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An Assessment of the Effects of Browsing by White-tailed Deer on Spring Wildlfowers at the Olin Nature Preserve

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In recent years populations of White-tailed deer (*Odocoileus virginianus*) have increased dramatically. Nowhere is this more apparent than in the near-urban setting of the Olin Nature Preserve on the outskirts of Godfrey and Alton, Illinois. Several deer can usually be observed on any day trip through the preserve and its surrounding areas. With a total ban on hunting, no native predators, and little risk of deer-automobile incidents the population can easily reach problem levels. Of importance to biologists and managers of these sites is the impact that the deer herd has on the remaining native plants on the site. Because the site has been highly disturbed in the past, and because of its close proximity to urban areas, few areas of high quality native flora remain. It is the goal of the preserve managers to restore native populations to the site through removal or control of invasive weeds and exotic species. Past studies have shown that deer browsing can negatively impact populations of native plants from tree recruitment (Hemlock, Oak) to small forest floor ephemerals (orchids, lilies). The goal of this study was to determine to what extent the deer population at the Olin Nature Preserve is affecting a target list of native species (table 1).

Table1- List of potential indicator species at Olin Nature Preserve

Scientific name	Common name	Habitat	Present
Arisaema triphyllum	Jack-in-the-pulpit	Wooded slopes	No
Baptisia leucantha	White false indigo	Disturbed woods	No
Claytonia virginica	Spring beauty	Moist woods	Yes
Corallorhiza wisteriana	Coral root orchid	Wooded slopes	No.
Corydalus flavula	Yellow corydalis	Low moist woods	No
Dentaria laciniata	Cut-leaved toothwort	Wooded slopes	Yes
Dicentra cucullaria	Dutchman's breeches	Rich woods	Yes
Dodecatheon meadii	Shooting star	Wooded slopes	No
Hydrophyllum canadense	Waterleaf	Moist woods	No
Hypoxis hirsuta	Yellow star grass	Hill prairie	Yes*
Isopyrum biternatum	False rue anemone	Hop hollow	No
Phlox divericata	Woodland phlox	Moist woods	Yes
Sanguinaria canadensis	Bloodroot	Hop hollow	No
Smilacina racemosa	False soloman's seal	Wooded slopes	Yes
Tradescantia ohioensis	Ohio spiderwort	Wooded slopes	No
Trillium recurvatum	Prairie trillium	Moist woods	Yes
Uvularia grandiflora	Bellwort	Moist woods	Yes
Veronicastrum virginicum	Culver's root	Wooded slopes	No
Viola cucullata	Marsh blue violet	Wooded ravines	Yes
Viola pratincola	Common blue violet	Open woods	Yes
Viola sororia	Wooly blue violet	Open woods	No
Viola Triloba	Cleft violet	Wooded slopes	No

* Reported by TNI volunteer worker

Methods and Materials

In December 1999 several "high quality" sites (those with minimal recent disturbance) were selected from areas known to have historical populations of target species. From January to March 2000 a series of $1M^2$ exclosures were constructed with plastic screening (similar to "chicken wire fencing") attached to $1M$ pieces of steel rebar driven into the ground at the corner of each $1M^2$ Quadrat. For each exclosure constructed a nearby $1M^2$ quadrat was established as a control. In all Thirty-two exclosures were constructed on various sites on the preserve. Weekly surveys were conducted and plants that flowered in the study areas were identified. Vegetation on the quadrats was sampled April 18⁻ 20 and May 15-18. All plants rooted on the quadrats and in the exclosures were identified, and estimates of percent cover were made for the quadrat. A cover-abundance coefficient was assigned each species on the study plots. Each unprotected quadrat was inspected for browse damage, which was subsequently assigned to a browse category of 0-5 (0 indicating no browse damage). A general survey of the surrounding area was also done and any plants exhibiting browse damage were identified and recorded. An estimate of the Deer population on the Olin Nature Preserve was made using aerial and ground surveys in February.

Results

Plant densities, percent cover, and species present were not different between the exclosures and the controls on any site in the preserve. Furthermore, no control quadrat experienced more than light browsing (level 1) and most experienced no browse damage at all. Target species that occurred in the survey plots are identified in table 1. Of the target species listed only Woodland Phlox (*Phlox divericata*), and Cut-leaved toothwort (*Dentaria laciniata*) were observed with browse damage. In both cases the browse removed roughly half of the plant, but in all observed cases the browsing was not fatal to the plant and in many cases inflorescences were still produced. Percent cover on the study plots ranged from a low of 0 to a high of 90. Percent cover on the exclosures tended to be slightly higher than the control. For a complete listing of survey results including percent cover and cover-abundance coefficients see appendix a. An aerial survey of the site resulted in one herd of eight deer being spotted and counted.

