private	Urban/ Suburb	No			
41	NC	Holbrook Farm	N		Private		No			
42	NC	NC Arboretum	BG	425	Public	Rural/ Forested	No	<\$50	Carya seedlings, Cornus.	
43										

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1	State	Site	Type	Acreage	Status	Setting	Deer Problem?	\$ Damage	Species Impacted Locally	Species Resistant Locally
	NC	NCSU Arboretum	BG	8	Public	Urban	No			
44	NC	Niche Gardens	N	7	Private	Exurb	No			
45	NC	Biltmore Forest	NA		Private		Yes			
46	NC	Martin-Marietta	Campus	2	Private		Yes		Asarum, Mitchella repens, Euonymus.	
47	NH	Beaver Brook Assn.	NA	1700	Private	Rural/Forested	No			
48	NJ	Native Plant Soc. of NJ	NA	1	Private	Rural/Ag	No			
49	NY	Staten Island Botanical Garden	BG	80	Public	Urban	No			
50	NY	Wave Hill	G	28	Public	Urban	No			
51	NY	Cornell Plantations	BG/NA	2700	Private	Rural/Exurb	Yes		Quercus, Amelanchier, Orchidaceae, Liliaceae, Taxus.	Prunus virginiana, Rhamnus, Fagus.
52	NY	Fire Island National Seashore	NA	3,000	Public	Wild/Suburb	Yes		Herbaceous perennials, Ilex glabra, Vaccinium corymbosum.	Ilex opaca.
53	NY	The Nature Conservancy	NA				Yes		Loss of woody seedlings; Lupinus.	
54	OH	Garden Center of Greater Cleveland	BG	7	Public	Urban	No			
55	OH	Toledo Zoo	ZG	65	Public	Urban	No			
56	OH	Holden Arboretum	BG	3100	Private	Exurb	Yes	\$10,000	Tsuga, Taxus, Trillium, Rosaceae, Liliaceae.	
57	ON	Niagara Parks Comm. Bot. Garden	BG	88	Public	Urban/Suburb	No		Pyrus.	
58										

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	A	B	C	D	E	F	G	H	I	J
1	State	Site	Type	Acreage	Status	Setting	Deer Problem?	\$ Damage	Species Impacted Locally	Species Resistant Locally
59	ON	Fed. Ont. Naturalists	NA	21,000	Public	Rural	Yes	\$75	Cypripedium, Trillium, Hamamelis, Viburnum, Acer, Tsuga.	Rhamnus.
60	ON	U. Guelph Arboretum	BG		Public		Yes		Acer seedlings, Viburnum, Rosaceae, Cornus florida, Euonymus.	Fraxinus, Liriodendron, Rhamnus, Magnolia, Hamamelis.
61	PA	Delaware Valley College	N	2	Private	Suburb/Ag	Minor	\$500	Tree rubbing.	
62	PA	Appalachian Wildflower Nursery	N	1	Private	Rural/Ag	No			
63	PA	Brandywine Conservancy	BG	3	Public	Rural/Exurb	Yes		Rhododendron, Kalmia, Tiarella, Phlox, Pachysandra procumbens.	
64	PA	Mrs. J.G. Williams	G	2	Private		Yes	\$350	Taxus, Rhododendron.	
65	PA	Waverly Heights Landscape Comm.	G	54	Private	Suburb	Yes	\$1,000	Rhododendron from browsing; saplings from antler rubbing.	Conifers; Berberis.
66	PA	Bowman's Hill	NA/BG	80	Public	Rural/Exurb	Yes!		Liliaceae, Cypripedium, Hellonias, Rhododendron maximum, Kalmia latifolia.	Lindera, Eupatorium rugosum, Cassia hebecarpa.
67	SC	Riverbanks Zoological Park	ZG	125	Public	Urban	No			
68	SC	Woodlanders	N		Private	Town	No			
69	TN	Cheekwood- TN Botanical Gardens	BG	55	Private	Urban/Forested	No	<\$100	Cornus alternifolia, Anthemis.	
70	TN	Native Gardens	N	3	Private	Rural	No			
71	TN	Reflection Riding	BG	300	Public	Rural	No			
72	TN	TVA	NA	10,000	Public		No		Euonymus.	
73	TN	Sunlight Gardens	N	55	Private	Rural	Yes	\$200	Polygonatum, Hepatica, Aquilegia.	Asarum, Polyopodaceae, Tiarella, Cimicifuga, Arisaema, Chrysogonum.

