Assessment of Deer Browse in For-Mar Nature Preserve and Arboretum, Holloway Reservoir Regional Park, and Genesee Recreation Area, Genesee County Parks

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Cover photograph: Forests heavily impacted by deer browse are characterized by a depauperate, often species-poor ground layer (photo by B. Slaughter).

Introduction

High white-tailed deer densities associated with loss of predators, low hunting pressure, and landscape fragmentation threaten plant diversity in natural areas throughout much of eastern North America. At high densities, deer can act as keystone herbivores, significantly altering habitat structure and species composition (McShea and Rappole 1992, Waller and Alverson 1997, Horsley et al. 2003, Rooney and Waller 2003). Deer browse is known to reduce establishment and survival of tree seedlings, and high browse pressure also reduces abundance of browse-sensitive groundlayer species (Mladenoff and Stearns 1993, Balgooyen and Waller 1995, Augustine and Frelich 1998, Didier and Porter 2003, Ruhren and Handel 2003, Kraft et al. 2004). Assessing deer browse intensity is an important step in developing management strategies for maintaining habitat structure and plant diversity in natural areas.

In 2007, The Genesee County Parks and Recreation Commission contracted with Michigan Natural Features Inventory (MNFI) to perform a reconnaissance survey of deer browse intensity in portions of For-Mar Nature Preserve and Arboretum, Holloway Reservoir Regional Park, and Genesee Recreation Area. The Genesee County park system contains areas of intact natural habitats important for the conservation of biodiversity in southeastern Michigan. A qualitative assessment of deer impacts on populations of browse-sensitive vascular plant species, community structure, and soil condition was completed in each park to provide recommendations for management of resident deer populations.

Study Sites

For-Mar Nature Preserve and Arboretum

For-Mar Nature Preserve and Arboretum is a 383-acre park located within the city limits of Burton, and bordered on all sides by residential subdivisions. Park staff identified 30 acres of primarily forested land for assessment of deer browse in 2007. The study area is comprised of two areas within the park. The acreage along Kearsley Creek is characterized by floodplain forest of black maple (*Acer nigrum*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), and several other hardwoods. The second area, a small woodlot in the eastern portion of the park, is characterized by mesic southern forest of sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), and American beech (*Fagus grandifolia*) (Figure 1). For descriptions of floodplain forest and mesic southern forest, see MNFI (2003), Cohen (2004), and Tepley et al. (2004).

Holloway Reservoir Regional Park

Holloway Reservoir Regional Park is a 5,500-acre park (including the 1,975-acre reservoir) in a rapidly urbanizing area approximately 7 miles northwest of Lapeer, occupying portions of western Lapeer County and eastern Genesee County. The park is bordered by rural residential development, including new subdivisions, and small agricultural fields. Park staff identified 640 acres in an area popularly known as the “Hogbacks” for assessment of deer browse in 2007. Several vegetative communities are included within this area. Old field occupies a large portion of the study area, and is dominated by smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), hoary alyssum (*Berteroa incana*), and several other non-native grasses and forbs. Some of this acreage is succeeding to forest. Mesic southern forest of sugar maple, red oak, white ash (*Fraxinus americana*) and white oak occupies the steep ridges bordering Mud Lake. Steep ridges south of the unnamed lake in the western portion of the park support dry-mesic southern forest of white oak, red oak, and black cherry (*Prunus serotina*), in addition to several other canopy associates. Emergent marsh, southern shrub-carr, and associated wetland communities border Mud Lake (Figure 2). For descriptions of dry-mesic southern forest, emergent marsh, and southern shrub-carr, see MNFI (2003).

Genesee Recreation Area

Genesee Recreation Area is a 4,540-acre park (including Richmond Park and Mott Lake) located on the Flint River northeast of Flint, bordered by agriculture and suburban and rural residential development. Park staff identified 900 acres for assessment of deer browse in 2007. A large portion

of this acreage is occupied by floodplain forest along the Flint River, dominated by several tree species, including black maple, silver maple (*Acer saccharinum*), green ash, eastern cottonwood, and hackberry (*Celtis occidentalis*). Upland forest of sugar maple, red oak, and white oak is concentrated on high banks north of the Flint River. Much of the remaining acreage is comprised of degraded successional communities, primarily old field with high shrub cover (Figure 3).

