Western Pennsylvania Conservancy

ALLEGHENY COUNTY PARKS ECOLOGICAL ASSESSMENT AND ACTION PLAN

DEER LAKES PARK

Prepared for the Allegheny County Parks Foundation
January, 2025

FOREWORD

With nine parks encompassing over 12,000 acres, Allegheny County boasts one of the largest regional park systems in the country. While recreational activities make each park a unique destination, nature is the common thread that connects our parks and is our most treasured – and jeopardized – asset. The abundant resources found in our parks' forests, meadows and streams provide vital habitat for flora and fauna, clean our air and water, pollinate our plants, and connect the web of life. We are stewards of these natural sanctuaries and are working to protect them for future generations.

The Allegheny County Parks Foundation received a grant from FedEx and PNC Charitable Trust to advance our stewardship efforts. The Parks Foundation, together with the Allegheny County Parks, partnered with the Western Pennsylvania Conservancy (WPC) to conduct an Ecological Assessment and Action Plan in Deer Lakes Park. This study evaluates the park's natural resources and ecological assets and recommends an implementation plan for protecting, preserving, and improving the environmental health of the park.

The earliest aerial photographs of Deer Lakes Park from 1938 show that about 80% of the park area was cleared for agriculture. Some steep slopes and valleys remained partially forested, and as a result, now have mature forest communities. Reforestation didn't begin until after the establishment of the park in 1967. Today about 75% of the park is forested, except areas maintained for recreational use such as disc golf, shelters, and playgrounds.

WPC classified the natural community types within the park which will help park staff to understand plant populations. In addition, their work also revealed that Deer Lakes Park contains several populations of plant species that are rare in Pennsylvania and Allegheny County, and conservation of these species should be a management goal, including natives such as skunk cabbage, ramps, Virginia bluebells, trillium, along with a large variety of oaks. Areas of invasive species populations such as Mile-a-minute and poison hemlock have also been observed and mapped for removal.

Using the data gathered by WPC, areas of the park have been mapped as best, good, or poor based on their ecological integrity. Only one area of Deer Lakes Park was designated as “best”, a hillside on the western side of the park. The challenge ahead is to raise the ecological integrity of the “good” areas to “best” and improve the “poor” areas using the recommendations provided.

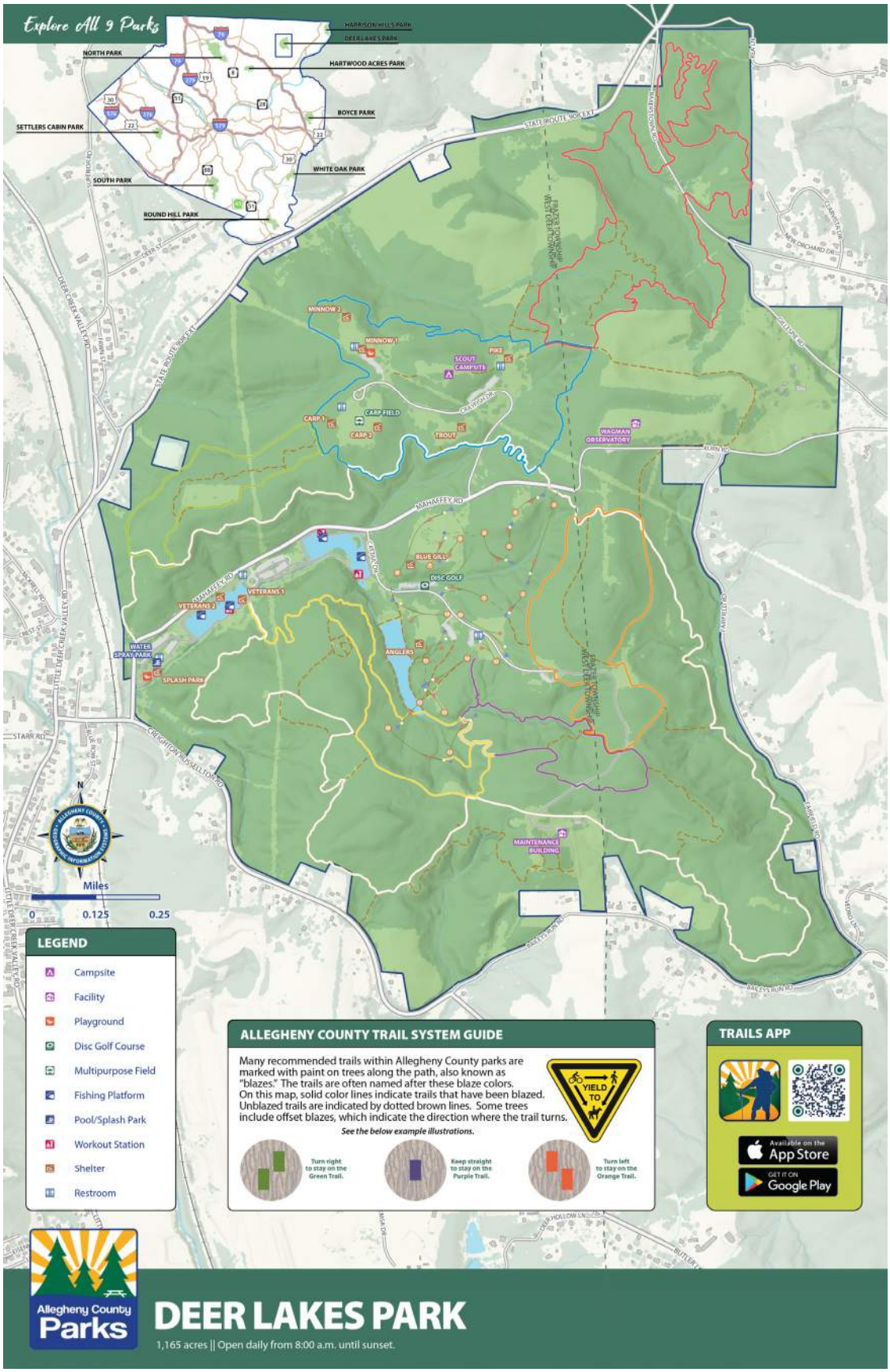
Gaps in the forest canopy have been noted within the study and their elimination should be prioritized. There is risk that these gaps will degrade the surrounding forest, especially when they exist within high quality forest. Invasive species also frequently establish populations in these favorable gap conditions. The invasives are often vines that pull down trees, which not only increases the size of the gap, but it can spread the gap and invasives into adjacent higher-quality areas.

The report also suggests installing deer fencing, to protect sensitive areas from extensive over browsing, trail management to protect sensitive areas, and recommendations to monitor trees and shrubs for diseases such as oak decline, target canker, and a fungus affecting spicebush. Management and alterations to the disc golf course are included as well as several opportunities to incorporate green infrastructure to help manage stormwater runoff.

We are deeply grateful to FedEx and the PNC Charitable Trust for providing the funding to make this report possible. We also thank the outstanding staff at the Western Pennsylvania Conservancy and Allegheny County Parks Department for their expertise and insightful contributions to this effort. We look forward to collaborating with the County Parks staff and other partners to prioritize, fund, and implement these recommendations and to continue this type of important ecological work in all nine of the Allegheny County Parks.

Joey-Linn Ulrich
Executive Director
January 2025

TABLE OF CONTENTS


Explore All 9 Parks
HARRISON HILLS PARK
DEER LAKES PARK
NORTH PARK
HARTWOOD ACRES PARK
BOYCE PARK
SETTLERS CABIN PARK
WHITE OAK PARK
SOUTH PARK
ROUND HILL PARK
STATE ROUTE 908 EXT
FRAZER TOWNSHIP
WEST DEER TOWNSHIP
DEER CREEK VALLEY RD
MINNOW 2
MINNOW 1
SCOUT CAMPSITE
PIKE
CARP FIELD
CARP 1
CARP 2
TROUT
WAGMAN OBSERVATORY
MAHAFFEY RD
BLUE GILL
DISC GOLF
VETERANS 1
VETERANS 2
WATER SPRAY PARK
SPLASH PARK
ANGLERS
MAINTENANCE BUILDING
STARR RD
CREIGHTON-DORSEL RD
N
Miles
0
0.125
0.25
LEGEND
Campsite
Facility
Playground
Disc Golf Course
Multipurpose Field
Fishing Platform
Pool/Splash Park
Workout Station
Shelter
Restroom
ALLEGHENY COUNTY TRAIL SYSTEM GUIDE
Many recommended trails within Allegheny County parks are marked with paint on trees along the path, also known as "blazes." The trails are often named after these blaze colors. On this map, solid color lines indicate trails that have been blazed. Unblazed trails are indicated by dotted brown lines. Some trees include offset blazes, which indicate the direction where the trail turns.
See the below example illustrations.
YIELD TO
Turn right to stay on the Green Trail.
Keep straight to stay on the Purple Trail.
Turn left to stay on the Orange Trail.
TRAILS APP
Available on the App Store
GET IT ON Google Play
Allegheny County Parks
DEER LAKES PARK
1,165 acres || Open daily from 8:00 a.m. until sunset.

SECTION I - ECOLOGICAL OVERVIEW:

1.1 ECOLOGICAL OVERVIEW

This section provides an overview of the ecology of Deer Lakes Park. The state of ecosystems today in the park is due to the interaction of the basic environmental conditions in the park; the plants, animals and other living organisms that inhabit our region; and the land management activities of people. Allegheny County's Ecological Heritage provides a background for understanding Deer Lakes Park's natural communities in a regional context, while Land Use and Ecological History of Deer Lakes Park describes the ways in which human activities have affected the development of natural communities in the park. The state of the natural communities is the result of historic land-use, most notably past agriculture. Soils and geology are the foundations of the web of life, providing nutrients and shaping growing conditions for plants, which are the base of the food chain. The Geology and Soils sections below describe these features of the park in more detail.

A display of the wildflower pussytoes (Antennaria sp.) beginning to flower in the "Mahaffey Road Slopes" ecological area at Deer Lakes Park

1.2 ALLEGHENY COUNTY'S ECOLOGICAL HERITAGE

This region's natural ecosystems have developed over tens of thousands of years. Further south, the Southern Appalachian Mountains are one of the world's biodiversity hot spots, in part because of a hospitable climate and in part because ecological development was never reset by glaciation. Southwestern Pennsylvania is at the northern edge of this bioregion; the character and diversity of its plant and animal life show both an Appalachian and Midwestern influence, and it is markedly different than previously glaciated ecosystems just a short distance to the north. Southern influences extend into Allegheny County in particular because of the moderate climates along the major river corridors: the Ohio, Allegheny, Monongahela, and Youghiogheny.

There are no detailed descriptions of the region's ecosystems preserved before about 1900. Historical ecological assessment techniques such as pollen analysis conducted in other areas of the northeast show that significant ecosystem changes were set in motion in the 1600 and 1700s by the arrival of Europeans and the decimation of Native American societies, who had influenced and managed natural landscapes for several thousand years previous to the arrival of European colonists. Furthermore, by the early 1900s, clear cutting for agricultural development and timber sale was already well advanced in the region, and early documentarians could only assess the remaining forest areas. However, despite these limitations, their work remains the best reference we have available for the original character of our region's forest ecosystems.

In the early 1900s, E. Lucy Braun catalogued the natural forest ecosystems of eastern North America, in a definitive work that can never be replicated because these systems have been so extensively altered in the years since. She placed southwestern Pennsylvania within the Cumberland and Allegheny Plateaus section of the original Mixed Mesophytic forest region (Braun 1950). This region extends from northern Alabama to glaciated northeastern Pennsylvania; Allegheny County is at the far northern end. The Mixed Mesophytic Forest is characterized by an exceptionally diverse tree canopy, and by a rich Appalachian-influenced herbaceous layer. Dominant species of the climax forest in this region are the American beech (*Fagus grandifolia*), tulip tree (*Liriodendron tulipifera*), basswood (*Tilia americana*), sugar maple *(Acer saccharum*), American chestnut (*Castanea dentata*), sweet buckeye (*Aesculus flava*), red oak (*Quercus rubra*), white oak (*Q. alba*), and hemlock *(Tsuga canadensis*). According to Braun's work, Allegheny County lies within a subdivision of this region called the Low Hills Belt, characterized by a larger proportion of oak than is typical for Mixed Mesophytic Forest.

Otto Jennings of the Carnegie Museum of Natural History also wrote pioneering baseline ecological descriptions for the region in the early 1900s (Otto E. Jennings 1908; O. E. Jennings 1924; 1943). He described two forest types for the region, a "White Oak Association" and a "Sugar maple – Beech Association". The White Oak Association is found on rolling uplands and rounded hills, and it is dominated by white oak, shagbark hickory, red maple, and other oak species. The Sugar maple – Beech Association is found on richer, moister soils such as floodplains, valleys, and lower slopes, and the canopy dominants are sugar maple, American beech, hickories (*Carya spp.*), red oak, white oak, white ash (*Fraxinus americana)*, and American basswood.

Deer Lakes Park covers several small headwaters drainages, most of which feed into Little Deer Creek. The upland hills and slopes are drier habitats that support oak forests, while the stream valleys support more mesic forest types. However, many of the headwaters drainages are small or intermittent, and the overall area supporting mesic forest habitat is not large. The largest stream valleys have been developed for the lakes and surrounding recreation areas.

In the last few centuries, since European colonization, the ecological baseline described by Braun and Jennings has undergone unprecedented changes; today's landscape reflects both the rich ecological heritage of the region, and the impact of many modern challenges such as forest pests, fragmentation, invasive species, and post-agricultural forest recovery. Tree species that were once a ubiquitous part of our region's forests, such as the American chestnut, American elm, white ash, and green ash, have been eliminated or greatly reduced in our forests by the introduction of exotic forest pests and diseases. More species may still be lost; oak species, hemlock, and American beech are threatened by the spongy moth, hemlock woolly adelgid, and beech bark disease complex, respectively. Invasive plant species have been introduced that are displacing native species on a large scale. Excessive deer browse is also a modern problem that threatens forest regeneration and diversity, as deer were previously held in check by keystone predators such as wolves. At Deer Lakes Park, deer browse is a significant problem that has depleted the diversity of the native mesic forest communities. However, there are significant remainders worth protecting, although action must be taken quickly before they too are lost. Our challenge in landscapes such as the Allegheny County Parks is to safeguard and improve the health of our remaining natural diversity, and to restore ecological health where it has been impaired.

1.3 LAND USE & ECOLOGICAL HISTORY OF DEER LAKES PARK

The land now encompassed by Deer Lakes Park has been settled by humans for thousands of years. Historical ecology investigations of Native American groups in central and northwestern Pennsylvania have found that they cleared small areas for farming and settlements and managed the larger landscape with fire to encourage edible species such as oaks, hickories, chestnut, and blueberries (Abrams and Nowacki 2008). European settlers arrived in significant numbers starting around 1800, and the activities of the settlers included clearing much of the landscape for agriculture, timbering, mining, and gas drilling (Lewetag 2004). Mining did not extend to the park area. The earliest records of land cover within the park are aerial photographs from 1938, which show about 20% of the park in forest cover. However, in the century of European settlement prior to the 1939 photographs, these forested areas may have been logged or cleared for agriculture and then regrown. The three fishing lakes in the park are man-made lakes that were created during the development of the park in the 1960s (Lewetag 2004).

Today at Deer Lakes Park, about 75% of the park area is currently in natural condition (not developed or actively managed), while 11% is managed and maintained for recreational use, 9% is in agricultural use, and 2% is developed for roads, parking, or buildings. The character of the area in natural condition is primarily determined by past land use. Most of the natural areas of the park were previously cleared and farmed, while about 20% of the park has been continuously forested since the first aerial photographs available (1939). While in some parks, reforestation occurred gradually over the course of the 20th century, in Deer Lakes, almost all the reforestation occurred after the establishment of the park in 1967.

The previously cleared areas today contain forests that are all fairly young and characterized as “early successional” or “mid-successional” depending on their maturity. When land uses entail soil turnover and complete removal of living forest plant material and seed banks, the forest communities that regenerate post-disturbance are typically much lower in diversity than undisturbed natural communities and include few “conservative” forest species. If the regeneration occurred in the last 3-4 decades, rather than earlier, invasive non-native species typically have high cover, due to the general ubiquity of invasive species seed in that timeframe. The post-1967 reforested areas in Deer Lakes have significant invasive species presence in many areas.

The areas that have been continuously forested since 1938 now have mature forest communities, which generally still have fairly low levels of invasive species. Most of the sensitive wildflower assemblages are found in these areas. These areas should be a special focus for management to maintain and enhance their diversity and integrity.