ENPA Deer-Vegetation Survey

	A	B	C	D	E	F	G	H	I	J
1	State	Site	Type	Acreage	Status	Setting	Deer Problem?	\$ Damage	Species Impacted Locally	Species Resistant Locally
	TN	U. TN Forestry Exp. Sta.	NA	2260	Public	Rural	Yes	\$6,500	Deciduous Ilex, Juniperus, woody seedlings.	Ilex opaca.
74	VA	Dept. Conservation & Recreation	NA	12,000	Public		Maybe		Iliamna corei, Arabis serotina, Cypripedium.	
75	VA	White Arboretum	BG	150	Public	Rural/Ag	Maybe	\$275	Tsuga, Larix; Ulmus and Quercus from antler rubbing.	Mature, woody species.
76	VA	Center for Historic Plants	BG	2	Private	Suburb	No		Large variety of historical crops.	
77	VA	Montpelier	Estate	2780	Private	Rural	No	\$1,000	Pinus strobus.	Quercus.
78	VA	Reston Association	NA	1300	Private	Suburb	No	<\$100		
79	VA	Virginia Zoological Park	ZG	52	Public	Urban	No		Low shrubs.	
80	VA	Winkler Botanical Preserve	NA	43	Private	Urban/ Suburb	No			
81	VA	Blackwater Ecological Preserve	NA	340	Public	Rural	Yes		Carphephorus.	Ericaceae- browsed but recover.
82	WI	Prairie Nursery	N	28	Private	Rural/Ag	Moderate	\$1,250	Lilium, Aster, Petalostemum.	Poaceae.
83	WI	U. of WI Arboretum	BG/NA	1280	Public	Suburb/ rural	Yes	\$10,000	Taxus, Trillium, Thuja.	Rhamnus, Lonicera.
84	WI	U.WI- Stevens Point	NA	1200	Public	Rural/ wild	Yes	\$5,000	Pinus strobus, Betula aleghaniensis, Tsuga.	Populus, Alnus.
85										