Methods

Meander surveys in the areas identified for assessment of deer browse were conducted in each of the parks in summer 2007. Plant species composition and community structure was documented in each area. Browse-sensitive herb, shrub, and tree species were identified, and browse damage on these species was assessed. Impacts of deer on community structure were also evaluated. Signs of deer presence, including presence of scat, tracks, and trails, were recorded.

Results

<u>For-Mar Nature Preserve and Arboretum</u>
Heavy to severe browse was noted in the floodplain forest and adjacent upland forest along Kearsley Creek (see Figure 1). Browse-sensitive groundlayer species, particularly false spikenard (*Smilacina racemosa*) and common trillium (*Trillium grandiflorum*), exhibited stunted growth, and fertile individuals were nearly absent. Large, fruiting individuals of false spikenard were observed on an eroded, steep bank above Kearsley Creek, where the plants were inaccessible to deer (Photograph 1). Plants in adjacent areas of the forest accessible to deer were stunted and infertile (Photograph 2). Tree seedlings, saplings, and shrubs were heavily browsed throughout the floodplain. Significantly impacted species included black cherry, white ash, and green ash (Photograph 3). In addition to browse-damaged vegetation, portions of the forest exhibited significant soil compaction and erosion associated with trampling, particularly on the upper floodplain (Photograph 4). Groundlayer vegetation in these areas was essentially absent.

The small woodlot south of the De Waters Education Center in the eastern portion of the park also exhibited severely browsed vegetation and soil disturbance associated with high deer density. Tree saplings exhibited a distinct browse line, with little to no green tissue below this line, except where protected by exclosures (Photograph 5). The groundlayer was depauperate, comprised of tree seedlings (primarily sugar maple), jack-in-the-pulpit (*Arisaema triphyllum*), and mayapple (*Podophyllum peltatum*). Soil was compacted and bare over much of the area. An April visit, following snow-melt, revealed a dense concentration of hoof prints in the woodlot and adjacent trails.

<u>Holloway Reservoir Regional Park</u>
In the old field community (see Figure 2), severe deer browse was noted on smooth sumac (*Rhus glabra*) and on the lower branches of black cherry. All smooth sumac branches below the browse line were heavily clipped and resprouted. Older individuals exhibited a distinct “topiary” browse line (Photograph 6). Browse was also noted on young shoots of northern dewberry (*Rubus flagellaris*). The old field community was dominated primarily by non-native grasses, and lacked deer-favored forbs.

The upland forest bordering Mud Lake to the west and south exhibited significant signs of browse. Eroded deer paths were common on the forested slopes, entering the wetlands on the periphery of Mud Lake. Tree saplings and shrubs were heavily clipped. Species that exhibited severe browse impacts included black cherry, witch-hazel (*Hamamelis virginiana*) and white ash. White ash in this area was infested by the emerald ash borer (*Agrilus planipennis*), and trunk sprouts were heavily browsed (Photograph 7). Deer-sensitive groundlayer forbs, including Canada mayflower (*Maianthemum canadense*), downy solomon’s-seal (*Polygonatum pubescens*), and white baneberry (*Actaea pachypoda*), and common trillium were represented by small populations of sterile, depauperate individuals, indicating significant browse pressure (Photograph 8).

The upland oak-dominated forest north of Halser Creek, south of the unnamed lake in the western portion of the park, exhibited light to heavy deer browse. The morainal ridge on the southwest side of the lake was of relatively high ecological integrity, and supported healthy populations of deer-sensitive ground layer species, including common trillium and false spikenard (Photograph 9). Fertile individuals were concentrated in areas characterized by a dense understory of maple-leaved viburnum (*Viburnum acerifolium*). Browse appeared to be concentrated along the trail in this area, where clipped individuals of several species were observed. Soil disturbance associated with deer activity was minimal. South of the lakeside ridge, closer to Halser Creek, signs of heavy browse were apparent. The open, species-poor understory was characterized by heavily clipped riverbank grape (*Vitis riparia*) and saplings of bigtooth aspen (*Populus grandidentata*).