We examined historic aerial photos of Deer Lakes Park utilizing the Pennsylvania Imagery Navigator [PASDA] database. Historic aerial photos from 1938, 1956, and 1967 were georeferenced in ArcGIS Pro. Modern aerial photos (ESRI basemap imagery 2024) were used to

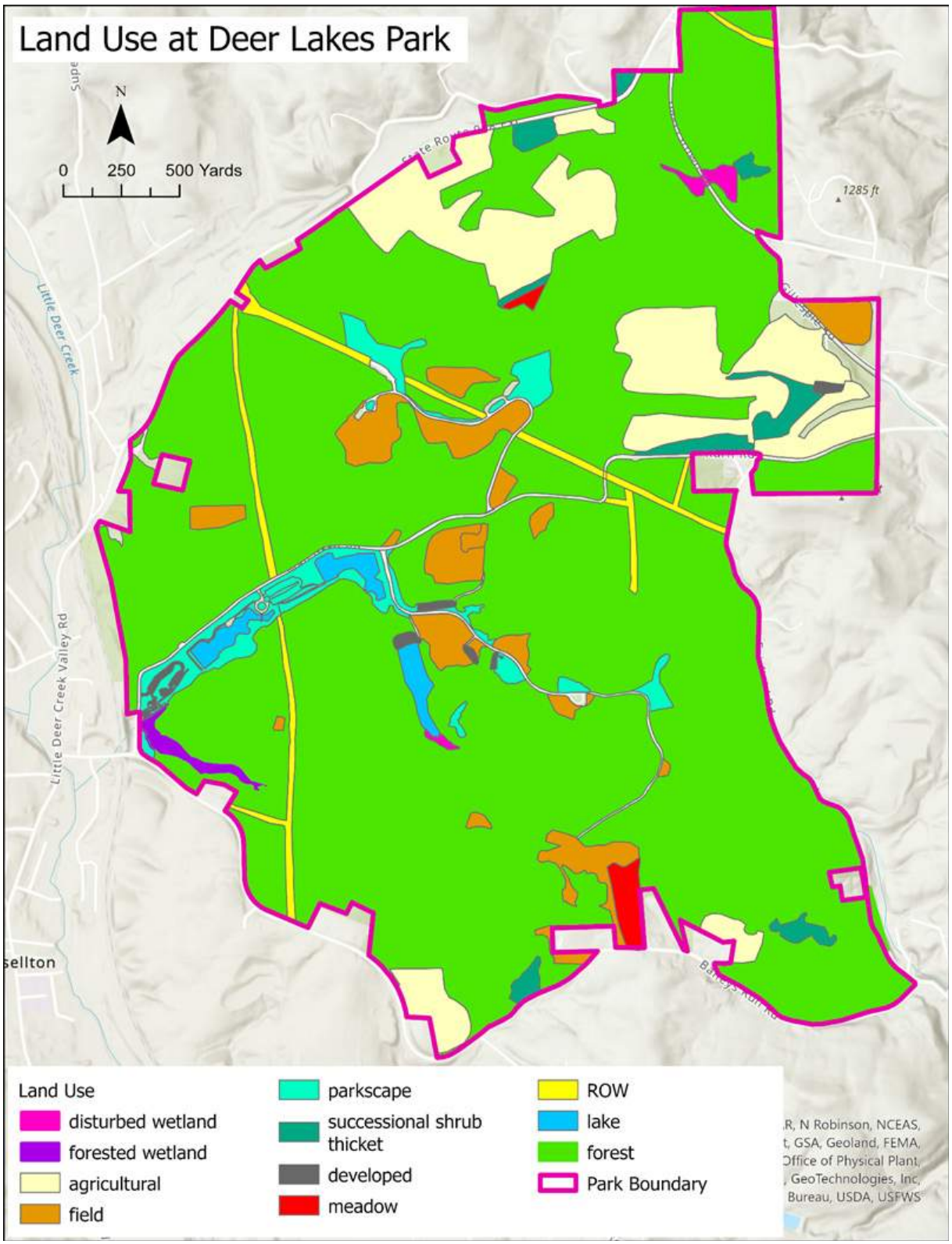
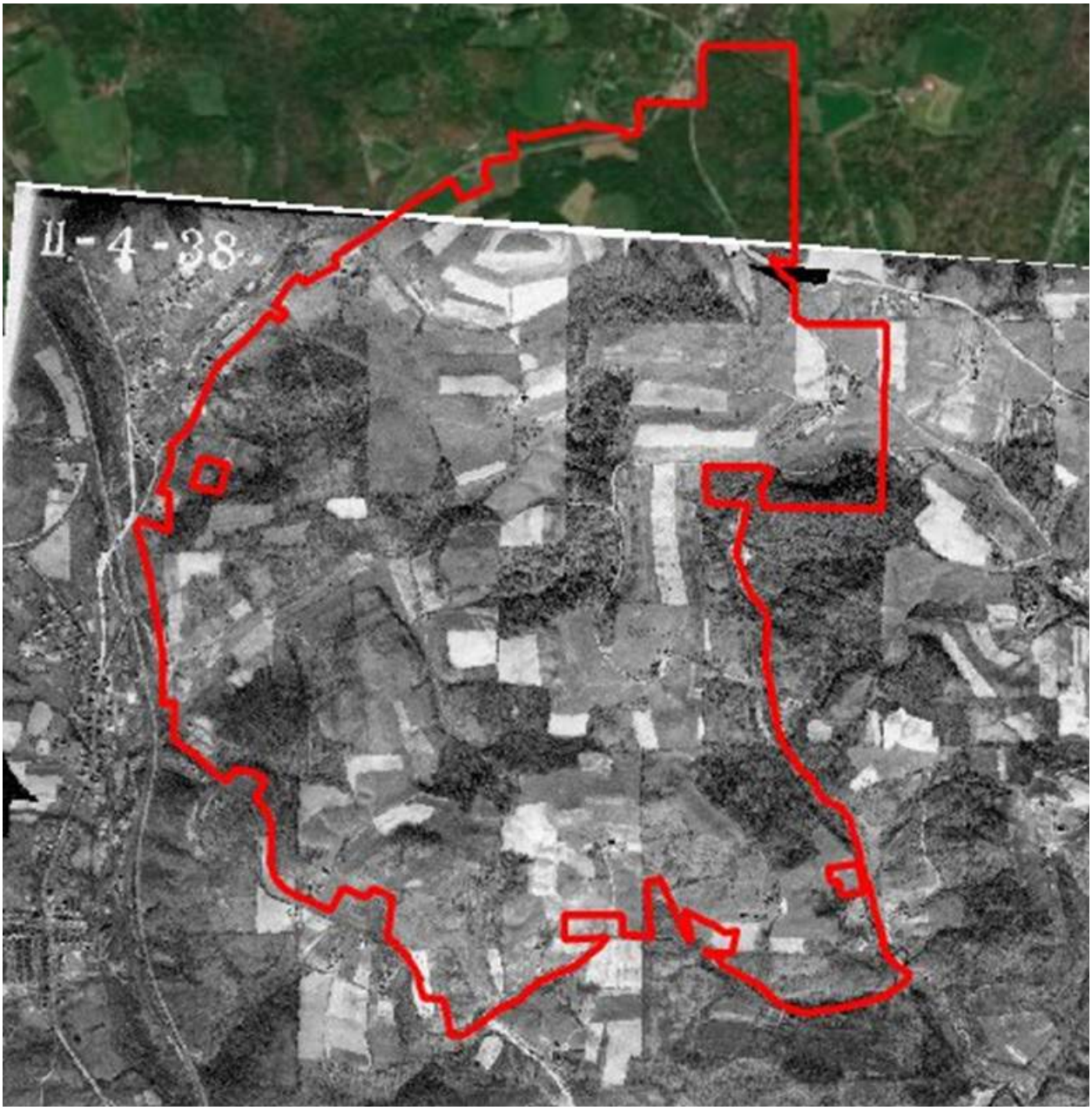
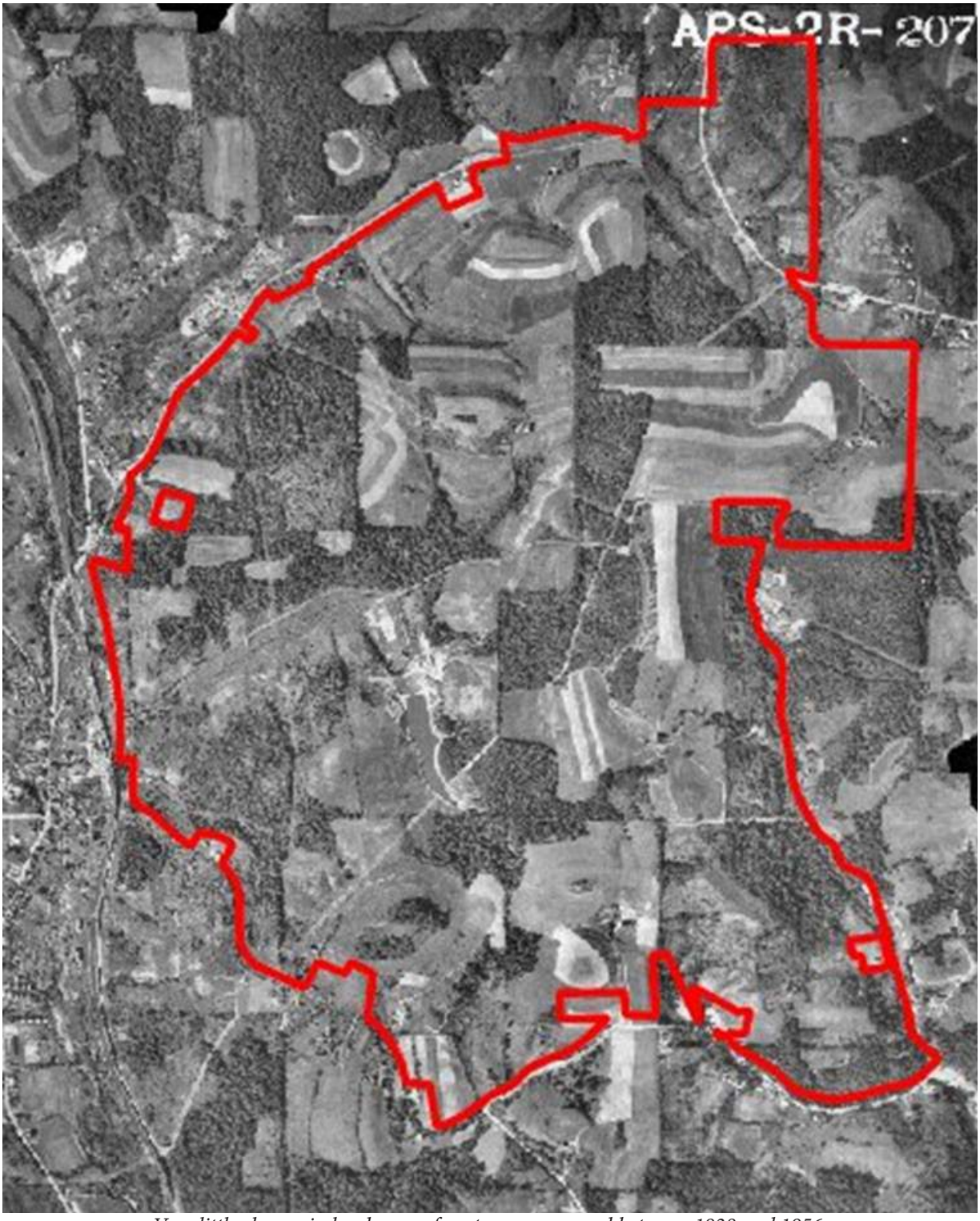

Land Use at Deer Lakes Park
N
0 250 500 Yards
1285 ft
Little Deer Creek
Little Deer Creek Valley Rd
Land Use
disturbed wetland
forested wetland
agricultural
field
parkscape
successional shrub thicket
developed
meadow
ROW
lake
forest
Park Boundary
R, N Robinson, NCEAS,
t, GSA, Geoland, FEMA,
Office of Physical Plant,
GeoTechnologies, Inc,
Bureau, USDA, USFWS

FIGURE I 1938 AERIAL IMAGERY



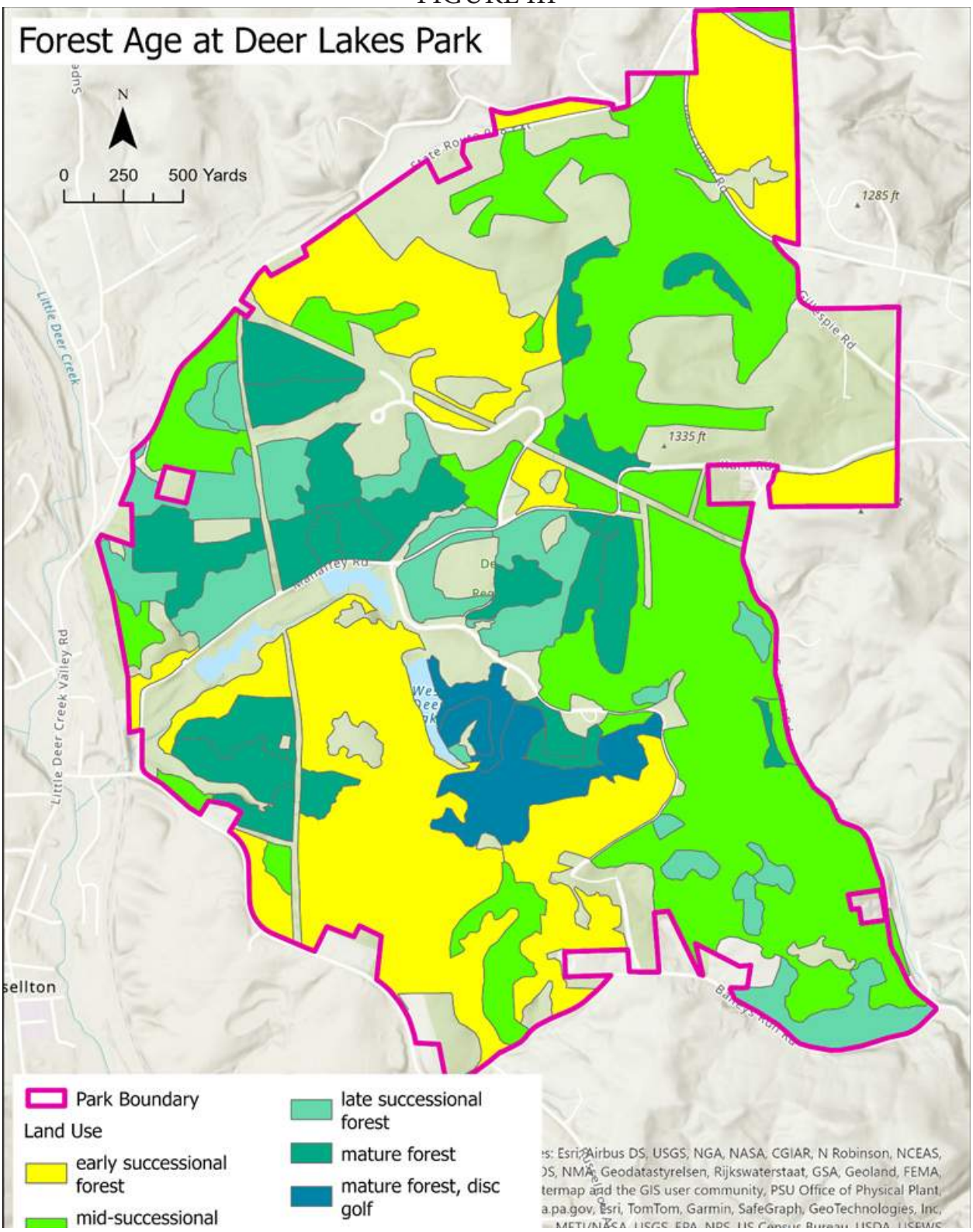
Deer Lakes Park in 1938. Dark grey patches are forested.

FIGURE II 1956 AERIAL IMAGERY



Very little change in land use or forest cover occurred between 1938 and 1956.

FIGURE III

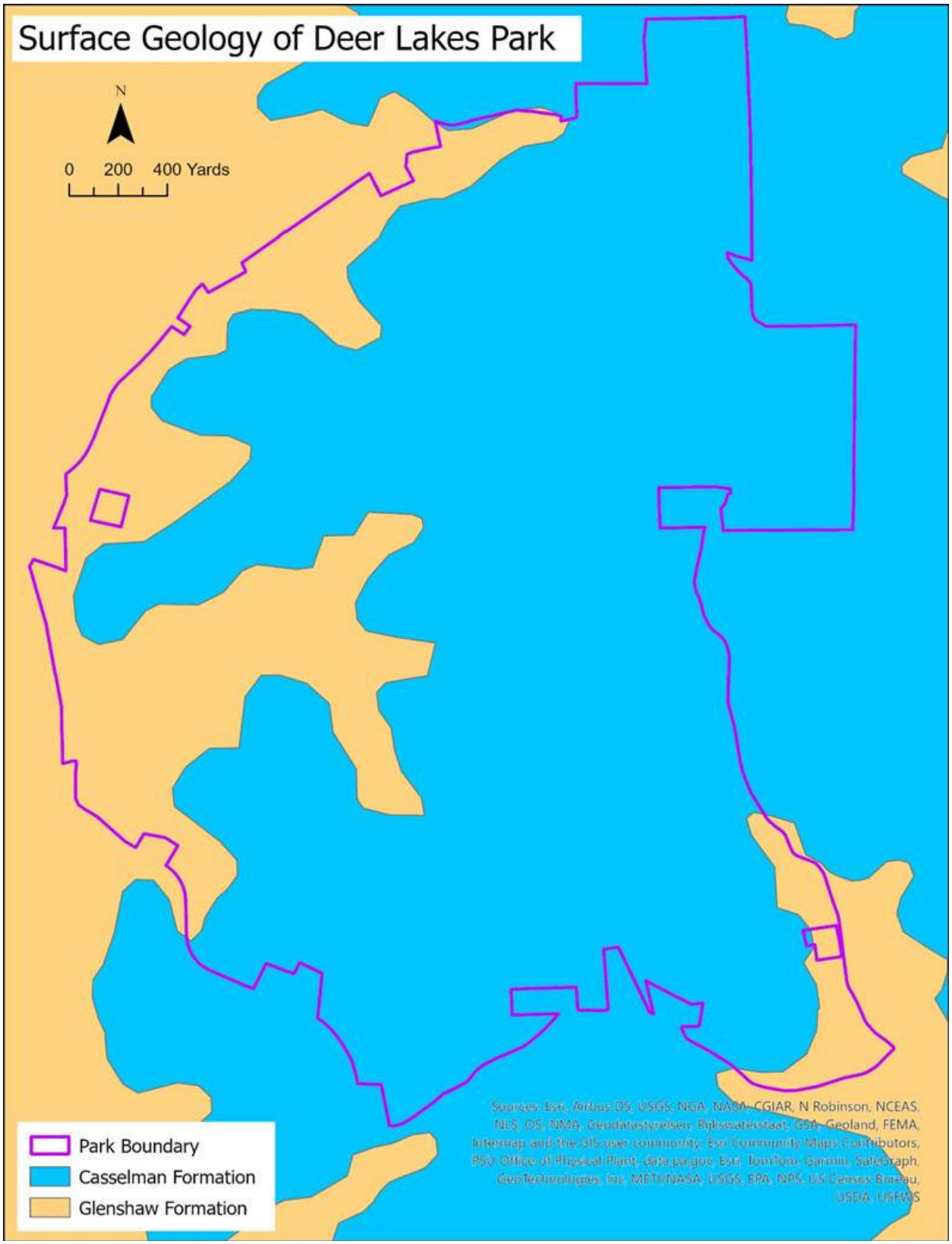


Current-day mature forest communities correspond to the areas forested in the 1938 and 1956 photos.

FIGURE IV 2021 AERIAL IMAGERY

Today, most of the park is forested. This mid-spring aerial photo shows the mature forests as grey-brown because they are dominated by oak species that have not yet leafed out, while the darker green patches are younger forests that have regrown since the park's creation in 1967, dominated by black cherry, tuliptree, and other early successional species.

FIGURE V


Surface Geology of Deer Lakes Park
N
0 200 400 Yards
Park Boundary
Casselman Formation
Glenshaw Formation
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, P&J Office of Physical Plant, data.pa.gov, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

make inferences about current land use practices and natural community composition.

1.4 GEOLOGY

Surface geology refers to the bedrock layers closest to the surface of the earth. Bedrock is the foundation material for soil, and also greatly influences the chemistry of water bodies such as streams, rivers, and lakes. Surface geology can be a determining factor in the diversity of plant life on land, and animal life in streams and lakes.