ENPA Deer-Vegetation Survey

	K	L	M	N	O	P	Q
1	Hunting?	Other Measures	Control \$	Comments	Contact	Address	Phone
2				No deer on campus.	Culwell, Donald	Biology Department University of Central Arkansas Conway, AR 72032	501-450-5919
3					Gerlach, G.	Birmingham Botanical Gardens 2612 Lane Park Road Birmingham, AL 35223	205-967-3173
4					Manthorne, Arthur E.	Woodstock Wildflower Nursery 422 Roseland Park road Woodstock, CT 06281	203-928-9441
5	No	Pepper sauce spray and netting partially effective.			Pettit, Nick	Bartlett Arboretum 151 Brookdale Road Stamford, CT 06903	203-322-6971
6				The 100 acres with 6' chain link + 1' barbed wire fence have no deer damage, the rest is browsed heavily.	Dreyer, Glenn	Connecticut College Arboretum 5625 Connecticut College 270 Mohegan Avenue New London, CT 06320	203-439-2144
7	Limited			Surrounded by Nature Conservancy lands. Deer populations have increased dramatically over past 30 years.	Goodwin, Richard H.	c/o Connecticut College Arboretum 5625 Connecticut College 270 Mohegan Avenue New London, CT 06320	203-439-2144
8	No	Pepper sauce spray, soap bars, dried blood, Milorganite.		Garden within the Bartlett Arboretum.	Faust, Joan L.	11 Field Road Riverside, CT 06878-2302	203-637-3725
9				Only 2 deer sighted in 1992.	Feely, Joan	U.S. National Arboretum 3501 New York Avenue, NE Washington, DC 20002	202-475-4855
10	No			Not major problem, but can see browsing impacts. On corridor to larger wooded areas.	Tufts, Craig	National Wildlife Foundation 1400 16th Street, NW Washington, DC 20036	703-790-4438
11	Limited		Ann=\$500	Controlled hunting with State permission for higher than normal harvest.	Welles, Susan W.	Delaware Nature Society P.O. Box 700 Hockessin, DE 19707	302-
12	Limited			Small problem at present.	Lighty, Richrd W.	Mt. Cuba Center for the Study of Piedmont Flora P.O. Box 3570 Greenville, DE 19807-0570	302-239-4244
13	Limited		Ann=\$500	Employee hunt.	Buchter, Thomas	Winterthur Museum and Garden Winterthur, DE 19735	302-888-4600
14					Lowman, Meg	Marie Selby Botanic Gardens 811 S. Palm Sarasota, FL 34236	813-955-7553
15					Pinnell, Mildred	Atlanta Botanical Garden P.O. Box 77246 Atlanta, GA 30357	404-876-5859

ENPA Deer-Vegetation Survey

	K	L	M	N	O	P	Q
1	Hunting ?	Other Measures	Control \$	Comments	Contact	Address	Phone
				Last deer seen in 1979.	Von Schmeling, Henning	Chattahoochee Nature Center 9135 Willeo Road Roswell, GA 30075	404-992-2055
16					Jacobs, Don L.	Eco Gardens P.O. Box 1227 Decatur, GA 30031	404-294-6468
17		Has Weimaraner dogs.			Beasley, Mary	Transplant Nursery Box 16, Parkertown Road Lavonia, GA 30553	706-356-8947
18				An urban zoo.	Barnett, Michael	Zoo Atlanta 800 Chebokee Avenue, SE Atlanta, GA 30315	404-624-5925
19				Deer populations are increasing.	Adams, Charles M.	1393 Poplar Point, SE Smyrna, GA 30082	404-436-0072
20	Yes	Encircle individual trees with wire mesh, spray HINDER. Dog hair.	Ann=\$500	Deer are a real problem for Piedmont gardeners.	Jones, Samuel	Piccadilly Farm 1971 Whipporwill Road Bishop, GA 30621	706-769-6516
21	No	Electric fences partially successful.	Ann=\$5000		Lewis, A.J.	State Botanical Gardens of Georgia 2450 S. Milledge Avenue Athens, GA 30605	706-542-1224
22					Berg, Inez Goodzey	Washington Park Botanical Garden P.O. Box 5052 Springfield, IL 62705	217-753-6228
23					Brown, Diane	Chicago Botanic Garden P.O. Box 400 Glencoe, IL 60022	708-835-5400
24	Marksman	Repellents, barriers, electric fences, chicken wire on individual plants.	Ann=\$8,000	Perimeter fence under study - would cost in excess of \$500,000. If all Trillium and Erythronium lost to deer were replaced it would cost \$1.7M.			
25	Marksman	Electric fence, 4' barrier fences+ repellants; perimeter fence under study.	Ann=\$7,200	Exlosures (3) constructed in 1991.; positive response by members to professional hunt. Has inventories of deer damaged species.	Bachtell, Kris R.	Morton Arboretum Lisle, IL 60532	708-968-0074
26	Yes			Damage nearly all species by antler rubbing or browsing.	Tyson, Stan	Rivendell Botanic Garden P.O. Box 17 Beardstown, IL 62618	
27					Drummond, Marion	Hilltop Arboretum P.O. Box 82608 Baton Rouge, LA 70884	504-767-6916
28				A recent problem with relocation of nursery near woods.	Shukis, Ellen M.	Botanic Garden Mount Holyoke College South Hadley, MA 01075	413-538-2199
29					Munson, Richard H.	Lyman Plant House Smith College Northampton, MA 01060	413-585-2748