Discussion

The results of this study are inconclusive as to the effect of deer browsing on the Olin Nature Preserve. Browse levels were much lower than expected given that most survey sites were well traveled by deer and many deer were observed in the area throughout the study. Most of the browsing, especially in

winter, occurred on European fly honeysuckle (*Lonicera xylosteum*) an invasive exotic to the site. Browsing also occurred on several other non-target species as listed in table 2. Deer densities were not as great as earlier believed. On the day of the aerial survey a second herd of 12 animals was reported under the protection of a pine stand in the arboretum. Based on this information and the aerial survey results we estimate the deer population in and around the preserve to be between 25 and 40 deer. This number can really be assumed to be even lower given the fact that the estimate is based on deer that move in and out of surrounding agricultural areas. Therefore the density of deer should be considered on much more area than the roughly 300 acres that make up the preserve proper. However, given the rapidity with which deer populations can change and the total lack of predators, it can be reasonably inferred that this estimate could be very low in the coming years.

Of note in the results is that in most cases the percent cover on the exclosures is higher than the control. In all cases this minor difference can be attributed to a damming effect created by the sides of the exclosures which prevented erosion and seed loss from the exclosure. One should also note that of the original 32 exclosures, only 22 were included in the results. This was a result of many quadrats not having target species on either the exclosure or the control. As can be seen from the list of observed species on table 2, weedy species are a definite problem with the site. This, however, appears to be the proverbial double-edged sword. While weedy species and invasive exotics increase competitive pressure on native species, they also appear to remove some of the browse pressure as is evidenced by the amounts of browsing observed on European fly honeysuckle. That being the case, it is still unclear as to whether the deer do have an impact on species for which they are known to selectively browse (orchids and lilies) since these were not encountered on any of the survey sites.

One glaring problem that this study points out is the lack of a current biological inventory of the site. Thompson (1981) provides the most recent account for the flora of the Olin Nature preserve, however, it appears that this is in need of update as much of the expected spring flora was either not present or very rare. An updated study would provide an adequate baseline for management plans in the future. Maintaining the exclosures as permanent, long-term study plots would attain further benefit. While there is no statistical correlation, the appearance of Oak seedlings on several of the exclosures presents the interesting question of deer impact on Oak regeneration.

Continued maintenance and monitoring of the exclosures as well as the deer population could be performed at minimal cost. Survey dates should be advanced at least two weeks to avoid the large populations of "weedy" species that appeared in mid-May. An additional study involving the tagging of Oak and Hickory seedlings on and off the exclosures could be used as a means of determining any constraints that deer place on recruitment of these species. The

Table 2- Summary list of observed species

Acer saccharum	Sugar maple*
Carya sp.	Hickory
Cercis canadensis	Red bud
Quercus sp.	Oak
Ulmus sp	Elm
Lonicera xylosteum	European Fly honeysuckle*
Rosa multiflora	Multiflora rose
Anthyrium felix-femina	Lady fern
Claytonia virginica	Spring beauty
Dentaria laciniata	Cut-leaved toothwort*
Dicentra cucullaria	Dutchman's breeches
Eleusine indica	Goosegrass
Euonymous fortunei	Common wintercreeper
Lamium amplexicaule	Henbit
Laportea canadensis	Wood nettle*
Oxalis europaea	Wood sorrel
Podophyllum peltatum	Mayapple*
Phlox divericata	Woodland phlox*
Smilacina racemosa	False soloman's seal
Trillium recurvatum	Prairie trillium
Urtica dioica	Stinging nettle
Uvularia grandiflora	Bellwort
Uvularia sessifolia	Perfoliate bellwort*
Viola cucullata	Marsh blue violet
Viola pratincola	Common blue violet
Vitis parthenocissus	Virginia creeper*
Zizia aurea	Golden alexanders

* Species observed with browse damage

information gathered in this and future studies will be important in determining an effective overall management strategy for improving and maintaining the biological diversity of the Olin Nature Preserve and the Mississippi Sanctuary.