The wetlands bordering Mud Lake were largely flooded by beaver activity and were not surveyed in detail. Tree seedlings and gray dogwood (*Cornus foemina*) at the upland edge of these wetlands were heavily clipped. Deer tracks were dense on wet, exposed muck at the periphery of the wetland (Photograph 10).

Genesee Recreation Area

Much of the floodplain south of the Flint River was characterized by forest with dense shrub and ground cover. This area exhibited light to moderate deer browse. Fertile individuals of several deer-favored liliaceous species, including Michigan lily (*Lilium michiganense*), merrybells (*Uvularia sessilifolia*), and common trillium were frequently encountered (Photograph 11). Forest structure on higher levees within the floodplain was less dense, and browse damage was evident in these areas. Shrubs, especially bladdernut (*Staphylea trifoliata*), were heavily clipped. Spicebush (*Lindera benzoin*) appeared to be the least impacted shrub species.

The floodplain forest north of the Flint River is badly degraded and heavily infested by non-native invasive species, including common buckthorn (*Rhamnus cathartica*), autumn-olive (*Elaeagnus umbellata*), honeysuckles (*Lonicera* spp.), and multiflora rose (*Rosa multiflora*) (Photograph 12). Dense growth made assessment of deer browse difficult over much of the area. Tree saplings in relatively open clearings within the forest were heavily clipped. Small areas of upland forest on high banks above the river exhibited moderate browse, with damage noted on white oak seedlings.

Browse-damaged vegetation was especially evident in the large old fields north of the Flint River. Smooth sumac was the most severely affected species, evidenced by the large number of dead and resprouted individuals below the browse line. Older individuals exhibited a distinct "topiary" browse line (Photograph 13). Browse was also noted on black oak (*Quercus velutina*) seedlings and saplings, but most individuals were robust and only lightly browsed. The ground layer in the old fields was comprised of weedy, non-native species not favored by deer, including spotted knapweed (*Centaurea maculosa*), hoary alyssum (*Berteroa incana*), and bouncing bet (*Saponaria officinalis*).

Management Recommendations

For-Mar Nature Preserve and Arboretum

Management efforts should focus on protecting and restoring the floodplain forest along Kearsley Creek (see Figure 1). Despite its small size and the presence of numerous invasive species, this forest is characterized by high vascular plant species richness and hosts several small colonies of twinleaf (*Jeffersonia diphylla*), which is listed as a species of Special Concern in Michigan. In addition, the floodplain forest harbors populations of numerous deer-sensitive forbs. This area was identified as having the highest priority for deer control of any area within the three surveyed parks based on its relative intactness, species richness, and severe impacts of the local deer population.

The extensive perimeter of the floodplain forest makes the construction and placement of a deer-restricting perimeter fence costly and difficult. The most effective strategy for reducing deer browse in this area is hunting and/or relocation of the local deer population. Hunting this property poses significant challenges for several reasons. First, the

park is located in a suburban setting, with dense residential development in close proximity to the browse study area. Second, the local deer population appeared to be acclimated to humans. Any proposal to hunt this property should be sensitive to public input. In the absence of hunting, deer exclosures can be erected within the forest to allow certain areas to recover from deer browse and activity, but this method is likely not feasible for the entire study area. If deer density is not reduced, further degradation of community structure, in addition to significant reduction of or loss of deer-favored groundlayer species will occur.

The small woodlot south of the De Waters Education Center is significantly degraded and harbors low species diversity, and is of lesser conservation concern than the Kearsley Creek floodplain (see Figure 1). Park staff should continue experimenting with small exclosures in this woodlot to better assess the community impacts of restricting deer browse. If forest structure and species composition in these exclosures exhibits a significant response to lack of browse, a deer-restricting perimeter fence may be warranted.

Holloway Reservoir Regional Park

The oak-dominated dry-mesic southern forest located southwest of the unnamed lake in the western portion of the park was identified as being of high conservation concern (see Figure 2). Hunting should be used as a management tool to control deer density at this large, mostly undeveloped park. In the absence of hunting, deer exclosures can be placed within the aforementioned dry-mesic southern forest, in addition to the mesic southern forest bordering Mud Lake. Enclosing large areas of forest will be costly and require routine maintenance.