	K	L	M	N	O	P	Q
1	Hunting ?	Other Measures	Control \$	Comments	Contact	Address	Phone
		Perimeter fence.			Lowe, Cheryl	Garden in the Woods New England Wildflower Society 180 Hemenway Road Framingham, MA 01701	508-877-7630
30	No	Mothballs, creosote, soaps; Nursery has 6' fence that is breached by deer in winter; burlap/snow fence single plants in winter.		In 4,000 a. sanctuary, in which deer are even being fed and given salt.	Duthie, Leslie A.	Norcross Wildlife Sanctuary 30 Peck Road Monson, MA 01057	413-267-9654
31					Huff, Jane Netting	Audubon Naturalist Society of the Central Atlantic States 8940 Jones Mill Road Chevy Chase, MD 20815	301-652-9188
32	Limited			Dogs in park repel deer.	Tierney, Jean	Patuxent River Park 16000 Croom Airport Road Upper Marlboro, MD 20772	301-627-6074
33	No	Chicken wire around individual plants.	Ann=\$7	In Acadia National Park.	Cole, Barbara C.	P.O. Box 896 Bar Harbor, ME 04609	207-288-3400
34					Justice, James	Anna Scripps Whitcomb Conservatory Detroit, MI 48207	313-267-7133
35	No	Repellants, barriers.	Ann=\$75		Kociba, Eugene	Fernwood Botanic Garden 13988 Range Line road Niles, MI 49120	616-695-6491
36	Limited	Electric fences.			Wolf, Jack	Hidden Lake Gardens 6280 W. Munger Road Tipton, MI 49287	517-431-2060
37				Deer seem to be eating exotic weeds more than native plants.	Wallace, Mervin	Missouri Wildflowers Nursery 9814 Pleasant Hill Road Jefferson City, MO 65109	314-496-3492
38	Limited	Area fencing- 9' high.	Cap=\$40,000	Deer populations have increased dramatically over past 50 years.	Behrer, John W.	Shaw Arboretum P.O. Box 38 Gray Summit, MO 63039	314-742-3512 314-742-0850
39					Easterling, Nancy	Boothe Hill Wildflowers 23B Boothe Hill Chapel Hill, NC 27514	919-967-4091
40				Rabbits and voles are a problem.	Steffek, Edwin F., Jr.	Sarah P. Duke Gardens P.O. Box 90341 Durham, NC 27708-0341	919-684-3698
41					Bush, Allen	Holbrook Farm P.O. Box 368 Fletcher, NC 28732	
42				In early stages of garden development; adjacent to Pisgah National Forest.	Lance, Ron	The North Carolina Arboretum P.O. Box 6617 Ashville, NC 28816	704-665-2492
43							