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Appendix a- Survey results

Survey plot/ % Cover	Species	C-A
Survey 1		
A1-E1/ 60%	*Euonymous fortunei*	2
	Gramineae	2
A1-C1/60%	*Viola pratencola*	1
	Euonymous fortunei	2
A1-E2/ 90%	Lonicera xylosteum	1
	Viola pratencola	1
	Eleusine indica	1
A1-C2/ 40%	Urtica dioica	3
A1-E3/ 50%	Urtica dioica	1
	Vitis parthenocissus	2
	Euonymous fortunei	1
A1-C3/ 50%	*Urtica dioica*	3
	Eleusine indica	1
A2-E1/ 90%	Oxalis europaea	1
	Urtica dioica	4
A2- C1/ 70%	Rosa multiflora	1
	Lamium amplexicaule	2
	Urtica dioica	3
A2-E2/ 50%	Viola pratincola	2
	Gramineae	2
	Urtica dioica	3
A2-C2/ 40%	Urtica dioica	4
A2-E3/ 10%	Vitis parthenocissus	2
	Eleusine indica	1
A2-C3/ 10%	Urtica dioica	2
	Eleusine indica	1

Survey plot/ % Cover	Species	C-A
A3-E1/ 50%	*Podophyllum peltatum*	2
	Claytonia virginica	3
	Vitis parthenocissus	2
A3-C1/ 50%	*Podophyllum peltatum*	2
	Claytonia virginica	3
	Vitis parthenocissus	1
A3-E2/ 60%	*Podophyllum peltatum*	2
	Claytonia virginica	4
A3-C2/ 40%	*Claytonia virginica*	4
A3-E3/ 70%	*Claytonia virginica*	4
	Gramineae	1
A3-C3/ 50%	*Claytonia virginica*	4
	Trillium recurvatum	1
	Gramineae	1
A4-E1/ 60%	*Phlox divericata*	2
	Claytonia virginica	3
	Vitis parthenocissus	1
	Dicentra cucullaria	1
	Acer saccharum	1
A4-C1/ 60%	*Phlox divericata*	2
	Claytonia virginica	3
	Lonicera xylosteum	1
	Laportea canadensis	1
A4-E2/ 40%	*Laportea canadensis*	3
	Claytonia virginica	2
A4-C2/ 70%	*Podophyllum peltatum*	2
	Claytonia virginica	4
	Rosa multiflora	1
A4-E3/ 40%	*Dicentra cucullaria*	3
	Claytonia virginica	3
	Phlox divericata	2

Survey plot/ % Cover	Species	C-A
A4-C3/ 50%	*Phlox divericata*	3
	Claytonia virginica	3
	Dicentra cucullaria	1
A5-E1a/ 50%	*Podophyllum peltatum*	2
	Claytonia virginica	3
A5-C1a/ 50%	*Podophyllum peltatum*	3
	Claytonia virginica	3
A5-E1b/ 20%	*Claytonia virginica*	3
	Viola pratincola	2
	Vitis parthenocissus	1
A5-C1b/ 20%	*Claytonia virginica*	3
	Trillium recurvatum	1
A5-E2a/40%	*Podophyllum peltatum*	2
	Claytonia virginica	3
A5-C2a/ 50%	*Podophyllum peltatum*	2
	Anthyrium felix-femina	1
A5-E2b/ 50%	*Podophyllum peltatum*	2
	Trillium recurvatum	1
	Claytonia virginica	1
	Vitis parthenocissus	1
A5-C2b/ 10%	*Vitis parthenocissus*	1
A5-E3a/ 40%	*Podophyllum peltatum*	2
	Anthyrium felix-femina	1
	Vitis parthenocissus	1
	Gramineae	1
A5-C3a/ 20%	*Laportea canadensis*	1
	Vitis parthenocissus	1
A5-E3b/ 10%	*Vitis parthenocissus*	1
	Gramineae	1

Survey plot/ % Cover	Species	C-A
A5-C3b/ <10%	*Vitis parthenocissus*	1
A5-E4a/ 0%	No plants present	
A5-C4a/ 10%	*Lonicera xylosteum*	1
	Vitis parthenocissus	1
A5-E5a/ 10%	*Podophyllum peltatum*	2
	Laportea canadensis	1
A5-C5a/ 10%	*Podophyllum peltatum*	2
A5-E5b/ 30%	*Podophyllum peltatum*	2
	Lonicera xylosteum	1
A5-C5b/ 10%	*Laportea canadensis*	3
	Vitis parthenocissus	1
A6-E1/ 0%	No plants present	
A6-C1/ 0%	No plants present	
A6-E2/ 10%	*Ulmus sp*	2
	Podophyllum peltatum	2
	Lonicera xylosteum	1
A6-C2/ <10%	*Cercis canadensis*	1
	Lonicera xylosteum	1
A6-E3/ <10%	*Lonicera xylosteum*	2
	Quercus sp.	1
A6-C3/ <10%	*Urtica dioica*	2
	Gramineae	1
A6-E4/ 20%	*Lonicera xylosteum*	2
	Quercus sp.	1
	Vitis parthenocissus	2
	Gramineae	2
A6-C4/ 20%	*Lonicera xylosteum*	2
	Cercis canadensis	1
	Gramineae	2