Much of the study area within Holloway Reservoir Regional Park was significantly degraded old field or shrub-dominated upland. Deer browse in these areas is primarily of aesthetic concern, as community structure and plant species composition is significantly altered from natural conditions. Although exclosures can be placed to demonstrate the impacts of deer browse on shrub and tree sapling growth, investment in costly management techniques in these areas is not recommended.

Genesee Recreation Area

Hunting should be used as a management tool to control deer density at this large, mostly undeveloped park. The natural communities within the park were significantly degraded, with dense populations of invasive, non-native plant species the primary biodiversity management concern. The highest quality portions of the floodplain forest along the Flint River had patchy shrub cover and dense, robust ground layer vegetation, which appeared to restrict deer activity to small openings and relatively open forest on higher portions of the floodplain (see Figure 3).

Severe browse on shrubs, primarily smooth sumac, in the non-forested uplands in this park were indicative of high deer densities. However, these impacts are primarily of aesthetic concern, as community structure and plant species composition within these degraded areas is significantly altered from natural conditions. Although exclosures can be used to demonstrate the impacts of deer browse on shrub and tree sapling growth, investment in costly management techniques in these areas is not recommended.

Conclusions

Deer browse severity was greatest in the relatively open forest along Kearsley Creek in For-Mar Nature Preserve and Arboretum and in the large old fields located in Holloway Reservoir Regional Park and Genesee Recreation Area. In general, browse damage was less severe where shrub and groundlayer vegetation was dense, as in the floodplain forest along the Flint River in Genesee Recreation Area. Soil disturbance associated with deer activity was noted in all three parks, and was locally severe. Several deer were encountered in each park during the course of the surveys.

Reduction of the deer herd at all three parks is recommended. In the absence of hunting, deer exclosures can be erected to limit damage to areas of particular ecological significance. However, fencing is costly, requires maintenance, and may

be of limited effectiveness, particularly along streams and rivers which deer can traverse to access forested floodplains. Hunting in the large, rural parks (Holloway Reservoir Regional Park and Genesee Recreation Area) should be implemented to reduce deer densities. Implementation of hunting at For-Mar Nature Preserve and Arboretum may be more difficult due to its relatively small size, suburban location, and potential for poor public reception. If hunting cannot be initiated at For-Mar, alternative methods of reducing the deer population should be considered, including relocation of the herd.

The majority of acreage within the study areas in Holloway Reservoir Regional Park and Genesee Recreation Area was significantly degraded by historic and current human land use and invasion of non-native invasive plant species. Reduction of the deer herd in the absence of additional restoration and management techniques will not significantly improve natural community structure or plant species composition in these parks. However, remnant areas of relatively intact natural communities within these parks locally exhibited significant effects of deer browse. Because deer movement is not restricted to the degraded areas of the parks, hunting should be implemented throughout each park, rather than being implemented only in specific areas.

In each park, hunting should be one part of a management plan that includes invasive species monitoring and removal, restoration of soil resources, and seeding/planting of degraded old fields and shrub land to native plant species.

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Photographs and Figures

Photo by Bradford S. Slaughter

Photograph 1. Fertile individuals of false spikenard (*Smilacina racemosa*) are concentrated in areas inaccessible to deer.

Photo by Bradford S. Slaughter

Photograph 2. Stunted, sterile individuals of false spikenard are common in areas accessible to deer.

Photo by Bradford S. Slaughter

Photograph 3. Tree seedlings, saplings, and trunk sprouts (depicted here) were heavily browsed throughout the floodplain.

Photo by Bradford S. Slaughter

Photograph 4. Soil trampling associated with deer activity.

Photo by Bradford S. Slaughter

Photograph 5. Branches below the browse line are protected by exclosures.

Photo by Bradford S. Slaughter

Photograph 6. Mature clones of smooth sumac (*Rhus glabra*) exhibited a distinct browse line.

Photo by Bradford S. Slaughter

Photograph 7. Many white ash (*Fraxinus americana*) near Mud Lake were infested by the emerald ash borer. Trunk sprouts were browsed (see Phogotraph 3).

Photo by Bradford S. Slaughter

Photograph 8. Sterile, stunted common trillium (*Trillium grandiflorum*) south of Mud Lake.