ENPA Deer-Vegetation Survey

	K	L	M	N	O	P	Q
1	Hunting ?	Other Measures	Control \$	Comments	Contact	Address	Phone
				Not a problem at all.	Foley, Tom, Jr.	NCSU Arboretum Box 7609 Raleigh, NC 27695-7609	919-515-3132
44		Has a large dog!			Hawks, Kim	Niche Gardens 1111 Dawson Road Chapel Hill, NC 27516	919-967-0078
45				There is a problem with deer damage in western NC.	Chipman, C. Lee	One Fir Tree Lane Biltmore Forest, NC 28803	
46	No	Human hair.			Cameren, Carole	Martin Marietta P.O. Box 30013 Raleigh, NC 27622	919-781-4550
47	No			Timber mgt. has probably encouraged deer.	Stone, Jason	Beaver Brook Association 117 Ridge Road Hollis, NH 03049	603-465-7787
48				Not as much a problem as in other parts of NJ.	Swain, Robert L.	The Native Plant Society of NJ Cook College P.O. Box 231 New Brunswick, NJ 08903-0231	908-928-0600
49					Huber, Frances X. Paulo	Staten Island Botanical Garden 1000 Richmond Terrace Staten Island, NY 10301	718-273-8200
50				Not many deer in the Bronx.	Stufano, Marco Polo	Wave Hill 675 W. 252 Street Bronx, NY 10471	212-548-4833
51	No	Small research exclosures.		Rabbits are problematic as well.	Ostman, N.	Cornell Plantations 1 Plantations Road Ithaca, NY 14850	607-255-9638
52	No	Research exclosures.		Feeding by residents may be stimulating deer population growth.	Art, Henry W.	Biology Department Williams College Williamstown, MA 01267	413-597-2461
53	No	A few exclosures.			Zaremba, Robert E.	The Nature Conservancy - NY Office 1736 Western Avenue Albany, NY 12203	518-869-6959
54					Siktberg, Robin	Garden Center of Greater Cleveland 11030 East Blvd Cleveland, OH 44106	216-721-1600
55		Completely fenced.			Bucher, Nancy	Toledo Zoo 2700 Broadway Toledo, OH 43609	419-385-5721
56	Limited	HINDER, DEER AWAY, netting, snow fence, electric fences.	Cap=\$10,000; Ann=\$5,000	Encourages deer hunting in the region. Has inventory of plants most and least vulnerable to deer damage.	Gerlica, Dawn M.	The Holden Arboretum 9500 Sperry Road Mentor, OH 44060	216-256-1110
57	No	Repellents.	Ann=\$35	Occasional activity in fruit orchards.	Dell, Melvin	Niagara Pks Comm. Bot. Gardens P.O. Box 150 Niagara Falls, ON, Canada L2E	416-356-8554
58							

	K	L	M	N	O	P	Q
1	Hunting ?	Other Measures	Control \$	Comments	Contact	Address	Phone
	No	None.	Cap=\$300	Some small exclosures to protect orchids; Some hunting in Provincial parks.	Lamb, Lawrence	Federation of Ontario Naturalists 355 Lesmill Road Don Mills, ON Canada M3B 2W8	416-444-8419
59	No	Chicken wire.	Ann=\$400	Edge habitats have contributed to increases in deer.	Kock, Henry	The Arboretum The University of Guelph Guelph, ON, Canada N1G 2W1	519-824-4120 ext.8162
60					Ray, Frederick H.	Delaware Valley College Guelph, ON, Canada N1G 2W1	215-345-1500 ext. 2293
61				Active hunting in the neighborhood.	Hackenberry, Don	Appalachian Wildflower Nursery Rt. 1, Box 275A Reedsville, PA 17084	717-667-6998
62	No	Plastic netting w/good results; ROPEL, soap, human hair.	Ann=\$300	Landscape fragmentation is altering deer feeding behavior.	Gormel, Mark R.	Brandywine Conservancy P.O. Box 141 Chadds Ford, PA 19317	2-5-388-2700 ext. 127
63		Fencing 8' high.	Cap=\$3,000	Concentration through habitat destruction in region.	Williams, Mrs. J.G.	Mrs. J.G. Williams 831 Black Rock Road Gladwyne, PA 19035	
64	No	Plastic netting over beds; perimeter fence 8' turkey wire.	Cap=\$2750		Truitt, Mrs. Charles S.	Villa 18 1400 Waverly Road Gladwyne, PA 19035	215-645-8667
65	No	10' chain link perimeter fence.	Cap=\$270,000 Ann=\$1500	No new plantings survive overnight w/o fencing.	Lowry, Janet L.	Bowman's Hill Wildflower Preserve Washington Crossing Hist. Park Washington Crossing, PA 18977	215-862-2924
66	No			Deer populations in nearby areas appear to be growing.	Shoemaker, Alan	Riverbanks Zoological Park P.O. Box 1060 Columbia, SC 29202	803-779-8717
67					McCartney, Robert B.	Woodlanders, Inc. 1128 Colleton Avenue Aiken, SC 29801	803-648-7522
68	No	Perimeter fence 6' high; blood meal.	Ann=\$5		Yando, David	Cheekwood-Tennessee Botanical Gardens 1200 Forrest Park Drive Nashville, TN 37205	615-353-2148
69				Has 4 large dogs that probably keep them away.	Bradford-Clebsch, Meredith	Native Gardens 5737 Fisher Lane Greenback, TN 37742	615-856-3350
70				Beaver are more of a problem.	McAloon, Steve	Reflection Riding 400 Garden Road Chattanooga, TN 37419	615-821-9582
71	Yes				Bartlow, Judith P.	Tennessee Valley Authority Natural Resources Building 17 Ridgeway Road Norris, TN 37828	615-632-1592
72	No	Bird netting draped over nursery beds.	Cap=\$45	Deer hunting in the vicinity.	Sessions, Andrea	Sunlight Gardens Rt. 1 Box 600A Andersonville, TN 37705	615-494-8237
73							