Pennsylvania is divided into physiographic regions based on landforms and geological history. Deer Lakes Park is within the Pittsburgh Low Plateau section of the Appalachian Plateau province, characterized by low rolling hills that formed by the gradual erosion of stream valleys, rather than the tectonic upheavals that formed the Allegheny and Appalachian ranges. In this region, the surface geology layers were formed through sedimentary processes, and they have not been extensively folded by subsequent tectonic activity; today they lie horizontally or gently undulate over large distances. The Pittsburgh Low Plateau is within the unglaciated portion of the Appalachian Plateau province.

Geologists classify rock layers into groups and formations based on the time period in which they formed. Formations are also described according to their mineral composition, which greatly influences soil materials and plant life. The surface geology of Deer Lakes Park is mostly Casselman formation, with some areas of Glenshaw formation in the western part of the park and the southeastern corner (Figure V).

The Glenshaw and Casselman formations consist of layers of shale, siltstone, sandstone, red beds, thin impure limestone, and thin nonpersistent coal. They contain very little calcareous material, except for a limestone layer called the Ames limestone, which occurs at the boundary of the two formations. This 2-4' thick layer can form small outcroppings and is notably rich in marine fossils. Where the Ames limestone is exposed on slopes by erosion that has cut through the geological layers, it may create a local zone roughly 5' to 10' in width that is calcium enriched. There is one location in the park where there are calcareous outcrops that may represent this formation. Besides this layer, the overwhelming character of the surface geology within the park is acidic and mineral-poor.

A bedrock exposure of possible Cassleman Formation shale created by a small, seasonal stream near the Fire Pink Slope ecological area.

1.5 SOILS

Soil types vary according to topographic position (USDA-SCS 1981). The lowest topographic positions, along the floodplains of major stream channels, have Atkins silt loam, Wharton silt loam, and Ernest silt loam soils. Gilpin, Weikert, and Culleoka channery silt loam (a map unit including several undifferentiated types) is found on mid- and upper- slopes, as is the Gilpin-Upshur complex. Gilpin soils and Upshur soils are also mapped to the upper slopes and summits.

Successional communities are extensive in the park across a variety of topographic settings and found on all of the park's major soil types. Interpreting the association between soils and natural communities, with the exception of successional communities in strip mined areas, should be approached with caution. In this setting, natural communities are more likely associated with disturbance history, aspect, and slope, rather than soil types. Previous farming use also impacts current soil condition through tillage, erosion, and compaction.

Biologists completing a soil pH test at Deer Lakes Park

SOILS LEGEND

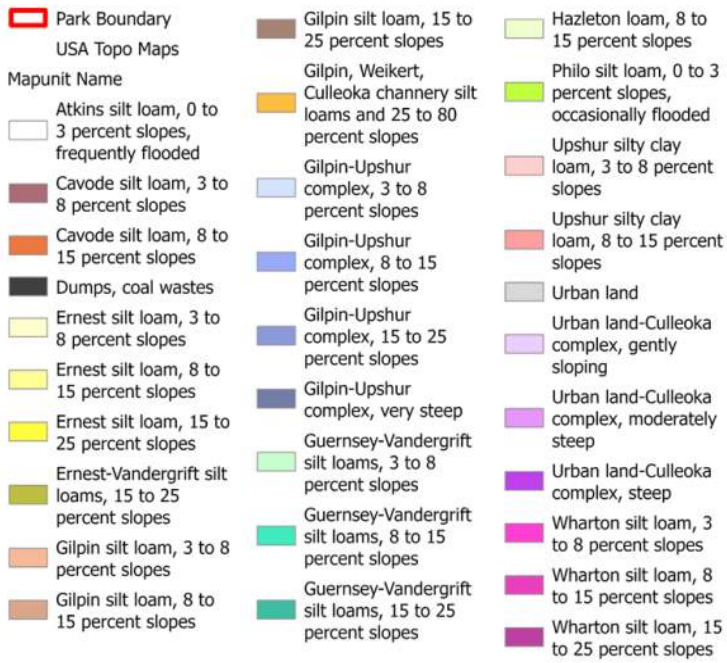


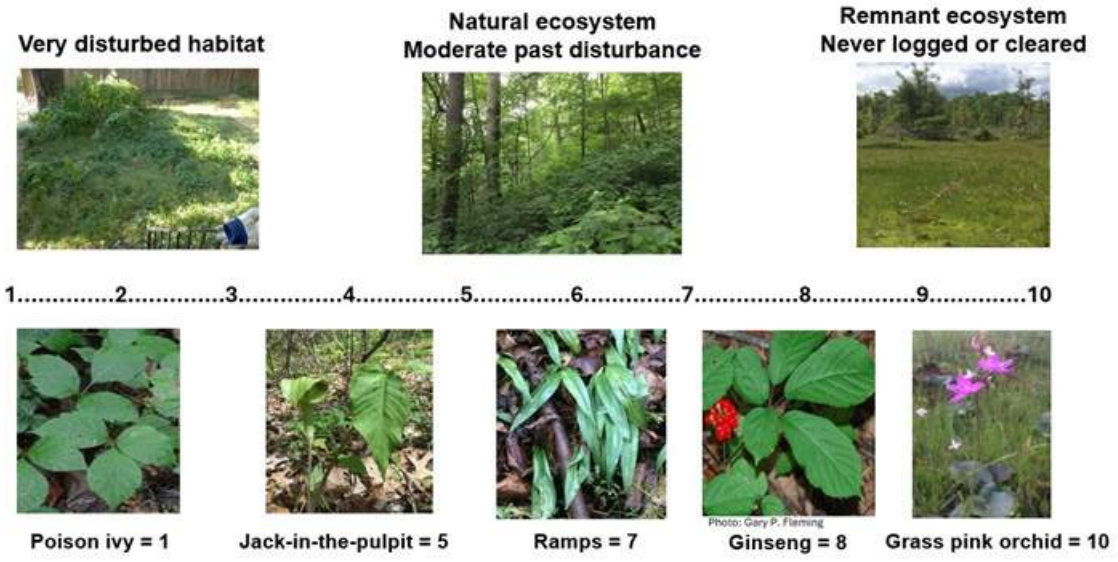
FIGURE VI


Soils at Deer Lakes Park
N
0
250
500 Yards
Water Tank
Transfiguration
Cem
Transfiguration
Cem

1.6 CONSERVATIVE PLANTS OF DEER LAKES PARK

The following table lists plant species found in Deer Lakes Park that require intact natural habitats with little disturbance. The "Coefficient of Conservatism" (C-Value) is a rating developed to estimate how strongly a plant requires such a habitat; a species rated "10" will almost never be found outside of a very intact natural habitat, while a species rated "1" can easily colonize disturbed areas. The presence of species rated "5" or above can serve as a guide to indicate good

FIGURE VII



Visual explanation of various plant species, their conservatism value, and possible expected habitats they may occur in. Note: some of these species and habitats are not found within Deer Lakes Park and are for example purposes.

Deer Lakes Park has a typical number of conservative plant species (117) in comparison with other Allegheny County Parks. There are not as many mature natural habitat types in Deer Lakes parks as in other parks, and the conservative species are primarily forest species with a smaller number of wetland species included. Some of the conservative species have very limited numbers of individuals present in the park, due to the impact of long-term overbrowsing by whitetailed deer and the establishment of invasive species.

TABLE I. CONSERVATIVE SPECIES (C-VALUE > 5) OF DEER LAKES PARK

Scientific Name	Common Name	Growth Form	C-value
Carex appalachica	Appalachian sedge	herb	8
Carex platyphylla	Broad-leaved sedge	herb	8
Carex prasina	Drooping sedge	herb	8
Conopholis americana	Bearcorn	herb	8
Gaultheria procumbens	Teaberry	herb	8
Gaylussacia baccata	Black huckleberry	herb	8
Magnolia acuminata	Cucumber magnolia	tree	8
Maianthemum canadensis	Canada mayflower	herb	8
Mertensia virginica	Virginia bluebells	herb	8
Mitella diphylla	Two-leaved miterwort	herb	8
Panax quinquefolius	Ginseng	herb	8
Parthenocissus quinquefolia	Virginia creeper	vine	8
Phlox divaricata	Blue wood phlox	herb	8
Pontederia cordata	Pickerelweed	herb	8
Saururus cernuus	Lizard's-tail	herb	8
Silphium perfoliatum	Cup plant	herb	8
Trillium grandiflorum	Great white trillium	herb	8
Tsuga canadensis	Eastern hemlock	tree	8
Trillium sessile	Common toadshade	herb	8
Actaea pachypoda	Doll's eyes	herb	7
Adiantum pedatum	Northern maidenhair fern	herb	7
Allium tricoccum	Common ramp	herb	7
Aralia nudicaulis	Wild sarsaparilla	herb	7
Asarum canadense	Canada wild ginger	herb	7
Cardamine bulbosa	Bulbous bittercress	herb	7
Carex communis	Fibrous-rooted sedge	herb	7
Caulophyllum thalictroides	Blue cohosh	herb	7
Claytonia caroliniana	Carolina springbeauty	herb	7
Cystopteris tenuis	Mackay's fragile fern	herb	7
Goodyera pubescens	Downy rattlesnake plantain	herb	7
Helianthus divaricatus	Woodland sunflower	herb	7
Hieracium venosum	Rattlesnake hawkweed	herb	7
Lespedeza violacea	Wand lespedeza	herb	7
Ostrya virginiana	American hophornbeam	tree	7
Physocarpus opulifolius	Ninebark	shrub	7
Quercus montana	Chestnut oak	tree	7

Silene virginica	Fire pink	herb	7
Tilia americana	American basswood	tree	7
Trillium erectum	Stinking Benjamin	herb	7
Viola rotundifolia	Roundleaf yellow violet	herb	7
Acer saccharum	Sugar maple	tree	6
Actaea racemosa	Common black cohosh	herb	6
Amelanchier arborea	Common serviceberry	tree	6
Cardamine pensylvanica	Pennsylvania bittercress	herb	6
Carex digitalis	Slender woodland sedge	herb	6
Carpinus carolinana	Musclewood	tree	6
Carya glabra	Pignut hickory	tree	6
Carya ovalis	Red hickory	tree	6
Carya ovata	Shagbark hickory	tree	6
Carya tomentosa	Mockernut hickory	tree	6
Claytosmunda claytoniana	Interrupted fern	herb	6
Fagus grandifolia	American beech	tree	6
Galium circaezans	Forest bedstraw	herb	6
Heuchera americana	American alumroot	herb	6
Micranthes virginiensis	Early saxifrage	herb	6
Monotropa uniflora	Ghost pipes	herb	6
Nyssa sylvatica	Black gum	tree	6
Oxalis violacea	Violet woodsorrel	herb	6
Packera obovata	Roundleaf Ragwort	herb	6
Pinus strobus	White pine	tree	6
Quercus alba	White oak	tree	6
Quercus imbricaria	Shingle oak	tree	6
Quercus phellos	Willow Oak	tree	6
Quercus rubra	Red oak	tree	6
Quercus velutina	Black oak	tree	6
Salix discolor	Pussy willow	tree	6
Scutellaria incana	Downy skullcap	herb	6
Sedum ternatum	Woodland stonecrop	herb	6
Solidago caesia	Blue-stemmed goldenrod	herb	6
Sparganium americanum	American bur-reed	herb	6
Symphyotrichum lateriflorum	Calico aster	herb	6
Thalictrum dioicum	Early meadowrue	herb	6
Thalictrum thalictroides	Rue anemone	herb	6
Uvularia perfoliata	Perfoliate bellwort	herb	6

Vaccinium pallidum	Lowbush blueberry	shrub	6
Viburnum acerifolium	Maple-leaved viburnum	shrub	6
Lilium sp. (superbum/canadense)	Lily species	herb	6
Aquilegia canadensis	Red columbine	herb	6
Amauropelta noveboracensis	New York fern	herb	5
Arisaema triphyllum	Jack-in-the-pulpit	herb	5
Asclepias incarnata subsp. incarnata	Swamp milkweed	herb	5
Athyrium asplenioides	Southern lady fern	herb	5
Betula lenta	Sweet birch	tree	5
Boehmeria cylindrica	Swamp nettle	herb	5
Botrypus virginiana	Rattlesnake fern	herb	5
Cardamine concatenata	Cutleaf toothwort	herb	5
Cercis canadensis	Eastern redbud	tree	5
Collinsonia canadensis	Richweed	herb	5
Dryopteris carthusiana	Spinulose wood fern	herb	5
Dryopteris intermedia	Intermediate wood fern	herb	5
Elymus hystrix	Bottlebrush grass	herb	5
Euphorbia corollata	Eastern flowering spurge	herb	5
Eurybia divaricata	White wood aster	herb	5
Floerkia proserpinacoides	False mermaidweed	herb	5
Fraxinus americana	White ash	tree	5
Galium triflorum	Sweet-scented bedstraw	herb	5
Geranium maculatum	Wood geranium	herb	5
Hamamelis virginiana	Witch hazel	shrub	5
Heliopsis helianthoides	Oxeye sunflower	herb	5
Lindera benzoin	Spicebush	shrub	5
Liriodendron tulipifera	Tulip poplar	tree	5
Luzula multiflora	Woodrush species	herb	5
Maianthemum racemosum	False Solomon's seal	herb	5
Osmorhiza claytonii	Sweet cicely	herb	5
Osmorhiza longistylis	Sweet chervil	herb	5
Platanus occidentalis	American sycamore	tree	5
Podophyllum peltatum	May apple	herb	5
Polystichum acrostichoides	Christmas fern	herb	5
Rudbeckia laciniata	Cutleaf coneflower	herb	5
Rudbeckia triloba	Brown-eyed Susan	herb	5
Sanguinaria canadensis	Bloodroot	herb	5

Spiraea alba	White meadowsweet	shrub	5
Swida racemosa	Gray dogwood	shrub	5
Symplocarpus foetidus	Skunk cabbage	herb	5
Ulmus americana	American elm	tree	5
Viola palmata	Wood violet	herb	5

Northern maidenhair fern

Rue anemone (Thalictrum thalictroides), C= 6

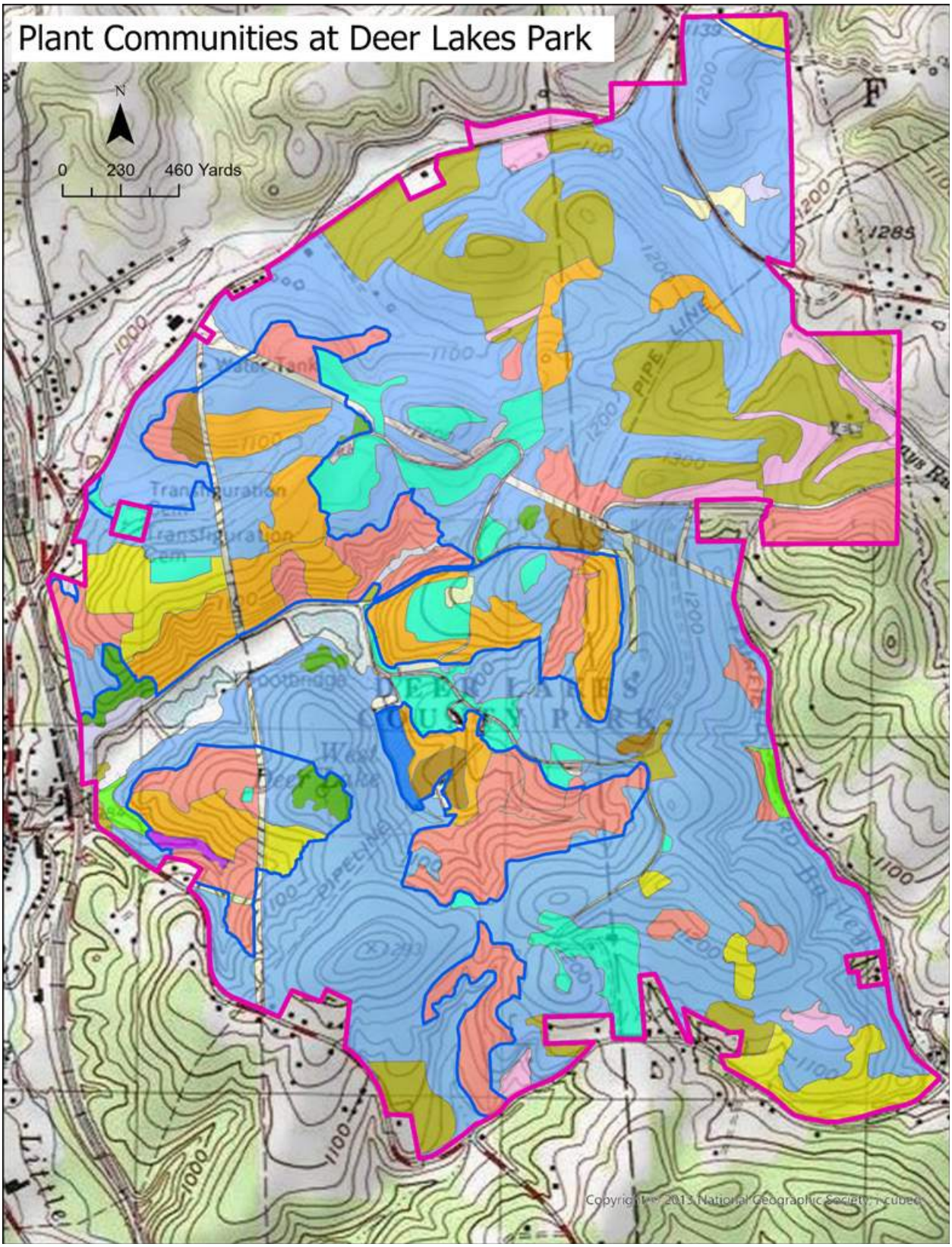
Wingstem (Verbesina alternifolia), C= 2

Great blue lobelia (Lobelia siphilitica), C= 4

Wood geranium (Geranium maculatum), C= 5

Rattlesnake orchid (Goodyera pubescens), C= 7

FIGURE VIII


Plant Communities at Deer Lakes Park
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1.7 PLANT COMMUNITY TYPES OF DEER LAKES PARK

Natural community types within Deer Lakes Park were assigned using the Pennsylvania Natural Heritage Program's plant community classification system and Natureserve's U.S. National Vegetation Classification. When possible, community types were assigned using the Pennsylvania Natural Heritage Program's plant community classification system (PNHP 2024). In certain situations, we utilized the National Vegetation Classification (USNVC 2024) if a similar, but more accurate community type was available for natural or successional communities at Deer Lakes Park. There were many successional areas that were not easily classified by the Pennsylvania or Natureserve classifications and are closely associated with disturbance history; these were separated by age and canopy cover in the "Successional Communities" section, but we did not attempt to further subdivide them based on species composition.