Photo by Bradford S. Slaughter

Photograph 9. Healthy populations of deer-favored ground layer forbs, including false spikenard, were found in the densely vegetated oak forest.

Photo by Bradford S. Slaughter

Photograph 10. Deer tracks and browsed shrubs were concentrated at the wetland margin.

Photo by Bradford S. Slaughter

Photograph 11. Michigan lily (*Lilium michiganense*) in the Flint River floodplain

Photo by Bradford S. Slaughter

Photograph 12. Invasive species, including autumn-olive (*Elaeagnus umbellata*) and multiflora rose (*Rosa multiflora*) are locally abundant.

Photo by Bradford S. Slaughter

Photograph 13. Severely browsed smooth sumac at Genesee Recreation Area

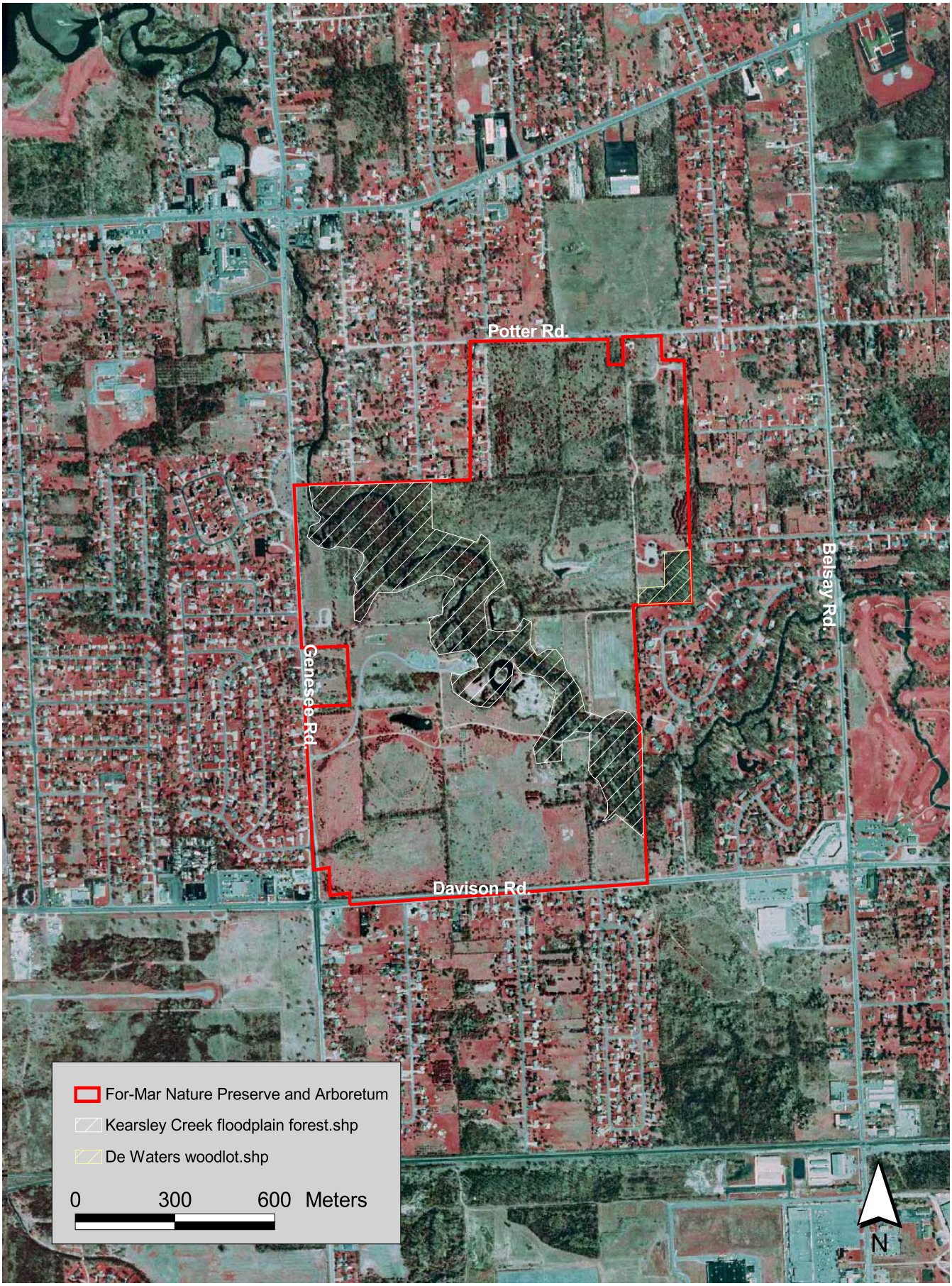

Figure 1. Deer browse assessment areas at For-Mar Nature Preserve and Arboretum.