	K	L	M	N	O	P	Q
	Hunting?	Other Measures	Control \$	Comments	Contact	Address	Phone
1	Limited			Exclusion fences under consideration.	Evans, Richard M.	U. TN Forestry Expt. Station & Arboretum 901 Kerr Hollow Road Oak Ridge, TN 37830	615-438-3571
74	Some	Small exclosures for sensitive populations.	Ann=\$1000	Has 9 natural areas.	Caljian, Caren	Division of Natural Heritage Department of Cons. & Recreation 1500 E. Main St., Suite 312 Richmond, VA 23219	804-786-7951
75	No			Hunting on surrounding farms.	Sacchi, Christopher F.	Orlando E. White Arboretum Blandy Experimental Farm P.O. Box 175 Boyce, VA 22620	703-837-1758
76	No	Electric fence - very effective.	Ann=\$25		Sacilotto, Robert	Center for Historical Plants P.O. Box 316 Charlottesville, VA 22902	804-296-7265
77	Limited				Scott, Ted G., Jr.	P.O. Box 67 Montpelier Station, VA 22957	703-672-2728
78	No	Soap in mesh bags.	Ann=\$50	Not much of a problem.	Thompson-Deahl, Claudia	Reston Association 12250 Sunset Hills Road Reston, VA 22090	703-437-7658
79				An urban zoo.	Schneider, Mark	Virginia Zoological Park 3500 Granby Street Norfolk, VA 23504	804-441-2374
80					Arrillaga, M. Charlene	Winkler Botanical Preserve 4900 Seminary Road (9th Floor) Alexandria, VA 22311	703-578-7888
81	Limited			Browsing of flowers hampers restoration of fire-dependent system.	Frost, Cecil	NCDA Plant Conservation Program Plant Industry Division P.O. Box 27647 Raleigh, NC 27611	919-733-3610
82	Limited	Repellents and soap bars moderately effective; hair low effectiveness.		Hunting in the surrounding area.	Diboll, Neil	Prairie Nursery P.O. Box 306 Westfield, WI 53964	608-296-3679
83	Limited	Snow fence; repellants, hair in bags.	Ann=\$3,000	Conducted a study in 1987 on deer management alternatives for the arboretum lands.	Armstrong, Gregory D.	U. Wisconsin Arboretum 1207 Seminole Highway Madison, WI 53711	608-262-2748
84	Yes			Would prefer pre-colonial deer density (1/10 of present).	Haney, Alan	College of Natural Resources U. Wisc. - Stevens Point Stevens Point, WI 54481	715-346-2955
85							