1.7.1 TERRESTRIAL COMMUNITIES

Western Allegheny Chestnut Oak – Mixed Oak / Heath Forest [NVC Link]:
This type is found on the driest settings in the park, in small patches on the uppermost slopes and hilltops. It is differentiated from the Western Allegheny Dry – Mesic Oak – Hardwood Forest by having greater amounts of chestnut oak (*Quercus montana*) and black oak (Quercus velutina) in the canopy in addition to red oak (*Quercus rubra)* and white oak (*Quercus alba*), a greater heath shrub component (*blueberry, huckleberry, and azalea species*), maple-leaved viburnum (*Viburnum acerifolium)*, and generally lacking mesic herbaceous species due to xeric conditions and acidic soil chemistry. In Deer Lakes, herbaceous understories within this type are extremely sparse and the bryophytes *Dicranum sp.* and *Leucobryum sp.* are prominent in the understory. Heath shrub species are common, and few, if any, invasive species are present. See the ecological integrity area "West Deer Lake Watershed" for more detail on species found within this community.

A bryophyte and huckleberry-dominated example of the Western Allegheny Chestnut Oak – Mixed Oak / Heath Forest community type within Deer Lakes Park.

Western Allegheny Dry – Mesic Oak – Hardwood Forest [NVC Link]:
This forest community type is found in mid to upper slope and hilltop positions within Deer Lakes. It is differentiated from the Western Allegheny Chestnut Oak – Mixed Oak / Heath Forest type by possessing slightly more mesic character, greater understory diversity, and mixed hardwood species in the canopy. Examples of this community type are dominated by white oak (*Quercus alba*), red oak (*Quercus rubra*), and red maple (*Acer rubrum*), though in other examples of this community (outside of Deer Lakes) sugar maple (*Acer saccharum*) is often the dominant maple. Chestnut oak (Q*uercus montana*) is often present and occasionally codominant. Other minor associates include shagbark hickory (*Carya ovata*), American beech (*Fagus grandifolia*), tulip poplar (*Liriodendron tulipifera*), and black gum (*Nyssa sylvatica*). The shrub and small-tree layer include serviceberry (*Amelanchier arborea)*, American hornbeam (*Carpinus caroliniana*), flowering dogwood (*Benthamidia florida*), and American hop-hornbeam (*Ostrya virginiana*). Heath shrubs may be present but uncommon. The herbaceous layer includes a range of dry-mesic to mesic herbs. See the descriptions for ecological integrity areas "Rea Lane Oak Slope" and "Mahaffey Road Slopes" for further information about this type within the park.

An example of the Western Allegheny Dry – Mesic Oak – Hardwood Forest community type within Deer Lakes Park. Note the presence of lowbush blueberry (Vaccinium pallidum) in the understory.

Dry Oak – Mixed Hardwood Forest [NVC Link]:
This forested community type was documented on mid to upper slopes within Deer Lakes Park. Dominant canopy species within this type include white oak (*Quercus alba*), red oak (*Quercus rubra)*, black oak (*Quercus velutina*), red maple (*Acer rubrum*), mockernut hickory (*Carya tomentosa)*, shagbark hickory *(Carya ovata)* and occasionally sugar maple (*Acer saccharum*) and black cherry (Prunus serotina). Although the understory of this community type is often quite rich in other parts of Pennsylvania, species richness was variable at Deer Lakes. Herbaceous and shrub layer cover is usually thin due to its xeric character and acidic soil chemistry, giving this forest type within the park an open appearance. Characteristic understory tree and shrub species include flowering dogwood (*Benthamidia florida*), American hophornbeam *(Ostrya virginiana*), serviceberry (*Amelanchier arborea*), witch hazel (*Hamamelis virginiana*), maple-leaved viburnum (*Viburnum acerifolium*), and scattered seedlings of canopy species. Heath species, namely lowbush blueberry (*Vaccinium pallidum*), may be present in areas. Herbaceous species present include Pennsylvania sedge (*Carex pensylvanica*), curly Dan grass (*Danthonia spicata)*, white snakeroot (*Ageratina altissima)*, intermediate wood fern (*Dryopteris intermedia)*, smooth Solomon's seal *(Polygonatum biflorum*), wild sarsaparilla *(Aralia nudicaulis*), and hay-scented fern (*Sitobolium punctilobulum)*. This community type is similar to the Red Oak – Mixed Hardwood Forest but is differentiated by its drier character. See the descriptions for the good ecological integrity areas "Fire Pink Slope", "Mahaffey Road Slopes", "Middle Lake Watershed", and "West Deer Lake Watershed" for further information about this type within the park.

An example of the Dry Oak – Mixed Hardwood Forest community at Deer Lakes Park.

Red Oak – Mixed Hardwood Forest [NVC Link]:
This is the most common mature forest community within Deer Lakes Park. It is often found on mid and lower slopes, on well-drained soils, and with slightly elevated pH compared to drier types. Red oak (*Quercus rubra)* is dominant in the canopy, often accompanied by white oak (*Quercus alba*), with lesser components of red maple (*Acer rubrum*), black cherry (*Prunus serotina*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), sassafras (*Sassafras albidum*) slippery elm (*Ulmus rubra*), and less frequently, American elm *(Ulmus americana*) and sugar maple (*Acer saccharum*). White ash *(Fraxinus americana*) was previously a minor component, but most have died due to emerald ash borer infestation. The shrub layer includes spicebush (*Lindera benzoin*), often dense in areas, as well as witch hazel (*Hamamelis virginiana*) and flowering dogwood (*Benthamidia florida*). In poorer ecological areas within the park, this community hosts a variety of exotic species such as bush honeysuckle (*Lonicera morrowii/sp.*), Japanese barberry (*Berberis thunbergii)*, and autumn olive (*Elaeagnus umbellata*). The herbaceous layer typically has a somewhat lower diversity of native species than would be expected for highly intact examples of this community; this may reflect overbrowsing by white-tailed deer, as well as the impacts of past land use and forest fragmentation. Species such as may-apple (*Podophyllum peltatum*), rue anemone (*Thalictrum thalictroides*), violets (*Viola spp.*), northern dewberry (*Rubus flagellaris*), hay-scented fern (*Sitobolium punctilobulum*), and white snakeroot *(Ageratina altissima)* are typical, while more conservative species such as wood geranium (*Geranium maculatum*), Virginia bluebells (*Mertensia virginica*), and other spring wildflowers were scattered with only a few populations in the park. See the descriptions for the good ecological integrity areas "Mahaffey Road Slopes", "Middle Lake Watershed", "Bailey's Run Tributary Slopes", and "West Deer Lake Watershed" for further information about this type within the park.

Representative example of the Red Oak – Mixed Hardwood Forest community type within Deer Lakes Park.

Northeastern Ruderal Hardwood Forest [NVC Link]:

This type occurs on mesic to dry-mesic sites that are becoming reforested after having been cleared for agriculture or otherwise heavily modified in the recent past. They are dominated by native species capable of rapid dispersal and growth, and invasive species. They generally have much lower total diversity and lack conservative native species. The physical structure of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early successional woody species dominate the canopy in a widely variable mix, depending on geographic location. In Deer Lakes Park, most of these forests are dominated by black cherry (*Prunus serotina*) with sassafras (*Sassafras albidum*) and red maple (*Acer rubrum*); tulip poplar (*Liriodendron*), red oak (*Quercus rubra*), and slippery elm (*Ulmus rubra*), and other hardwoods can occasionally be present, and sometimes dominant in localized patches.

An example of the Northeastern Ruderal Hardwood Forest community type within Deer Lakes Park. Note smaller tree sizes, a dense shrubby understory, and presence of many vines extending into the canopy.

In Deer Lakes Park, examples of this community type range in age from fairly mature to quite young and early successional. The younger forests often have incomplete canopy closure. The shrub layer is dominated by spicebush (*Lindera benzoin*), or by non-native invasive shrubs, most commonly bush honeysuckles *(Lonicera maackii, L. morrowii*) but also multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*) and privet (*Ligustrum sp.*).

The herbaceous layer is variable, often containing grasses and forbs of both native and non-native origin but typically lacking diversity and conservative species. Common species include white snakeroot (*Ageratina altissima*), jewelweed (*Impatiens capensis*), Virginia jumpseed (*Persicaria virginiana*), and spinulose wood fern (*Dryopteris carthusiana*). Japanese stiltgrass (*Microstegium vimineum*) is ubiquitous throughout this type within the park, and in some areas, it has reached monoculture density in the understory. Garlic mustard (*Alliaria petiolata*) can be locally abundant in the understory as well. Vines can be present and abundant; in stands with high vine cover, the vegetation structure may be altered by the weight of the vines pulling down trees and shrubs. Common vines include Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), wild grape (*Vitis labrusca*), and the invasive vines round-leaved bittersweet (*Celastrus orbiculatus*) and Japanese honeysuckle (*Lonicera japonica*). It is unlikely that these stands will develop into a natural plant community dominated by native species without significant restoration work.

Ruderal Black Walnut Forest [NVC Link]:
This successional forested community is a minor component of the natural communities mapped within Deer Lakes Park. Canopy cover can range from closed to somewhat open, and black walnut (*Juglans nigra*) is dominant in all instances. Associated canopy tree species can include tulip poplar (*Liriodendron tulipifera*), black locust (*Robinia pseudoacacia*), American elm (*Ulmus americana*), sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), sassafras (*Sassafras albidum*), and musclewood (*Carpinus caroliniana*). The shrub layer can range from thin to well-developed; within Deer Lakes Park, the shrub layer is often dense and is composed of invasive shrubs such as bush honeysuckle (*Lonicera morrowii/sp.*), privet (*Ligustrum sp.*), multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata*). Understories are very similar to those found in adjacent Northeastern Ruderal Hardwood Forest communities, with white snakeroot (*Ageratina altissima*), deer tongue grass (*Dichanthelium clandestinum*), Virginia jumpseed (*Persicaria virginiana*), and wingstem (*Verbesina alternifolia)* as common dominant species. This type is heavily invaded by herbaceous species Japanese stiltgrass *(Microstegium vimineum*) and garlic mustard (*Alliaria petiolata*) where found in the park.

An example of the variable Ruderal Black Walnut Forest type. This community often occurs in wet, floodplain-like areas and is uncommon in the park.

Pine Plantation [NVC Link]:
Pine plantations are an artificial community type resulting from the planting of significant amounts of pine species in a given area. Within Deer Lakes Park, these plantings are dominated in most instances by white pine (*Pinus strobus)*, though one area is a shortleaf pine (*Pinus echinata)* planting. Both of these areas contain relatively large individuals comprising a mature canopy containing some mixed hardwood species including black cherry *(Prunus serotina)*, red maple (*Acer rubrum*), and sassafras (*Sassafras albidum*). The shrub and understory layers are similar to the Northeastern Ruderal Hardwood Forest type within the park but may be slightly less invaded due to acidic soil conditions created by pine trees.

An example of an artificial Pine Plantation community within Deer Lakes Park. Note the accumulation of needles in the understory layer.

1.7.2 PALUSTRINE AND AQUATIC COMMUNITIES

Skunk Cabbage – Golden Saxifrage Seep [NVC Link]:
This type is a closed-canopy wetland that occurs where groundwater seepage emerges in a forest. It may have a great diversity of wetland species present. At Deer Lakes Park, there is one example of this type of seepage community present nestled in a ravine between oak mixed hardwood forest. It is primarily dominated by native species, though diversity in native species is depleted compared to a reference example of this community type. Skunk cabbage (*Symplocarpus foetidus*) is the dominant species alongside jewelweed (*Impatiens capensis*) and drooping sedge (*Carex prasina*). Golden saxifrage (*Chrysosplenium americanum*), a conservative seepage species, is absent, likely due to slight habitat degradation. Other herbaceous species present include jack-in-the-pulpit *(Arisaema triphyllum*), dwarf enchanter's nightshade (*Circaea alpina*), clearweed (*Pilea pumila*), sensitive fern (*Onoclea sensibilis*), and roundleaf ragwort (*Packera obovata).* Japanese stiltgrass (*Microstegium vimineum*) is dense in portions of this wetland, particularly as it transitions to a more open, disturbed area. This community type has high ecological function, providing valuable habitat for amphibians, insects, burrowing crayfish, and other invertebrates. See the ecological integrity area "Fire Pink Slope" for more detail on species found within this community.

The good-quality skunk cabbage seep present within the Fire Pink Slopes ecological area within Deer Lakes Park.

Eastern North American Freshwater Aquatic Vegetation [NVC Link]:
At Deer Lakes Park, this aquatic vegetation community is present in the West Deer Lake. Here, native aquatic plants, specifically hornwort (*Ceratophyllum demersum*) and white waterlily (*Nymphaea odorata*), are the most abundant types of aquatic plants found in the lake. This community type is a catch-all term for various types of permanent or semi-permanent water bodies that are mostly native species-dominant, including disturbed and artificial water bodies. Eurasian watermilfoil (*Myriophyllum spicatum*) and hydrilla (*Hydrilla verticillata*) are present in West Deer Lake, but not to the same dominant proportions that they are found in East and Middle Deer Lakes. Overall, aquatic vegetation beds do not cover the entirety of West Deer Lake, and a significant portion of the lake is mostly bare gravel and sediment.

West Deer Lake as seen in the fall. This lake is the only lake within the park that isn't completely dominated by exotic aquatic species.

Ruderal Water-thyme – Eurasian Water-milfoil Aquatic Vegetation [NVC Link]:

This is a highly disturbed aquatic vegetation community type that is present in the East and Middle Deer Lakes. It is typical of artificial water bodies like the ones at Deer Lakes Park. These lakes are completely dominated by dense colonies of hydrilla (*Hydrilla verticillata*), also known as water-thyme, and Eurasian watermilfoil (*Myriophyllum spicatum*). Coontail (*Ceratophyllum demersum*) and white waterlily (*Nymphaea odorata*) are also abundant in both lakes. Invasive aquatic species are the characteristic dominant plants for this community type. The higher proportions of native plants, particularly coontail and white waterlily, are notable deviations from the average example of this community. Invasive plants like hydrilla and Eurasian watermilfoil usually arrive as hitchhikers on fishing gear or waterfowl.

Hydrilla is a common invasive species found in East Lake and Middle Lake within the park.

1.7.3 SUCCESSIONAL COMMUNITIES

Disturbed Forest:

This type does not originate within an existing NVC or PNHP community description; this type is applied to forests that have experienced significant disturbance and as a result do not resemble any defined natural community types. This community type within Deer Lakes is most similar to the Northeastern Ruderal Hardwood Forest community but differs in lacking understory shrub and herbaceous structure, a consistent canopy composition, and in having other modifications to the landscape.

A disturbed successional forest with young trees and a similar assemblage to the northeastern ruderal hardwood forest community, but lacking in understory vegetation.

Invasive Shrubland:
These are areas dominated entirely by non-native invasive shrub species, forming a tall shrub canopy. Autumn olive (*Elaeagnus umbellata*), bush honeysuckle (*Lonicera morrowii/sp.)*, multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and privet (*Ligustrum sp.*) are the most common species. The understory layer, if present, is often dominated by Japanese stiltgrass (*Microstegium vimineum*) within the park. Most invasive shrublands within the park represent recently overgrown fields, significant canopy gaps, and field edges and hedgerows.

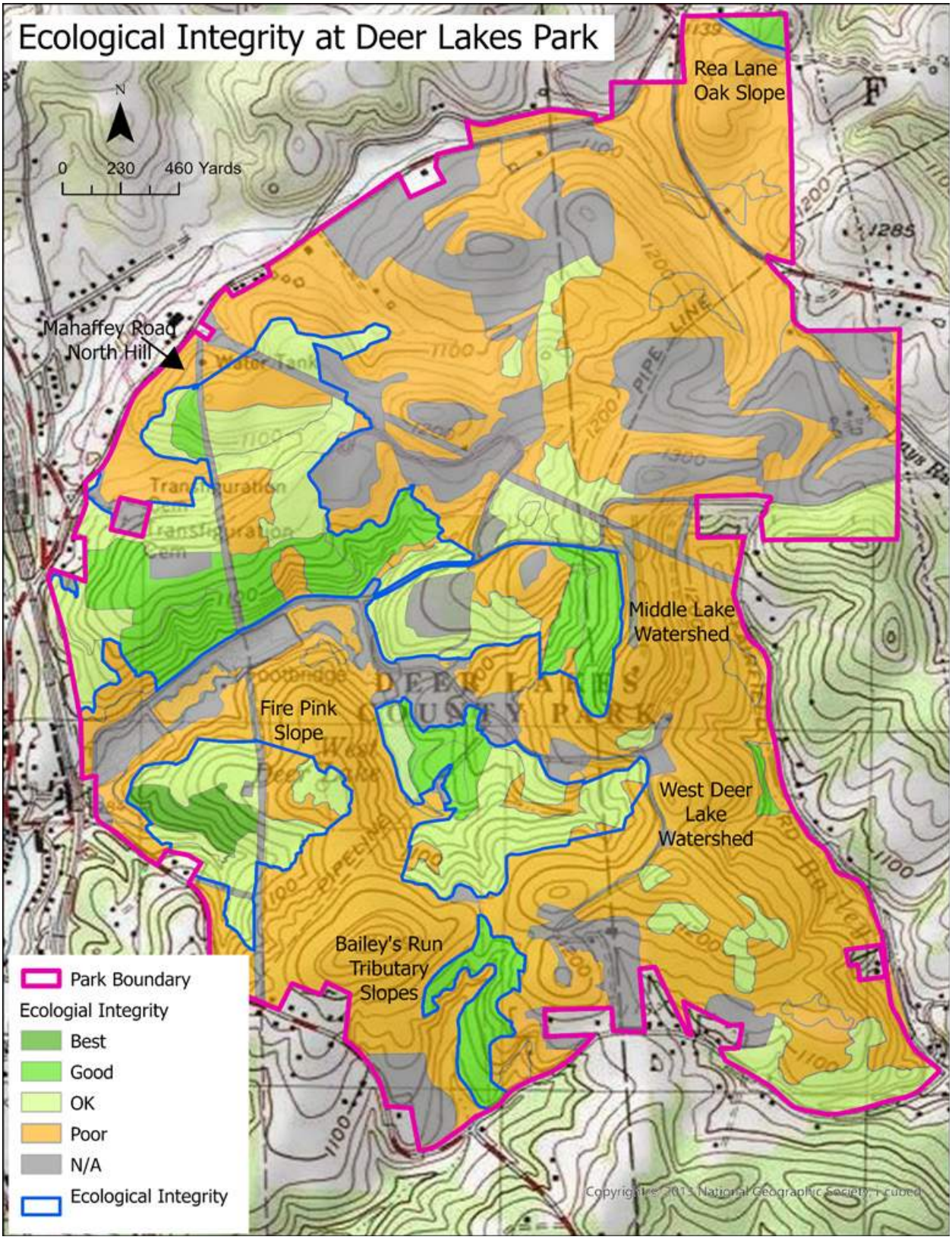
An example of the variable Invasive Shrubland community type within the park.