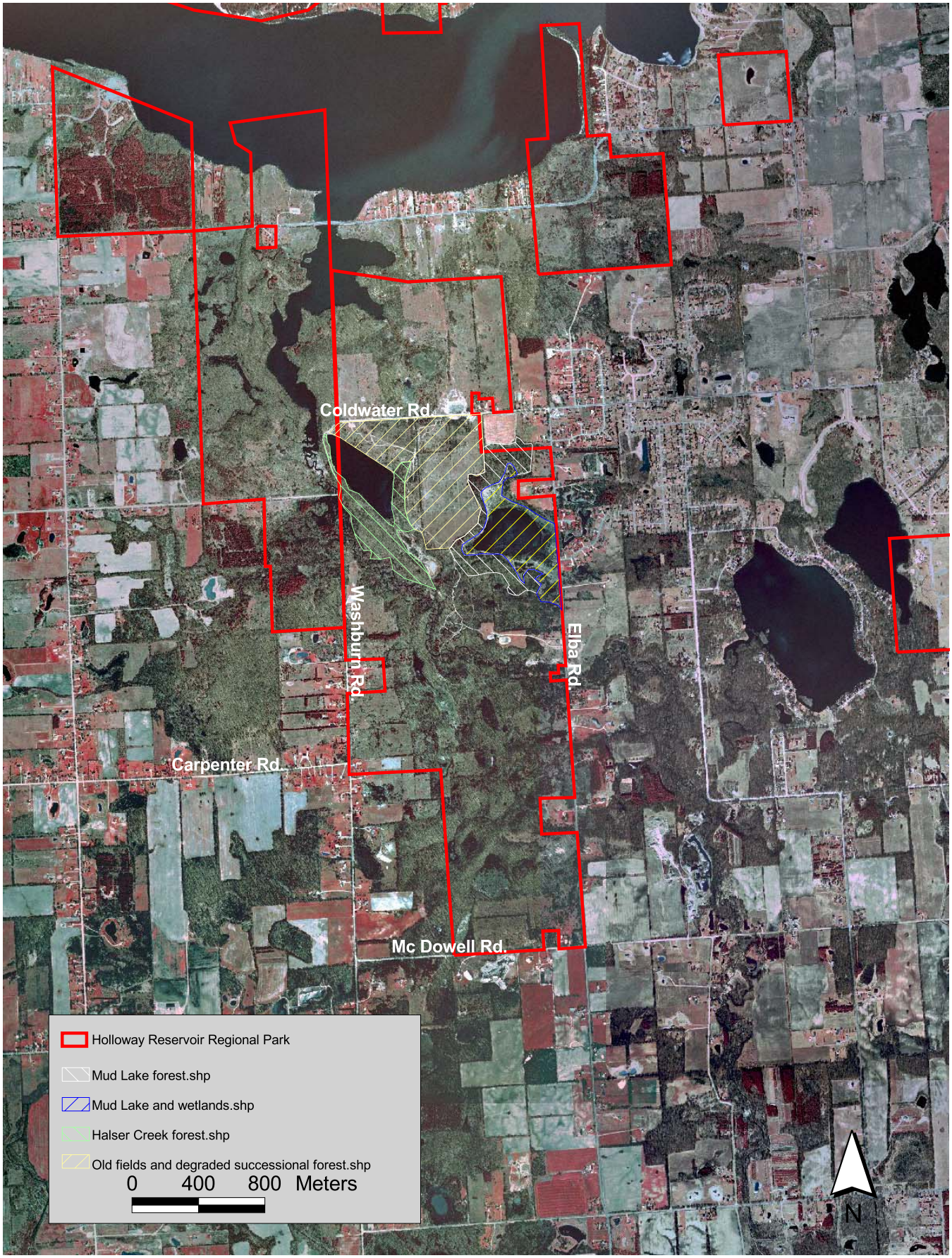

Figure 2. Deer browse assessment areas at Holloway Reservoir Regional Park.