Early Successional Herbaceous:
This community type is applied to areas that lack canopy cover and are predominantly herbaceous rather than shrub dominated. They can occur as a result of canopy blowdown openings or roadside ditches, particularly around small seepage wetlands, and contain a mixture of upland species, as well as successional aquatic species such as narrowleaf cattail (*Typha angustifolia*), common reed (*Phragmites australis*), colt's foot (*Tussilago farfara*), multiflora rose (*Rosa multiflora*), reed canary grass (*Phalaris arundinacea*). Alternatively, early successional herbaceous communities can represent previously maintained openings that have begun to succeed into more natural community types but remain heavily invaded by pioneer herbaceous

Meadow:
Several meadow areas are mown infrequently and host a range of early successional native species and old field/hayfield non-native species. These provide habitat for bird species and other animals that require open, early successional conditions. Native species such as wrinkle-leaf goldenrod (*Solidago rugosa*), Canada goldenrod (*Solidago canadensis*), dogbane (*Apocynum cannabinum*), and deer-tongue grass (*Dichanthelium clandestinum*) provide habitat value. Invasive shrubs, including autumn olive (*Elaeagnus umbellata*) and privet (*Ligustrum sp.)* are scattered in the meadow matrix in addition to invasive herbs, including mugwort (*Artemesia vulgaris*) and Japanese stiltgrass (*Microstegium vimineum*).

An example of a relatively healthy meadow community type found near the large agricultural fields at the north end of the park.

FIGURE IX


Ecological Integrity at Deer Lakes Park
N
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Rea Lane Oak Slope
Mahaffey Road North Hill
Middle Lake Watershed
Fire Pink Slope
West Deer Lake Watershed
Bailey's Run Tributary Slopes
Park Boundary
Ecologial Integrity
Best
Good
OK
Poor
N/A
Ecological Integrity

1.8 ECOLOGICAL INTEGRITY MAPPING

The most ecologically intact communities within Deer Lakes Park are concentrated on the crests of hill plateaus, as well as adjacent south-facing, steep slopes, and have been continuously forested since the earliest aerial imagery (1938), therefore retaining natural plant communities. Most of these areas represent mature, oak-dominated communities found on dry, acidic soils common to ridgetops; these tend to be less invaded and have retained their original character compared to younger, post-agricultural successional forests. The mature forested areas within the park possess depleted diversity in the herbaceous and shrub layer compared to what is expected for their respective community types, likely as a result of long-term over browsing by deer.

Predating the designation of Deer Lakes Park, this area has experienced a variety of land usage, including logging, agricultural clearing, subsequent planting of selected trees, and agricultural succession to young forest communities. Approximately 75% of the park is forested or in natural condition, with 20% of this total classified as mature or late successional forest. The remainder of forested areas were classified as modified mid- to early- successional forest of varying quality, representing agricultural land that has since succeeded into forest. One mature forest area qualified as "best quality" given its overall canopy characteristics and understory herbaceous and shrub species assemblage. Targeted ecological stewardship efforts may restore "good" areas to the desirable "best" quality; likewise, ecological areas designated as "OK" may be restored to an improved "good" quality over time. Ways to improve ecological quality and restore ecosystem functions include:

- Controlling invasive species
- Employing deer management strategies to preserve and facilitate regeneration in native plant populations
- Reintroducing ecologically appropriate native plant species that have been reduced or lost
- Monitoring and managing canopy gaps as needed.

These stewardship tasks and recommendations are further detailed in the Natural Area Project Recommendations section (Page 77).

We have highlighted the areas with greatest ecological integrity and diversity by mapping them as "best", "good", "OK" and "poor" quality natural communities as follows.

"Best Quality" – These areas have mature plant communities with species diversity as good as or better than is typical for an intact example of the community type in our region, including more "conservative" species that require intact forest habitat and do not re-establish quickly after disturbance. These species have special conservation value, because they are difficult to re-establish once lost. They can also provide seed and propagule stock for restoration efforts elsewhere in the park, if they are managed to develop healthy populations and sustainably harvested. These areas also currently have low presence of invasive species and should be monitored and managed to prevent the establishment and spread of invasive species.

"Good Quality" – These are areas that have medium-aged to mature plant communities, with species diversity that is somewhat lower than expected for a reference example of the community type. "Conservative" species are less common or absent in these areas. Exotic species may be present but native species are dominant. Restoration of greater species diversity should be considered through movement of seed propagules from "best quality" examples of similar community types in the park. Invasive species management may also be needed in these areas.

"OK Quality" – these are areas that have some elements of native natural communities, such as a native tree canopy that is fairly intact, or a meadow that includes a significant proportion of native species but are also significantly disturbed and/or invaded.

"Poor Quality" – these are areas that have early successional plant communities with low diversity of native plants; species tend to be non-conservative, i.e. those that can colonize disturbed habitats easily, and exotic invasive plants are common. These areas will require intensive management to restore ecological quality and allow them to proceed on a natural successional path to develop a mature native plant community. The primary difficulty is the need to manage invasive species so that natives can establish and mature; propagule introduction may also eventually be needed to restore more conservative species.

1.8.1 "BEST" ECOLOGICAL AREAS

Fire Pink Slope:
The fire pink slope ecological area can be divided into two components, a forested skunk cabbage seepage wetland and adjacent upland forest. The forested skunk cabbage wetland is the only wetland of this type within the park and is characterized by having extensive colonies of skunk cabbage (*Symplocarpus foetidus*), as well as other species indicative of groundwater seepage such as jewelweed *(Impatiens capensis*) and drooping sedge (*Carex prasina)*. This area hosts a handful of conservative species found in this habitat type, indicative of high quality. There is extensive shrub invasion occurring downstream where the creek drainage and seepage complex transition to a more open canopy; however, the forested portion of this seepage is in good condition.

Drooping sedge (Carex prasina).

Canopy species include adjacent trees from nearby uplands, including white oak (*Quercus alba*), red oak (*Quercus rubra*), and species found within the wetland area itself, such as black walnut (*Juglans nigra*), black cherry *(Prunus serotina)*, and sweet birch (*Betula lenta*). Given this area's hydrology, invasive herbaceous species are present in open areas, particularly as canopy cover decreases immediately west. Japanese stiltgrass (*Microstegium vimineum*) is ubiquitous throughout much of the park but becomes concentrated in these wetter areas alongside other invasive species such as narrowleaf bittercress *(Cardamine impatiens).*

Shrub species present: Florida dogwood (Benthamidia florida), witch hazel (*Hamamelis virginiana*), hawthorn (*Crataegus sp.*), ash seedlings (*Fraxinus sp.*). Other herbaceous species present: northern lady fern (*Athyrium angustum*) and Christmas fern (*Polystichum acrostichoides)*. A species of special concern, roundleaf ragwort (*Packera obovata*), was observed in this seepage wetland as well.

Skunk cabbage (Symplocarpus foetidus) is a large, dominant species growing with other conservative herbaceous species within this seepage complex.

The forested wetland area sharply transitions to a steeply climbing slope to its north that contains a variety of understory species indicative of intact, high quality dry oak forest. This area also contains an impressive and noteworthy population of fire pink (*Silene virginica*), this area's namesake. Soils here possess a pH of around 5.5 and may have some influence from calcium-rich shale outcropping on the slopes here. Calciphile species such as red columbine (*Aquilegia canadensis*) and woodland stonecrop (*Sedum ternatum*) occur in the transitional zone above the forested wetland area.

Mixed red oak hardwood forest along the feeder ravines into this wetland area have greater mesic character and show calcium influence as well. These areas contain occasional patches of Virginia bluebells (*Mertensia virginica*), other spring wildflower species, as well as one sensitive species of conservation concern. The drier upland forest is characterized by a mature canopy of large red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak *(Quercus velutina*), shagbark hickory *(Carya ovalis*), and mockernut hickory (*Carya tomentosa*), as well as occasional sassafras *(Sassafras albidum)*, red maple (*Acer rubrum*), and black cherry (*Prunus serotina*). The shrub and herb layers are fairly open and low density, which likely results from a combination of long-term overbrowsing by whitetailed deer and from the steeply sloped, relatively dry habitat. Overall, this area is one of the most ecologically intact mature natural communities in the park, at this point uninvaded by shrub or herbaceous species other than occasional Japanese stiltgrass (*Microstegium vimineum*), particularly in mesic areas. One of the only natural geologic outcrops within the park occurs in the immediate ravine that enters the wetland seepage zone, and hosts Mackay's fern (*Cystopteris tenuis*), a conservative species.

Shrub species present: Florida dogwood (*Benthamidia florida),* spicebush *(Lindera benzoin*), serviceberry *(Amelanchier arborea*), ash seedlings *(Fraxinus sp.)*, black gum (*Nyssa sylvatica*), and American hophornbeam (*Ostrya virginiana*). Other herbaceous species present: common woodrush (*Luzula multiflora)*, curly Dan grass (*Danthonia spicata*), rattlesnake weed (*Hieracium venosum),* mayapple *(Podophyllum peltatum)*, rattlesnake root (*Nabalus sp.)*, Virginia fire pink (*Silene virginica)*, false rue anemone (*Thalictrum thalictroides)*, Virginia jumpseed (*Persicaria virginica*), and Virginia creeper (*Parthenocissus quinquefolia*).

A mature Red Oak – Mixed Hardwood community within the Fire Pink Slope area, with its namesake, Virginia fire-pink (Silene virginica) in the understory.

1.8.2 "GOOD" ECOLOGICAL AREAS

Mahaffey Road North Hill:
Located north of the main entrance to Deer Lakes Park, this area is generally bounded by Mahaffey Road and the park's western boundary. It is characterized by a steep, south facing slope that transitions upward to a relatively flat, broad plateau bisected by small ravines and seasonal streams. The forest within this area is mature to late successional in character, with large red oak (*Quercus rubra*), white oak (*Quercus alba)*, and occasional chestnut oak (*Quercus montana*), shagbark hickory (*Carya ovata)*, black cherry (*Prunus serotina*), and red maple (*Acer rubrum*) as canopy dominant tree species.

The small ravine and seasonal stream areas are richer and more mesic with a pH of around 5.5 and are characterized by an increased abundance of spring wildflowers within red oak dominant forest. This immediate area contains one of the best assemblages of spring wildflowers within the park, including a nice display of Virginia bluebells (*Mertensia virginica)*, and very small populations of common toadshade (*Trillium sessile*) and great white trillium (*Trillium grandiflorum).*

A display of Virginia bluebells (Mertensia virginica) amongst other spring wildflowers within the Red Oak – Mixed Hardwood Forest found within the Mahaffey Road Slopes area.

These mesic areas transition to drier uplands that exhibit xeric characters, including the occasional presence of chestnut oak and black oak, as well as lowbush blueberry (V*accinium pallidum*), a classic indicator species of dry, xeric oak forest. Given its maturity, invasive species cover is lower in this area compared to successional forest areas, though Japanese stiltgrass (*Microstegium vimineum)* is ubiquitous throughout the park and can become concentrated on trail edges here. Small patches of heavily invaded, ruderal forest are present nearby, as well as invaded shrubby edges surrounding a small cemetery, park fields, and two open right-of-ways.

Other canopy tree species found within this area: American hophornbeam (*Ostrya virginiana),* serviceberry *(Amelanchier arborea),* sassafras *(Sassafras albidum*). Understory shrub species found within this area: witch hazel *(Hamamelis virginiana*), ash saplings (*Fraxinus spp*.), American elm *(Ulmus americana*), maple-leaved viburnum (*Viburnum acerifolium)*, Florida dogwood (*Benthamidia florida),* spicebush *(Lindera benzoin),* hawthorne *(Crataegus sp.)*, and occasional Japanese barberry (*Berberis thunbergii*), bush honeysuckle (*Lonicera morrowii)*, multiflora rose (*Rosa multiflora*), and autumn olive (*Elaeagnus umbellata)*. Herbaceous species found within this area: Virginia bluebells (*Mertensia virginica*), false rue anemone (*Thalictrum thalictroides*), cutleaf toothwort (*Cardamine concatenata*), Virginia saxifrage (*Micranthes virginiensis),* spikegrass *(Danthonia spicata)*, Pennsylvania sedge (*Carex pensylvanica)*, northern dewberry (*Rubus flagellaris*), may apple *(Podophyllum peltatum)*, rattlesnake root (*Nabalus sp.)*, woodland geranium (*Geranium maculatum*), white snakeroot (*Ageratina altissima)*, and invasive herbs including garlic mustard (*Alliaria petiolata*), and Japanese stiltgrass (*Microstegium vimineum).*

A healthy assemblage of spring wildflowers, such as great white Trillium (Trillium grandiflorum), mayapple (Podophyllum peltatum), violets (Viola spp.), cutleaf toothwort (Cardamine concatenata), and rue anemone (Thalictrum thalictroides).

Bailey's Run Tributary Slopes:
This area contains ecologically intact red oak mixed hardwood forest that surrounds a tributary ravine to Bailey's Run and extends down its eastern slope until it bisects the park boundary at Bailey's Run Road. This area is characterized by a mature canopy of mixed age red oak (*Quercus rubra)* and white oak (*Quercus alba*), with occasional large individuals over 70cm DBH. Younger trees within this area include these two species in addition to shagbark hickory *(Carya ovata)*, black cherry *(Prunus serotina*), and occasional white pine (*Pinus strobus*), as well as eastern hemlock (*Tsuga canadensis*), black walnut (*Juglans nigra),* sassafras *(Sassafras albidum*), and red maple (*Acer rubrum*). This area's shrub and herb layers are open and sparse, indicating long-term overbrowsing by deer, but it is of mature quality and uninvaded. Spicebush (*Lindera benzoin*) is dominant in the shrub layer, and herbaceous dominants include dewberry (*Rubus flagellaris*), Virginia jumpseed (*Persicaria virginiana),* sedges *(Carex spp.),* bluegrass *(Poa spp.*), and white snakeroot (*Ageritina altissima*). Multiflora rose *(Rosa multiflora*) and Japanese stiltgrass (*Microstegium vimineum)* are occasional invasive species encountered along trail edges and disturbed areas such as canopy gaps.

A representative example of what much of the Bailey's Run Tributary Slopes ecological area looks like.

Middle Lake Watershed:
The uplands of the Middle Lake watershed area host a dry oak – mixed hardwood forest community with a mature, healthy canopy composed of red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), and chestnut oak (*Quercus montana)*, as well as occasional mockernut hickory (*Carya tomentosa*), red maple (*Acer rubrum*), and shagbark hickory (*Carya ovata*) that range from 40-70cm DBH in size. Some northeastern ruderal hardwood forest patches are present within this general area and are indicated by a higher fraction of black cherry (*Prunus serotina),* sassafras *(Sassafras albidum*), and greater presence of red maple.

The eastern portion of this ecological area contains a few small stream ravines with slightly richer character, represented in both the understory, as well as canopy, transitioning to red oak as a dominant canopy species instead of other oak species. Much of this area contains dry, acidic soils and an open, sparse understory and shrub assemblage. Lowbush blueberry (V*accinium pallidum*) is present within the driest portions of this area, as well as other shrubs and small trees including maple-leaf viburnum (*Viburnum acerifolium*), witch hazel (*Hamamelis virginiana*), Florida dogwood *(Benthamidia florida*), black gum (*Nyssa sylvatica*), American hophornbeam (*Ostrya virginiana)*, slippery elm (*Ulmus rubra*), sweet birch (*Betula lenta*), and Allegheny blackberry (*Rubus allegheniensis*). In ravine areas, as well as ruderal patches, spicebush (*Lindera benzoin*) is present and dominant.

Understory herbaceous species within the most intact ecological areas are sparse given their xeric character, but occasionally may include Virginia jumpseed (*Persicaria virginiana), mayapple (Podophyllum peltatum*), Pennsylvania sedge (*Carex pensylvanica*), star chickweed (*Stellaria pubera*), wood sorrel *(Oxalis species*), Virginia creeper *(Parthenocissus quinquefolia*), northern dewberry *(Rubus flagellaris*), and in wetter, mesic areas, intermediate wood fern (*Dryopteris intermedia*), common dogbane (*Apocynum cannabinum*), northern lady fern *(Athyrium angustum*), spotted cranesbill (*Geranium maculatum*), bloodroot (*Sanguinaria canadensis*), and jewelweed (*Impatiens capensis)*. Invasive species are sparse, particularly within dry oak forest areas and become more prevalent in ruderal forest zones. These include multiflora rose (*Rosa multiflor*a), garlic mustard (*Alliaria petiolata*), autumn olive (*Elaeagnus umbellata*), and Japanese barberry (*Berberis thunbergii*).

The disc golf course within this area, as well as the West Deer Lake drainage, has caused significant impacts to understory species assemblages, particularly within the dry forest type. This may be due to soil compaction and heavy use, trampling of existing vegetation, and subsequent erosion. Additionally, spicebush (*Lindera benzoin*) within this area is experiencing significant decline and early season defoliation as a result of an unknown pathogen currently under investigation. We address these concerns and suggest restoration techniques in the Project Recommendations section.

This ecological area hosts a healthy tree canopy; however, the understory has experienced impacts from the disc golf course.

West Deer Lake Watershed:

This area contains good quality dry oak - mixed hardwood forest on xeric, acidic ridgetops, and red oak – mixed hardwood forest within sloping areas and small creek ravines that drain into West Deer Lake. Overall, the forests within this area are high quality and uninvaded, with mature canopies and open but relatively high understory diversity compared to other areas within the park. The canopy within the dry oak forest area is dominated by black oak (*Quercus velutin*a), red oak (*Quercus rubra*), and white oak (*Quercus alba*), with occasional chestnut oak (*Quercus montana*) and scattered red maple *(Acer rubrum*). The understory within this xeric area contains high bryophyte cover, mostly *Dicranum spp.,* as well as lowbush blueberry (*Vaccinium pallidum),* huckleberry *(Gaylussacia baccata)*, and deerberry (*Vaccinium stamineum*), and represents the most intact xeric forest in the park.

Mature forest areas on lower slopes and within small creek ravines have greater red oak (*Quercus rubra*) canopy dominance, as well as other mixed hardwood species such as sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), shagbark hickory (*Carya ovata*), American hophornbeam *(Ostrya virginica)*, and occasional bitternut hickory (*Carya cordiformis*) and American beech (*Fagus grandifolia)*. These areas possess elevated moisture levels and slightly higher soil pH levels (5.5) than the uplands, and contain greater spring wildflower diversity compared to adjacent xeric upland forests. In particular, the floodplain area upstream of West Deer Lake is one of the better wildflower areas in the park. A trail runs through this area and should be carefully maintained to avoid impacts.

Shrub species within this area include witch hazel *(Hamamelis virginiana),* spicebush *(Lindera benzoin*), white ash (*Fraxinus americana*), maple-leaf viburnum (*Viburnum acerifolium*), Florida dogwood (*Benthamidia florida*), Allegheny blackberry (*Rubus allegheniensis*), and an occasional presence of Japanese barberry (*Berberis thunbergii)* and multiflora rose (*Rosa multiflora)*. Herbaceous species within this area include mayapple (*Podophyllum peltatum*), smooth Solomon's seal (*Polygonatum biflorum*), Virginia jumpseed (*Persicaria virginica*), sweet cicely (*Osmorhiza longistylis*), northern lady fern (*Athyrium angustum*), poison ivy (*Toxicodendron radicans*), Christmas fern (*Polystichum acrostichoides*), Robert's geranium *(Geranium robertianum),* Virginia creeper *(Parthenocissus quinquefolia)*, yellow fumitory *(Corydalis flavula*), northern dewberry (*Rubus flagellaris*), New York fern (*Amauropelta novaboracensis)*, as well as two sensitive species of concern. This forest area is relatively uninvaded except for occasional small multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and Japanese stiltgrass (*Microstegium vimineum)* along trails and in disturbed areas.

A small herbaceous wetland within the main drainage east of West Deer Lake contains a small, heavily invaded skunk cabbage seep. This area is of lower ecological quality due to significant disturbance by invasive species but is surrounded by good quality upland forest. Species found within this disturbed wetland area include skunk cabbage (S*ymplocarpus foetidus*), jewelweed (*Impatiens capensis*), false nettle (*Boehmeria cylindrica*), white cutgrass (*Leersia virginica)*, bulbous bittercress (Cardamine bulbosa), Virginia jumpseed (Persicaria virginica), spinulose wood fern (*Dryopteris carthusiana*), Jack-in-the-pulpit (*Arisaema triphyllum),* elderberry *(Sambucus canadensis*), and significant amounts of narrowleaf bittercress (*Cardamine impatiens*), Japanese stiltgrass (*Microstegium vimineum*), roundleaf bittersweet (*Celastrus orbiculatus*), garlic mustard (*Alliaria petiolata*), and occasional seedlings of Norway maple (*Acer platanoides*).

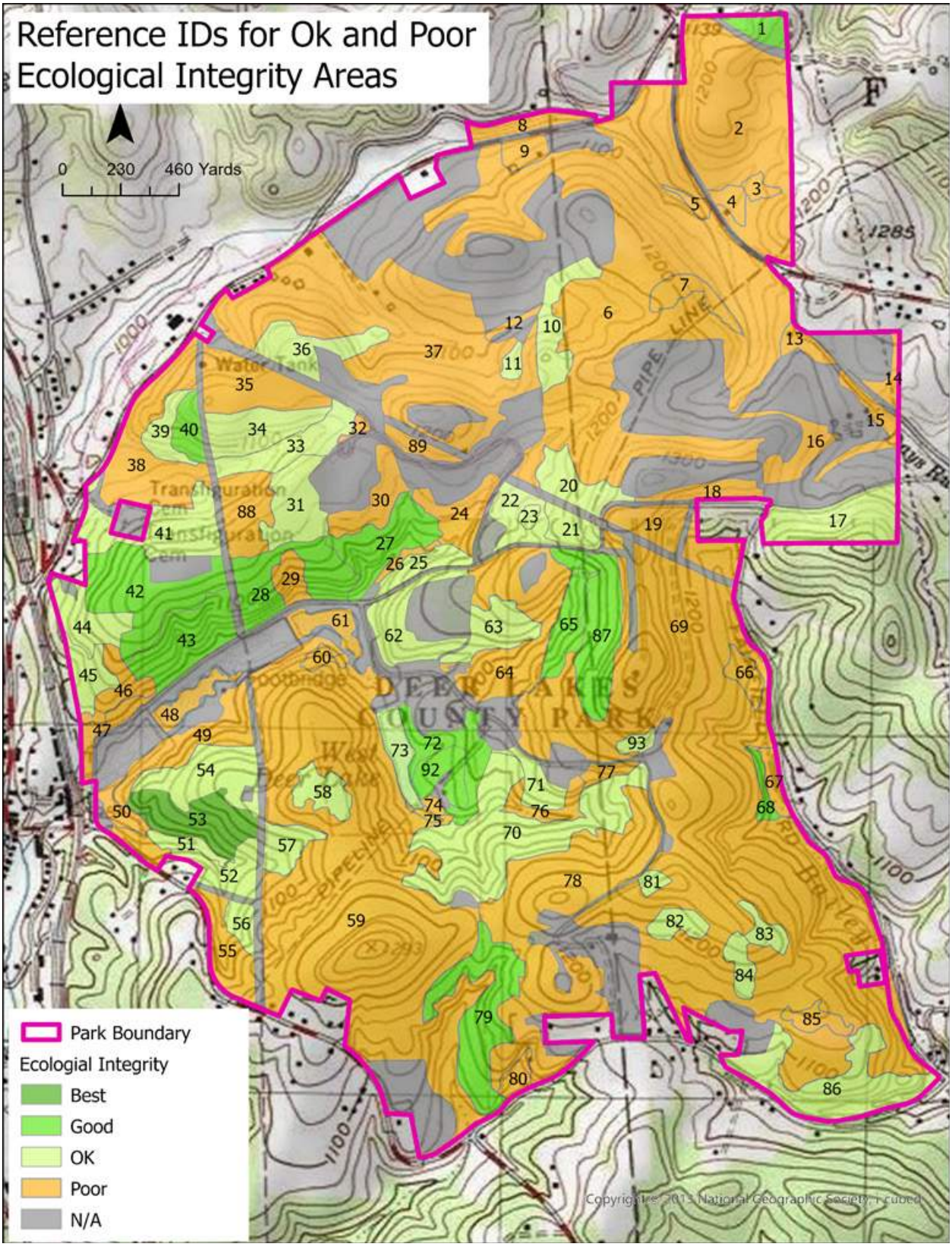
The disc golf course within this area, as well as the West Deer Lake drainage, has caused significant impacts to understory species assemblages, particularly within the dry forest type. This may be due to soil compaction and heavy use, trampling of existing vegetation, and subsequent erosion. Additionally, spicebush (*Lindera benzoin*) within this area is experiencing significant decline and early season defoliation as a result of an unknown pathogen currently under investigation. We address these concerns and suggest restoration techniques in the Project Recommendations section.

Black huckleberry (Gaylussacia baccata) is an uncommon shrub within the park, only growing in the driest, most acidic settings, such as in this Western Allegheny Chestnut Oak – Mixed Oak / Heath Forest community.

Rea Lane Oak Slope:
This small area hosts a relatively young but nevertheless high-quality patch of western Allegheny dry-mesic oak hardwood forest, with a canopy dominated by red oak (*Quercus rubra*), white oak (*Quercus alba*), and some red maple (*Acer rubrum),* sassafras *(Sassafras albidum*), and black gum (*Nyssa sylvatica*). Unlike other areas within the park, this area has a noticeable absence of black cherry (*Prunus serotina*). The subcanopy is open and contains scattered beech (Fagus grandifolia), sometimes growing as dense, isolated shrubby thickets. The understory is sparse with few invasive species and contains lowbush blueberry *(Vaccinium pallidum*), a classic dry oak forest indicator species, as well as oak seedling regeneration, dewberry *(Rubus flagellaris*), Virginia jumpseed (*Persicaria virginiana),* sedges *(Carex spp.),* bluegrass *(Poa spp.),* and white snakeroot (*Ageritina altissima*). Unlike other intact ecological areas within the park that are generally a mature forest or late successional type, this area appears to be a younger, more recently succeeded area of forest. Most trees here range from 25 to 45cm DBH and are denser in their distribution compared to forests with greater maturity, though some larger trees exceed 65cm DBH.

The Rea Lake Oak Slope area is unique within the park in that it is representative of a younger tree cohort that has maintained relatively high ecological integrity throughout its succession.

FIGURE X


Reference IDs for Ok and Poor Ecological Integrity Areas
0 230 460 Yards
Park Boundary
Ecologial Integrity
Best
Good
OK
Poor
N/A
DEER LAKES COUNTY PARK
PIPE LINE
Water Tank
Transfiguration Cem
Footbridge
West Deer Lake
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Tabulated descriptions for individual "Good" and "Best" polygons shown in figure X. Descriptions are provided for these areas in the table below, per community type unit. Information in the table corresponds to each ID listed.

TABLE II

ID	Composition	Plant Community	Integrity
53	This mature dry oak – mixed hardwood forest area is characterized by red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), shagbark hickory (*Carya ovalis*), and mockernut hickory (*Carya tomentosa*) as canopy dominants, as well as occasional sassafras (*Sassafras albidum)*, red maple (*Acer rubrum*), and black cherry (*Prunus serotina*), ranging from 30-60cm dbh with some larger oaks ranging from 75-90cm dbh. Approximate canopy cover is 60-70%. This area has an open understory consisting of spicebush (*Lindera benzoin),* serviceberry *(Amelanchier sp.*), ash seedlings (*Fraxinus sp.*), black gum (*Nyssa sylvatica*), American hophornbeam (*Ostrya virginiana*), and Florida dogwood (*Benthamidia florida*). Herbaceous understory species are thinly scattered but abundant and include Virginia fire pink (*Silene virginica)*, common woodrush (*Luzula multiflora),* rattlesnakeweed *(Hieracium venosum*), red columbine (*Aquilegia canadensis),* mayapple *(Podophyllum peltatum*), rattlesnake root (*Nabalus sp.*), Virginia jumpseed (*Persicaria virginiana*), and white bear sedge (*Carex albursina*). This understory composition is indicative of elevated pH and minor calcareous influence, perhaps from underlying bedrock geology. Overall this area is uninvaded, except for minor occurrences of Japanese stiltgrass *(Microstegium vimimeum)* along trails, as well as garlic mustard (*Alliaria petiolata*), multiflora rose (*Rosa multiflora*), and Japanese barberry (*Berberis thunbergii*).	Dry oak - Mixed Hardwood Forest	Best
43	This late successional forest area is characterized by red oak, white oak, black oak, as well as occasional shagbark hickory, shingle oak, black cherry, and red maple as canopy dominant tree species that range from 35 to 55cm dbh, comprising an overall canopy cover of 80-85%. This area has a relatively open understory consisting of witch hazel, Florida dogwood, spicebush, and American hophornbeam as dominant subcanopy shrubs, and cutleaf toothwort, mayapple, false rue anemone, maple-leaved viburnum, white snakeroot, asters, goldenrods, northern dewberry, and deer tongue grass as herbaceous dominants. Invasive species are thinly scattered within this polygon but include garlic mustard, multiflora rose, autumn olive, and Japanese stiltgrass. Overall, the forest quality within this polygon is good with relatively low invasive impact and scattered native herbaceous species. This area experiences slightly drier conditions compared to the good quality dry oak forest located upslope of this.	Dry oak - Mixed Hardwood Forest	Good

42	This mature forest area is characterized by red oak, white oak, and occasional chestnut oak, shagbark hickory, and black cherry as canopy dominant tree species that range from 40-65cm dbh, in addition to some larger red oak and white oak. This comprises an overall canopy cover of approximately 85%. This area has an open understory with understory shrubs consisting of Florida dogwood, serviceberry (*Amelanchier sp*.), ash saplings, American elm, sassafras, and maple-leaved viburnum. Understory herbs include cutleaf toothwort, Virginia saxifrage, spikegrass (*Danthonia spicata*), Pennsylvania sedge (*Carex pensylvanica)*, northern dewberry, may apple, rattlesnake root *(Nabalus sp*.), woodland geranium, and false rue anemone. Overall this mature forest area is relatively uninvaded except for occasional garlic mustard and multiflora rose. Some small drainages may exhibit slightly richer character, with increased moisture and elevated pH; the center of this polygon has a small swale with baneberry (*Actaea sp.*), early meadow-rue (*Thalictrum dioicum*), and a pH of 6.5-7.	Western Allegheny Dry-mesic Oak - Hardwood Forest	Good
40	This late successional dry oak – mixed hardwood forest is characterized by red oak, white oak, black oak, and occasional sassafras, shagbark hickory, and bitternut hickory as canopy dominant tree species that range from 30 to 50cm dbh, comprising an overall canopy cover of 70-75%. This area has a sparse and relatively open understory consisting of sapling black cherry, hawthorn (*Crataegus sp.)*, spicebush, and canopy seedlings and saplings, as well as lowbush blueberry (*Vaccinium pallidum*). Herbaceous diversity is sparse. This area has relatively high oak regeneration in the understory, as well as occasional multiflora rose. Downslope of this area, which is on the crest of a ridge, invasive species increase in abundance.	Western Allegheny Chestnut Oak - Mixed Oak / Heath Forest	Good
28	This mature dry oak mixed hardwood forest is characterized by white oak, red oak, black oak, black cherry, and occasional shagbark hickory and American hophornbeam as canopy dominant tree species that range from 40 to 60cm dbh in size, comprising an overall canopy cover of 75-85%. Some oaks within this area may be larger. This area has an open understory relatively uninvaded by invasive species, though Japanese barberry, multiflora rose, Japanese stiltgrass and garlic mustard are present in addition to occasional autumn olive and Morrow's honeysuckle. Understory shrubs consist of Florida dogwood, sapling hickories, sapling American hophornbeam, spicebush, and sassafras. Understory species are sparse but include white snakeroot (*Ageratina altissima*), rattlesnake root (*Nabalus sp.*), and seedling canopy species. This area possesses a gentle slope that transitions to a drier, steep slope above Mahaffey Road.	Dry oak - Mixed Hardwood Forest	Good

27	This mature red oak – mixed hardwood forest area is characterized by large red oak, white oak, and black oaks up to 50-70cm dbh, in addition to smaller red maple, American elm, American hophornbeam, black cherry as canopy dominant species, comprising an overall canopy cover of 70-80%. This area has an open understory that is relatively uninvaded except for occasional sweet cherry *(Prunus avium)* and Japanese barberry, in addition to native spicebush and sapling canopy species. Herbaceous understory species are sparse, except in small drainages present within this area which contain moderately diverse wildflower assemblages, including Virginia bluebells, mayapple, violet wood sorrel, woodland phlox, cleavers, and Trillium. This area is slightly more mesic than surrounding oak forest polygons due to the small seasonal stream at the base of this polygon, contributing to its moisture and composition difference.	Red oak - Mixed Hardwood Forest	Good
1	Dry hilltop forest patch dominated by younger red oak, white oak, and red maple with black gum and sassafras scattered in, forming a strong canopy with 85% cover.. Most trees are 30-45DBH, but a few are over 65cm. The understory is very sparse, with some beech brush and spotty lowbush blueberry in patches that border on heath. Very few invasives and good quality overall.	Western Allegheny Dry-mesic Oak - Hardwood Forest	Good

65	This mature red oak – mixed hardwood forest area is characterized by red oak (*Quercus rubra)*, white oak (*Quercus alba*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*) as canopy dominant tree species, as well as occasional black oak (*Quercus velutina*) and chestnut oak (*Quercus montana*), although the latter two species increase in abundance upslope where the landscape is less mesic and drier. These trees range from 40 to 75cm dbh, with occasionally larger oaks mixed in, comprising an overall canopy of 80-85%. This area has a relatively open understory with shrub dominants consisting of sapling canopy species, shagbark hickory *(Carya ovata*), mockernut hickory (*Carya tomentosa*), northern dewberry (*Rubus flagellaris*), spicebush (*Lindera benzoi*n), Florida dogwood (*Benthamidia florida*), sweet birch (*Betula lenta*), witch hazel (*Hamamelis virginiana*), American hophornbeam *(Ostrya virginiana*), and scattered hawthorn *(Crataegus sp.*). Herbaceous and low understory species include black raspberry (*Rubus occidentalis*), wild sarsaparilla (*Aralia nudicaulis)*, northern lady fern (*Athyrium angustum*), New York fern (*Amauropelta novaboracensis),* rattlesnake root (*Nabalus sp*.), white snakeroot *(Ageratina altissima*), false rue anemone (*Thalictrum thalictroides*), dwarf cinquefoil (*Potentilla canadensis)*, wood sorrel (*Oxalis sp*.), Virginia creeper (*Parthenocissus quinquefolia)*, mayapple (*Podophyllum peltatum*), jewelweed (*Impatiens capensis)*, Pennsylvania sedge *(Carex pensylvanica*), common woodrush (*Luzula multiflora)*, smooth Solomon's seal (*Polygonatum biflorum),* Virginia jumpseed (*Persicaria virginiana),* as well as very sparse and occasional invasive species such as multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), garic mustard (*Alliaria petiolata*), and Japanese stiltgrass (*Microstegium vimineum*) along trails.	Red oak - Mixed Hardwood Forest	Good

87	This mature dry oak – mixed hardwood forest area is characterized by red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), and chestnut oak (*Quercus montana*) as canopy dominant species, as well as occasional mockernut hickory (*Carya tomentosa*) and red maple (*Acer rubrum)*, ranging from 40-70cm dbh in size, comprising an overall canopy cover of 75-85%. This area is similar to the adjacent and slightly more mesic red oak – mixed hardwood forest, except it is drier and more xeric due to its topographic position. Understory shrub species include lowbush blueberry (*Vaccinium pallidum*), witch hazel (*Hamamelis virginiana*), Allegheny blackberry (*Rubus allegheniensis*), wild sarsaparilla (*Aralia nudicaulis)*, New York fern (*Amauropelta novaboracensis*), mayapple (*Podophyllum peltatum*), northern dewberry *(Rubus flagellaris*), cleavers (*Galium aparine*), and cinquefoil (*Potentilla canadensis)*. Invasive species are sparse within this area but occasionally include Morrow's honeysuckle (*Lonicera morrowii)*, multiflora rose (*Rosa multiflora*), garlic mustard (*Alliaria petiolate*), Japanese barberry (*Berberis thunbergii*), and Japanese stiltgrass *(Microstegium vimineum*) along trails.	Dry oak - Mixed Hardwood Forest	Good
68	This is a small, narrow, good quality forest remnant on east-facing an slope. The largest trees are 60-80cm diameter red oaks and shagbark hickories, up to 25m in height. The average tree diameter is closer to 30-45cm. This size class is comprised of red oak, shagbark hickory, red maple, mockernut hickory, elm, and beech. The southern part of this area has a slightly different tree composition that includes eastern hemlock, beech, white oak, tuliptree, and sugar maple. The average shrub cover is ~25%, decreasing southward. Common shrubs are spicebush, multiflora rose, Japanese barberry, hawthorns, acer-leaf viburnum, and American hophornbeam. Herbaceous plants make-up ~40% of the groundcover. Species like Japanese stiltgrass (*Microstegium vimineum*), white snakeroot (*Ageratina altissima*), Virginia jumpseed (*Persicaria virginiana*), hay-scented fern (*Sitobolium punctilobulum*), mayaple (*Podophyllum peltatum*). Other herbs are present, includes sedges (*Carex spp)* and violets (*Viola spp*).	Red oak - Mixed Hardwood Forest	Good

79	This red oak - mixed hardwood forest surrounds a tributary ravine to Bailey's Run and extends down the eastern slope of the ravine. It has a mixed age structure of red oak and white oak dominance and 75-80% total canopy cover with occasional gaps. There are larger red and white oaks (70-80cm diameter) scattered throughout, and a younger canopy tree cohort between the older oaks that averages 30-50cm diameter. These younger canopy trees include red oak, white oak, shagbark hickory, black cherry, and the occasional white pine. A distinct subcanopy is present below the taller trees and is comprised of eastern hemlock, black walnut, sassafras, and red maple. The understory is fairly sparse. Shrub, primarily spicebush and multiflora rose, only cover only ~5%. Herbaceous plants average 5-10% cover, and Japanese stiltgrass (*Microstegium vimineum)*, dewberry (*Rubus flagellaris*), Virginia jumpseed (*Persicaria virginiana*), sedges (*Carex spp*.), bluegrass (*Poa spp*.), and white snakeroot (*Ageritina altissima*) are the dominant plants on the forest floor.	Red oak - Mixed Hardwood Forest	Good

1.8.3 "OK" & "POOR" ECOLOGICAL AREAS

Descriptions are provided for these areas in the table below, per community type unit. IDs are shown on the map above, and the information in the table corresponds to the IDs.