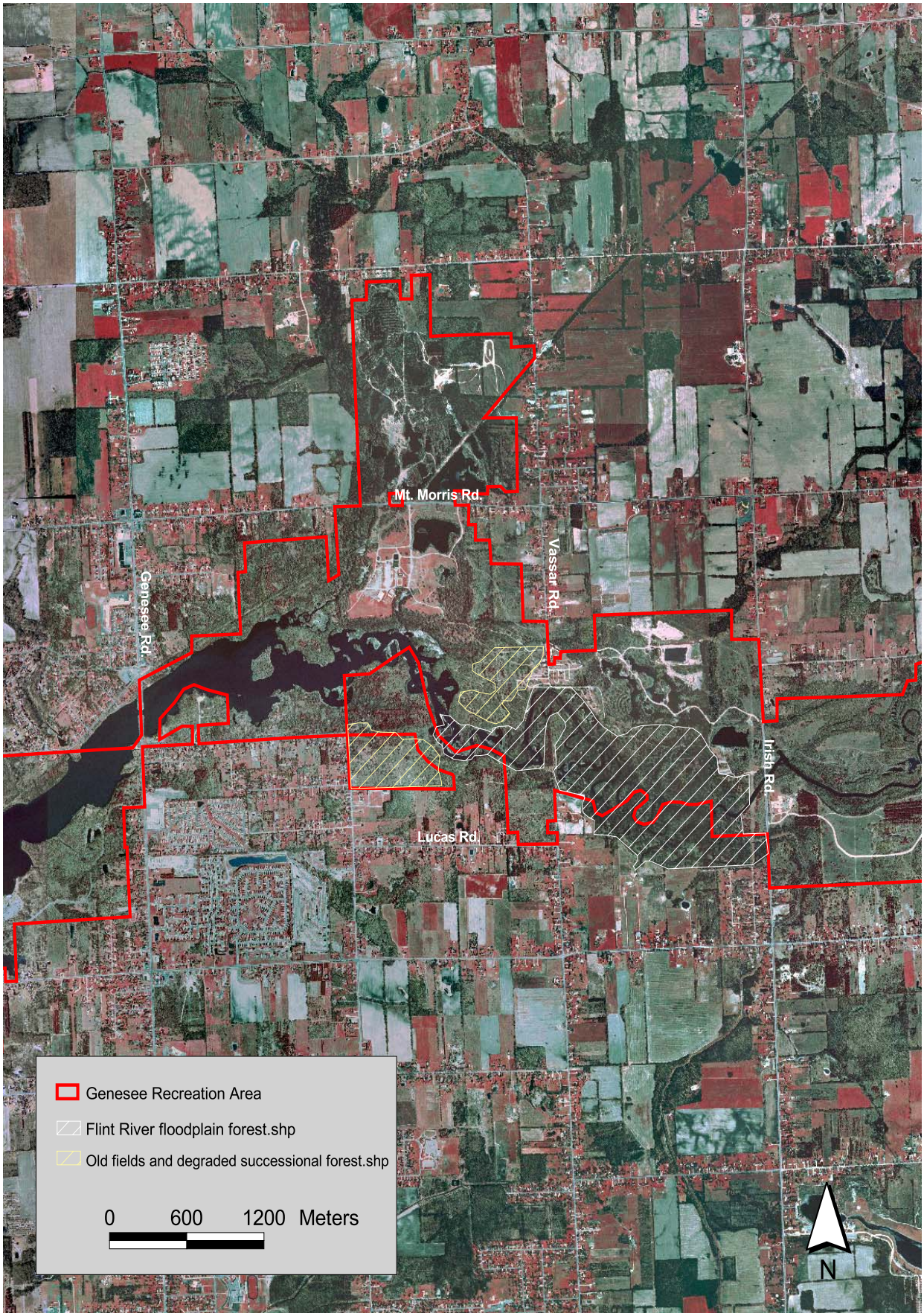

Figure 3. Deer browse assessment areas at Genesee Recreation Area.