TABLE III

ID	Composition	Plant Community	Integrity
2	Ruderal, successional forest dominated by black cherry, red maple, and sassafras. Red oak, white oak, and black oak occur scattered throughout and in patches, but are not abundant enough to form a dominant contingency. Canopy cover and tree DBH is highly variable. The densest canopies have 75% cover, but the forest often thins to 55%. Typical DBH ranges from 15-40cm, with some standout trees (mainly oaks) reaching 50-60cm. Shrubs are typically dense, usually invasive species, and tend to form thickets. Multiflora rose and Japanese barberry are common, but native shrubs like spicebush and flowering dogwood are also present. Japanese spiraea appears in the northern section of this forest, seemingly encroaching from the ROW in the north. Japanese stiltgrass is dominant in the herbaceous layer, but disturbance-tolerant plants like white snakeroot and Virginia jumpseed are present as well.	Northeastern Ruderal Hardwood Forest	poor
3	Open overgrown field area that has succeeded into an open forest matrix with invasive shrub thickets. Trees present show open grown character, mostly red maple. Some areas impenetrable with multiflora rose and autumn olive.	Disturbed forest	poor
4	Heavily invaded open area dominated by invasive shrubs and herbaceous species surrounding a small wetland area near a road culvert.	Early successional herbaceous	poor
5	Heavily invaded open area dominated by invasive shrubs and herbaceous species surrounding a small wetland area near a road culvert.	Early successional herbaceous	poor

6	Mixed matrix of northeastern ruderal hardwood forest with small red oak dominant areas. In most places, canopy is dominated by black cherry, red maple, red oak, with occasional sweet birch, slippery elm, sassafras, and American hophornbeam. Canopy is generally around 65-70% depending on species composition. Understory is uniformly invaded by stiltgrass and other shrubby invaders (multiflora rose and barberry), but some areas may have increased native herb diversity. Forested areas closest to fields may have increased invasive presence.	Northeastern Ruderal Hardwood Forest	poor
7	Extremely similar to ID 6 polygon, except trees, notably red oak and white oak, are larger.	Dry oak - Mixed Hardwood Forest	poor
8	Ruderal, narrow, roadside woodland dominated by black cherry, black walnut, tree-of-heaven, and grape vines. Understory shrubs are dense, mostly invasive, including multiflora rose and bush honeysuckle. Powerline maintenance along the road keeps young trees and shrubs dominant along the edge.	Invasive shrubland	poor
9	Ruderal roadside woodland dominated by black cherry, black walnut, tree-of-heaven, and grape vines. Understory shrubs are dense, mostly invasive, including multiflora rose and bush honeysuckle. Powerline maintenance along the road keeps young trees and shrubs dominant along the edge.	Invasive shrubland	poor
10	Dry oak hardwood forest with canopy dominated by white oak, red oak, black cherry, and red maple, as well as other mixed hardwoods. Mature canopy around 75% with moderate native understory herbs but experiencing significant pressure from dense stiltgrass and invasive shrub encroachment.	Dry oak - Mixed Hardwood Forest	OK
11	Ruderal hardwood forest dominated by increased red oak compared to surrounding areas, as well as white oak, red maple, and black cherry. Trees around 30-40cm DBH and constitute a canopy of 65%. Understory dense with spicebush and heavily invaded by Japanese stiltgrass.	Red oak - Mixed Hardwood Forest	OK

12	Invasive shrub thicket on edge of field, namely 5-10ft tall bush honeysuckle, multiflora rose, privet, and autumn olive.	Successional shrub thicket	poor
13	Ruderal shrub thicket dominated by occasional black cherry and invasive shrubs including dense multiflora rose, autumn olive, barberry, bush honeysuckle, and privet. Adjacent pasture keeps edges maintained as hedgerow habitat.	Invasive shrubland	poor
14	Ruderal shrub thicket dominated by occasional black cherry and invasive shrubs including dense multiflora rose, autumn olive, barberry, bush honeysuckle, and privet. Adjacent pasture keeps edges maintained as hedgerow habitat.	Invasive shrubland	poor
15	Ruderal shrub thicket dominated by occasional black cherry and invasive shrubs including dense multiflora rose, autumn olive, barberry, bush honeysuckle, and privet. Adjacent pasture keeps edges maintained as hedgerow habitat.	Invasive shrubland	poor
16	Ruderal shrub thicket dominated by occasional black cherry and invasive shrubs including dense multiflora rose, autumn olive, barberry, bush honeysuckle, and privet. Adjacent pasture keeps edges maintained as hedgerow habitat.	Invasive shrubland	poor
17	Successional mixed hardwood forest. Seems to be red oak mixed hardwood with black cherry, red oak, white oak, sassafras. Trees around 30-50dbh, some areas smaller with 15-35cm. Canopy relatively nice, 70%. Understory relatively open with occasional multiflora rose and stiltgrass but somewhat higher quality than other areas given lack of dense thickets of invasives.	Red oak - Mixed Hardwood Forest	OK
18	Ruderal shrub thicket dominated by occasional black cherry and invasive shrubs including dense multiflora rose, autumn olive, barberry, bush honeysuckle, and privet. Adjacent pasture keeps edges maintained as hedgerow habitat.	Invasive shrubland	poor

19	Successional, ruderal hardwood forest comprised of canopy dominant red maple, black cherry, and tulip poplar, forming a 70% cover canopy. DBH is highly variable, ranging from 20-60cm. Dense shrub layer of 70% made up of spicebush, autumn olive, barberry, and tulip poplar seedlings. 50% cover of herbaceous species, primarily Japanese stiltgrass, white snakeroot, and Virginia jumpseed. This is a small patch that is highly fragmented and disturbed from canopy gaps and ROWs in all direction, both old and newer.	Northeastern Ruderal Hardwood Forest	poor
21	Dry oak mixed hardwood forest that types to western Allegheny chestnut type. Canopy is mostly red oak and chestnut oak, some black oak and white oak. 75% canopy, with trees raging from 40-70cm DBH. Open understory with high bryophyte cover, oak seedlings, and occasional multiflora rose and Japanese stiltgrass.	Western Allegheny Chestnut Oak - Mixed Oak / Heath Forest	OK
22	Small woodland patch, sparse canopy of roughly 50% cover, mainly comprised of second-growth red oaks that range from 50-70cm DBH. Canopy gaps are filling in with a sub-canopy cohort of sassafras, tulip poplar, black cherry, and red maple. The shrub layer is fairly dense, a mix of ash seedlings, multiflora rose, spicebush, barberry, and Florida dogwood, plus saplings of all canopy and subcanopy species, including red oak regeneration. Herbs are sparse, generally struggling beneath the dense shrub layer. Common herb species include northern dewberry, stiltgrass, white snakeroot, and blue goldenrod.	Northeastern Ruderal Hardwood Forest	OK
23	Small patch of planted white pine with similar understory composition as 22. Dense, shrubby understory composed of spicebush and invasive shrubs.	Pine plantation	OK
24	Mixed successional ruderal hardwood forest, with short, 30-50ft tall trees comprising a canopy cover of 65%. Canopy dominated by red maple, black cherry, and sassafras, as well as shagbark hickory and black walnut. Dense invasive shrubs in understory, with Japanese stiltgrass and ruderal native herbs.	Northeastern Ruderal Hardwood Forest	poor

25	Disturbed dry oak mixed hardwood forest, with fewer downed trees and high disturbance indicators compared to adjacent polygon 26 but includes, tip up mounds, bare soil, and extensive Japanese stiltgrass colonies. Scattered, dense patches of Japanese barberry and multiflora rose present. Canopy dominated by red oak, black cherry, red maple, shagbark hickory, American elm, American hophornbeam, with spicebush, maple-leaved viburnum, Morrow's honeysuckle, and redbud in the understory. Sweetgum (*Liquidambar styraciflua*) present and naturalizing as well.	Red oak - Mixed Hardwood Forest	OK
26	Disturbed dry oak mixed hardwood forest, with many downed trees and high disturbance indicators, such as tip up mounds, bare soil, and extensive Japanese stiltgrass colonies. Scattered, dense patches of Japanese barberry and multiflora rose present. Canopy dominated by red oak, black cherry, red maple, shagbark hickory, American elm, American hophornbeam, with spicebush, maple-leaved viburnum, Morrow's honeysuckle, and redbud in the understory. Sweetgum (*Liquidambar styraciflua*) present and naturalizing as well. This polygon encompasses a small seepage complex, possibly exacerbated by treefall and ash die-off.	Disturbed forest	poor
29	Mature forest canopy that fits the Red oak – Mixed Hardwood Forest type. Canopy here is 70-90% cover and trees range from 20-50cm DBH up to 75-100cm DBH. Although the canopy within this polygon is mature, the understory is heavily invaded by exotic shrubs, including multiflora rose, Japanese barberry, Morrow's honeysuckle, as well as garlic mustard, Japanese stiltgrass, and dense spicebush.	Red oak - Mixed Hardwood Forest	poor
30	Late successional northeastern ruderal hardwood forest with canopy dominated by red maple, sassafras, and black cherry. Canopy cover is somewhat intact, around 70%, but understory is heavily invaded by the typical suite of shrub and herbaceous invaders found elsewhere in this type of habitat.	Northeastern Ruderal Hardwood Forest	poor

31	Dry Oak – Mixed Hardwood Forest type. Canopy here is 70-90% cover and trees ranging from 20-50cm DBH up to 75-100cm DBH. Mature forest type with low invasive cover in the understory; only sparse scattering of multiflora rose, Japanese barberry, Morrow's honeysuckle, and garlic mustard.	Dry oak - Mixed Hardwood Forest	OK
32	Small patch of planted white pine with similar understory composition as 33. Dense, shrubby understory composed of invasive shrubs.	Pine plantation	poor
33	Disturbed forest surrounding small intermittent creek/seep run at base of slope, with disturbance primarily due to impact from ash die off. Otherwise, forest type is a continuation of a Northeastern Ruderal Hardwood Forest type with canopy dominated by chestnut oak, red oak, and black cherry. Understory species include mayapple, Christmas fern, and occasionally skunk cabbage where there is slight groundwater influence. This disturbed area is dominated by Japanese barberry, multiflora rose, Japanese stiltgrass, and garlic mustard in the understory, particularly in open canopy areas from ash die off.	Northeastern Ruderal Hardwood Forest	OK
34	Variable Dry Oak – Mixed Hardwood Forest type with canopy composed primarily of white oak, red oak, black cherry, and occasionally shagbark hickory and sassafras. In small seepage areas, felled ash trees may be present. Most trees range from 25-75cm DBH, though there are some large individuals present that are up to 100cm DBH. Canopy cover ranges around 60-80% cover. Forest understory is somewhat invaded, mostly by multiflora rose, Japanese barberry, garlic mustard, and Japanese stiltgrass. Native species in the understory include spicebush, may-apple, purple wood sorrel, wood geranium, bugbane (*Actaea sp.*), Virginia jumpseed, Pennsylvania sedge, and rue anemone. In some areas, large grape vine thickets (*Vitis sp.*) are present. Community may be grading into a Successional Mixed Hardwoods type, but is quite dry in places.	Dry oak - Mixed Hardwood Forest	OK

35	Mature Successional Mixed Hardwood Forest dominated by black cherry, red maple, sassafras, and elm, comprising a canopy of around 80% cover. This successional forest type is heavily invaded by multiflora rose and Japanese barberry, as well as privet and hay-scented fern. Spicebush, garlic mustard, mayapple, and yellow fumewort are present in the understory.	Northeastern Ruderal Hardwood Forest	poor
36	Dry successional mixed hardwood forest dominated by black cherry, red maple, American elm, red oak, and American hophornbeam; multiflora rose, barberry, spicebush in shrub layer, mayapple, garlic mustard, sweet cicely, violets, Japanese stiltgrass, and ramps in understory. Grades into successional mix of red oak mixed hardwood forest with canopy dominated by red oak, black cherry, red maple, American elm, American hophornbeam, with shrubby invasive understory, namely Japanese barberry. Some native herbs present, including may apple, sweet sicely, viola sp., and garlic mustard and Japanese stiltgrass.	Red oak - Mixed Hardwood Forest	OK
37	Disturbed northeastern ruderal hardwood forest with canopy dominated by 30-50cm black cherry, red maple, American hophornbeam, sassafras, and occasional other hardwood species. Area has very successional “feel” to it, with dense shrubby understory composition dominated by invasive shrubs, namely barberry, multiflora rose, as well as spicebush and stiltgrass. Canopy gaps common, as well as occasional standing dead trees.	Northeastern Ruderal Hardwood Forest	poor
38	Successional forest with dominant canopy of 20-40cm DBH black cherry, sassafras, and other mixed hardwoods. Canopy is patchy in areas, ranging from 55-70%. Understory heavily invaded by shrubby exotics and Japanese stiltgrass. Some areas impenetrable with dense multiflora rose.	Northeastern Ruderal Hardwood Forest	poor
39	Transitional forest between drier, xeric upland forest and northeastern ruderal composition downslope. Some shrubby invaders present, with somewhat mature canopy of red oak and other mixed hardwood species. Trees 30-45cm DBH and 70% canopy cover with shrubby exotic understory.	Red oak - Mixed Hardwood Forest	OK

41	Successional/ruderal type dry red maple – black cherry forest with occasional red oak and white oak present. Understory shrubs and small trees include Florida dogwood, sassafras, sweet cherry (*Prunus avium)*, maple-leaved viburnum, and heavily invaded by Japanese barberry, bush honeysuckle, multiflora rose, Japanese honeysuckle, spicebush, and privet, sometimes forming dense thickets in areas. Understory species include mayapple, Virginia jumpseed, false Solomon's-seal, golden ragwort (*Packera aurea*), and abundant garlic mustard.	Northeastern Ruderal Hardwood Forest	OK
44	Canopy red oak and red maple present, with high sapling regeneration in the understory. Autumn olive is present as an occasional shrub, as well as multiflora rose and Maack's honeysuckel. Sparse understory with northern dewberry and mayapple.	Red oak - Mixed Hardwood Forest	OK
45	Successional black cherry forest, with dominant shrub layer consisting of autumn olive, Maack's bush honeysuckle, multiflora rose, privet (*Ligustrum sp.*), and pagoda dogwood (*Swida alternifolia*). Understory is sparse, with occasional mayapple and black cherry seedlings.	Northeastern Ruderal Hardwood Forest	OK
46	Planted white pine area with ruderal canopy species mixed in.	Pine plantation	poor
47	Ruderal forest opening with surrounding canopy of black walnut, Norway spruce, horse chestnut, and with autumn olive, bush honeysuckle, multiflora rose, garlic mustard, Japanese stiltgrass, and some sort of planted bluegrass species in open canopy areas.	Disturbed forest	poor
48	Artificial water body. The water column is completely dominated by invasive hydrilla *(Hydrilla verticillata*) and Eurasian water-milfoil (*Myriophyllum spicatum*), with some native hornwort (*Ceratophyllum demersum*) also present. A significant portion of the water's surface is covered in white waterlily (*Nymphaea odorata*). A hodgepodge of wetland and ruderal plants occupy the lake margins.	Ruderal Water-thyme - Eurasian Water-milfoil Aquatic Vegetation	poor

49	Canopy dominated by medium size black cherries 30-40cm DBH as well as smaller red maples. Japanese barberry and spicebush in the understory, thick in areas, with a weedy understory composed primarily of garlic mustard, Virginia jumpseed, mayapple, jewelweed, and Japanese stiltgrass.	Northeastern Ruderal Hardwood Forest	poor
50	Ruderal, disturbed area that encompasses a low floodplain-like wetland that is downstream of the higher quality forested skunk cabbage seep (Fire Pink Slopes area). Canopy consists of adjacent upland hardwood species such as red oak, black cherry, red maple, as well as a significant fraction of black walnut within the floodplain itself, as well as occasional sweet birch and tulip poplar. Within the wetland itself, invasive shrub cover is high, forming dense thickets of multiflora rose, privet, bush honeysuckle, and autumn olive. Herbaceous species are somewhat limited due to the density of Japanese stiltgrass present.	Ruderal black walnut forest	poor
51	See ecological area description for Fire Pink Slope for description.	Skunk cabbage - Golden saxifrage seep	OK
52	See ecological area description for Fire Pink Slope for description.	Red oak - Mixed Hardwood Forest	OK
54	See ecological area description for Fire Pink Slope for description.	Red oak - Mixed Hardwood Forest	OK
55	Ruderal hardwood forest with some mature components. Canopy is dominated by black cherry and red maple with some older white oak intermixed. Florida dogwood and blakc walnut are also scattered, resulting in 65-70% canopy cover overall. Average DBH is ~15-35cm. Shrubs are very dense and mostly invasive. Multiflora rose, privet, and bush honeysuckle form an understory thicket throughout. There are some herbaceous openings that are also mainly dominated by Japanese stiltgrass.	Northeastern Ruderal Hardwood Forest	poor

56	Small red oak - mixed hardwood forest patch with many small and narrow ravine channels. A greater level of disturbance compared to the dry oak plant community to the north has allowed a larger contingency of invasive plants to establish. Canopy cover is around 70%. Larger oak trees reach up to 70-80cm DBH, but smaller trees are more common and range from 20-40cm DBH. Red oak, white oak, and red maple are the primary canopy trees, and black walnut also appears near to ravine channels. Understory shrubs are somewhat dense, comrpised of barberry, American hophornbeam, musclewood, and witch hazel. Herbs are also abundant, dominated by Japanese stiltgrass with garlic mustard, false rue-anemone, woodland stonecrop, and mayapple.	Red oak - Mixed Hardwood Forest	OK
57	Mixed quality red oak - mixed hardwood forest. Canopy cover around 80%, largely comprised of red oak, white oak, shagbark hickory, and red maple. Largest trees, typically oaks, reaching 60-70cm DBH, some in the eastern section appear open-grown. Other trees ranging from 40-60cm at most, with many smaller in DBH as well. Non-dominant trees appearing are mockernut hickory, pignut hickory, black cherry, black gum, and sassafras. Shrubs are not particularly dense, mostly barberry and spicebush found throughout. Herbs are sparsest in the west and become more abundant eastward. Some areas of significant stiltgrass invasion, otherwise native herbs are scattered throughout, including Virginia jumpseed and white snakeroot. Forest is largely surrounding by a more ruderal and successional landscape, impacting quality and ecological integrity.	Western Alleghe-ny Dry-mesic Oak - Hardwood Forest	OK
58	Ruderal forest that is dominated by planted shortleaf pine. Most pines appear to be in some stage of minor decline. Canopy is dominated by shortleaf pine, with occasional mixed hardwoods such as black cherry, red maple, red oak, and sassafras in between. Most trees range from 25-45cm DBH, though some outliers reach 60cm. Relatively open understory with occasional shrubby invaders. *Goodyera pubescens* seems to be somewhat scattered here. Pine needle accumulation has kept herbaceous layer at a minimum.	Pine plantation	OK

59	Large area of classic early successional ruderal northeastern hardwood forest. Area is a mosaic of mixed canopy cover and gaps representing approximately 50-60% cover. Canopy dominated by red maple, black cherry, sassafras, white oak, red oak, slippery elm, and occasional black walnut. All trees more or less even in age and crown size, with diameters ranging from 20-40cm DBH. Understory heavily invaded by exotic shrubs, notably multiflora rose, bush honeysuckle, barberry, privet, and Japanese stiltgrass.	Northeastern Ruderal Hardwood Forest	poor
60	Small planting of white pine and scattered shortleaf pines. Some mixed ruderal type hardwoods present as well, including black cherry, red maple, and sassafras, but pines comprise over 50% of the canopy in this area. Most trees around 40cm DBH. Understory is shrubby and somewhat open, with multiflora rose, bush honeysuckle, and barberry as dominants, similar to adjacent ruderal hardwood forest communities.	Pine plantation	poor
61	Artificial water body. The water column is completely dominated by invasive hydrilla (*Hydrilla verticillata*) and Eurasian water-milfoil (*Myriophyllum spicatum*), with some native hornwort (*Ceratophyllum demersum*) also present. A significant portion of the water's surface is covered in white waterlily (*Nymphaea odorata*). A hodgepodge of wetland and ruderal plants occupy the lake margins.	Ruderal Water-thyme - Eurasian Water-milfoil Aquatic Vegetation	poor
62	see Middle Lake Watershed ecological area for more details.	Dry oak - Mixed Hardwood Forest	OK
63	see Middle Lake Watershed ecological area for more details.	Dry oak - Mixed Hardwood Forest	OK
64	Invaded shrubby northeastern ruderal hardwood forest with mixed mosaic but dominant canopy of sassafras, black cherry, red maple, and some varying dominants including shagbark hickory, red oak, sweet birch, and white oak. Tree of heaven found in the southern portion of this polygon. Some large trees present up to 80cm DBH but most are around 40-50. Canopy is 60-75 with occasional gaps. Very invaded understory with stiltgrass, barberry, multiflora rose, roundleaf bittersweet, garlic mustard, as well as native shrubs and subcanopy spicebush and American hophornbeam. Some mayapple, Virginia jumpseed, and others present. Spicebush in this polygon is experiencing heavy dieoff.	Northeastern Ruderal Hardwood Forest	poor

66	Similar to description of area 64, but with greater red oak in the canopy. This smaller area types to red oak mixed hardwood forest and has a more intact canopy; however, the understory composition is still similar to adjacent poor areas with dense shrubby and herbaceous invaders.	Red oak - Mixed Hardwood Forest	poor
67	Somewhat open, floodplain-like area dominated by dense Japanese stiltgrass with an open canopy. Scattered black walnut, particularly around wetter areas, with black cherry and red maple nearby. Dense grapevine scrambling over shrubs and small trees. Scattered large shrubs, mostly invasive shrub species, including autumn olive, multiflora rose, and privet. Other herbaceous species present include Joe Pye weed, sensitive fern, Virginia jumpseed, and nettle-leaved vervain.	Ruderal black walnut forest	poor
69	Mosaic of ruderal forest and woodlands succeeded from old fields and pastures mixed with patches of former mature forest that experienced significant disturbance in the past 10-15 years. Not uncommon for old growth red oaks to be sticking out above thickets of invasives and dense woodlands. Black cherry and red maple common throughout, other trees include sassafrass, red oak, white oak, white pine, black walnut, slippery elm, beech, hemlock, tulip poplar, and sugar maple. Some areas of successional forest, up to 75% canopy cover of young trees. Other areas shrubby thickets leaning toward invasive thickets. Shrubs often 75-95% cover throughout: spicebush, multiflora rose, barberry, autumn olive, privet, hawthorne, and ash seedlings. Abundant Japanese stiltgrass, as well as native herbs including Virginia jumpseed, white snakeroot, and enchanter's nightshade.	Northeastern Ruderal Hardwood Forest	poor
70	See ecological area description for West Deer Lake Drainage for description.	Red oak - Mixed Hardwood Forest	OK
71	See ecological area description for West Deer Lake Drainage for description.	Red oak - Mixed Hardwood Forest	OK
72	See ecological area description for West Deer Lake Drainage for description.	Dry oak - Mixed Hardwood Forest	OK

78	Early successional mosaic of forested canopy and semi-woodland areas based on canopy cover of 40-60%. Canopy trees dominated by black cherry, red maple, red oak, and sassafras, as well as other mixed hardwood species. Understory is heavily invaded, particularly in canopy gap and disturbance areas, and can be dominated by multiflora rose, bush honeysuckle, autumn olive, privet, barberry, as well as Japanese stiltgrass.	Northeastern Ruderal Hardwood Forest	poor
80	Open canopy successional shrub thicket dominated by invasive shrub thickets, notably autumn olive, multiflora rose, bush honeysuckle, and privet.	Invasive shrubland	poor
81	A small patch of remnant, mature white oak-dominated forest nestled within successional, ruderal forest and woodland expanses. White oak is the predominant canopy tree, joined by red oak and red maple. Larger oaks are in the minority, reaching 70-90cm DBH, intermixed with smaller trees of the same species and red maple, all 15-40cm DBH, resulting in a total canopy cover of 75-80%. A noteworthy amount of grapevine coverage also appears in the canopy. Shrubs are sparse, only ~5% total cover, and primarily spicebush and white ash seedlings. Herbs are practically absent.	Western Allegheny Dry-mesic Oak - Hardwood Forest	OK
82	A small patch of remnant, mature white oak-dominated forest nestled within successional, ruderal forest and woodland expanses. White oak is the predominant canopy tree, joined by red oak and red maple. Larger oaks are in the minority, reaching 70-90cm DBH, intermixed with smaller trees of the same species and red maple, all 15-40cm DBH, resulting in a total canopy cover of 75-80%. A noteworthy amount of grapevine coverage also appears in the canopy. Shrubs are sparse, only ~5% total cover, and primarily spicebush and white ash seedlings. Herbs are practically absent.	Red oak - Mixed Hardwood Forest	OK

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SECTION II - PARK SPECIFIC RECOMMENDATIONS

Understory impacts from high use of the Deer Lakes disc golf course.

Deer Lakes Park serves the public by offering a variety of activity spaces, including hiking trails, mountain biking, disc golf, and outdoor recreation areas within its assemblage of natural communities and parkscape features. This section offers management recommendations to improve ecological quality in natural areas found within the park. Overall, we recommend that management should prioritize maintaining areas that currently have high ecological integrity. Invasive species management and overbrowsing by white-tailed deer are particularly critical challenges that require immediate intervention to maintain the existing level of ecological quality and to prevent the local extinction of conservative native wildflowers from the park. Stewardship can also improve ecological quality: areas rated as "Good" may be managed to meet "Best" ecological criteria and "OK" areas may be managed to meet "Good" ecological criteria.

Recommendations are provided below under headings for different categories of work. Within each category, general recommendations and specific project opportunities are listed. Opportunities to steward intact natural areas and rare species are emphasized.

2.1 NATURAL AREA MANAGEMENT RECOMMENDATIONS

2.1.1 TRAIL IMPACTS

This section addresses trails outside of the Frisbee Golf Course, which is addressed in its own section.

In Deer Lakes Park, trail density is generally reasonable, and overall trail condition is good. Few major trail impacts were observed during this assessment (Figure XX). All were in ruderal forested communities, and none were within Ecological Integrity Areas. At all mapped areas of trail impact, trail erosion is occurring, resulting in root exposure, sediment release, and deepening of the existing trail bed. Soil compaction in one area has resulted in the pooling of water, which, when wet, causes hikers to avoid water and widen trail areas, contributing to erosion. We recommend using erosion buffers to aid in this, encouraging mountain bikers to adhere to designated trails, as well as potentially modifying and moving trail footprints to allow impacted areas to recover over time.

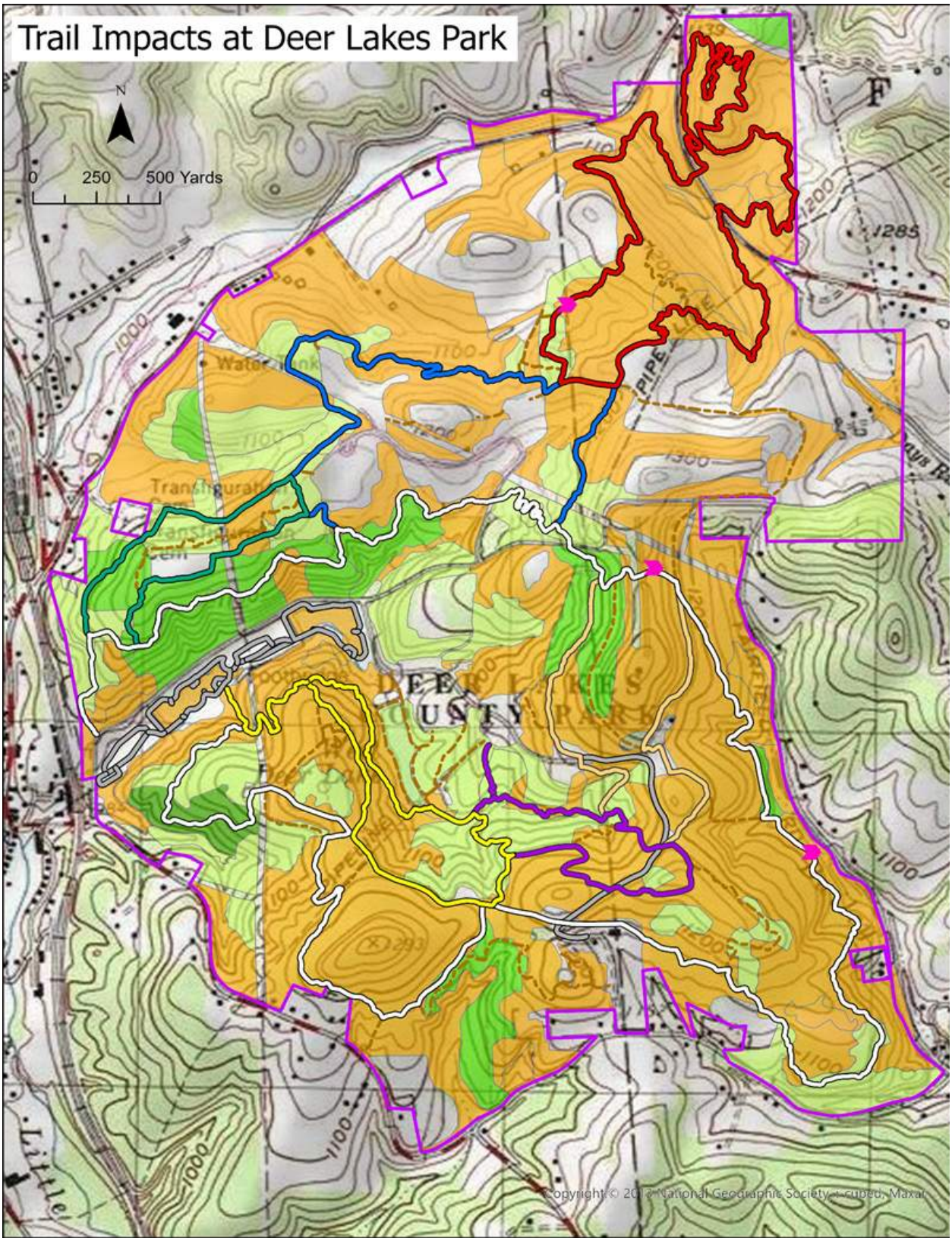
General Reccomendations

- Follow best management practices to minimize trail impact on surrounding vegetation, topography, and erosion. We noted a few wet areas where trail damage was occurring.
- Professional assessment of the trail system can identify problem areas and recommend alternative solutions.
- Avoid routing trails near sensitive ecological features that would be vulnerable to poaching or damage from recreational exploration; this might include attractive rare flower species, delicate geological formations such as waterfalls, caves, or cliffs, etc. If trail routing cannot avoid such features, signage and physical barriers can help prevent damage to these features.
- From the perspective of ecological impact, the areas rated "OK" and "poor" ecological integrity are ideal for trail placement, and for more active uses. Most of the informal, unblazed forest trail network is currently in these areas.
- Minimize trail density in "best" and "good" ecological integrity areas (Figure XX); while some trail development is not incompatible with these areas and can create the benefit of developing public appreciation, dense networks of trails can erode the area available to native plants and wildlife. Trails in these areas should be managed with particular attention to prevent dispersal of invasive species, and to prevent impacts to surrounding natural areas.
- Limit use to foot traffic in particularly sensitive areas, such as those with steep slopes, abundant and diverse native vegetation, or wetland terrain.
- In less-sensitive high ecological integrity areas, active use should be contingent on the user community's ability to stay on existing trails and avoid unsanctioned trail proliferation.
- Because horses can transport invasive species, horse use should be avoided in areas with high ecological integrity.

An example of minor trail damage within the park; note visible tree roots and some exposed bedrock resulting from erosion.

TRAILS IMPACT LEGEND

FIGURE XI


Trail Impacts at Deer Lakes Park
N
0
250
500 Yards
1285
1200
1100
1000
PIPE
Little

2.1.2 CANOPY GAP REMEDIATION

General Recommendations:

Canopy gaps are openings in an existing continuous forest canopy that allow increased light levels in the understory and represent a significant disturbance event within a forested area. Employ ecological forest restoration practices where canopy gaps develop within high quality forest. If left unmanaged, canopy gaps in high quality forest can become establishment sites for invasive non-native species that then expand outwards into adjacent forests, often causing further canopy loss and ecosystem destabilization. In most cases, even when canopy gaps occur from natural events such as treefall, native forest will not be able to re-establish without protection from deer browse and management of invasive species.

An area within the park experiencing high canopy mortality, gap formation, and subsequent invasive species entry.

The goal of canopy gap restoration is to reforest relatively small areas where gaps have formed in native forest communities, to create a trajectory for re-establishment of native forest and improved forest integrity. A general project outline for canopy gap restoration is provided below; however, this should be adapted based on local site conditions. At some sites, deer fencing may be sufficient to encourage natural regrowth, while at others, invasive clearing, restoration planting, and deer protection may all be necessary.

The strategy is to first eradicate any existing invasive plant populations, then plant a suite of native trees, shrubs, and herbs that match the existing natural forest community, and will over time out-compete invasive plant species that could seed in, to restore a contiguous forest community.

A canopy gap created by the standing dead tree (center) experiences rapid Japanese stiltgrass (Microstegium vimineum) invasion.

Ongoing management will be needed at such sites to water new plantings, protect them from deer and small mammal herbivory, and to spot-treat any invasive plants that appear. Plantings may be designed in multiple phases. At first, establishing density and shade are most important; species that grow fast in gaps but do not persist long-term in shade may be used in this phase, possibly interspersed with slower-growing species. A second planting may be designed for a few years later once shade has been established, to introduce native forest species that are shade-tolerant, slower growing, and typical of the target forest community but unlikely to re-establish on their own.

In Deer Lakes Park, restoration planting species selection can be guided by the Natural Community map for the park (page 27) and the species composition in the associated plant community descriptions (pages 28 - 29). The New York City Park System's "Guidelines for Urban Forest Restoration" includes more detail about many aspects of restoration plantings, including how to control invasive plants, sizing and density of tree plantings, and examples of planting plans.

TABLE IV

Project Phase	Cost Item	Timeframe
Site preparation	Invasive species treatment	Year 1-2
First-stage planting	Faster-growing trees & shrubs	Year 2 or 3 (if site requires invasive removal prior to planting)
	Herbivory protection (fencing, tubes...???)	Planting years
Maintenance Costs	Watering	Years 1-? Following plantings
	Invasive monitoring and treatment	Years 2+
	Replanting any failures	Year following any plantings
Second stage planting	Shade tolerant trees, shrubs, herbs	Years 7-10 depending on first stage growth
	(potential cost offset if local site materials are propagated in-house in time interval between stage 1 and 2)	
	Herbivory protection	Planting years

Mahaffey Road North Hill:
A few canopy gaps were noted within this ecological area, particularly within the small seepage ravine with native wildflower assemblages. The groundwater seepage may have made tree root systems more vulnerable to high winds or other physical disturbance. The oak death complex noted in the park is likely the cause of tree mortality here; adjacent trees should be monitored to detect any further declines and address tree health issues if possible. Remediation of the gaps will help to prevent the spread of invasive species and improve the ecological integrity of the areas.

A large "tip-up" mound resulting from a canopy tree blowdown event.]

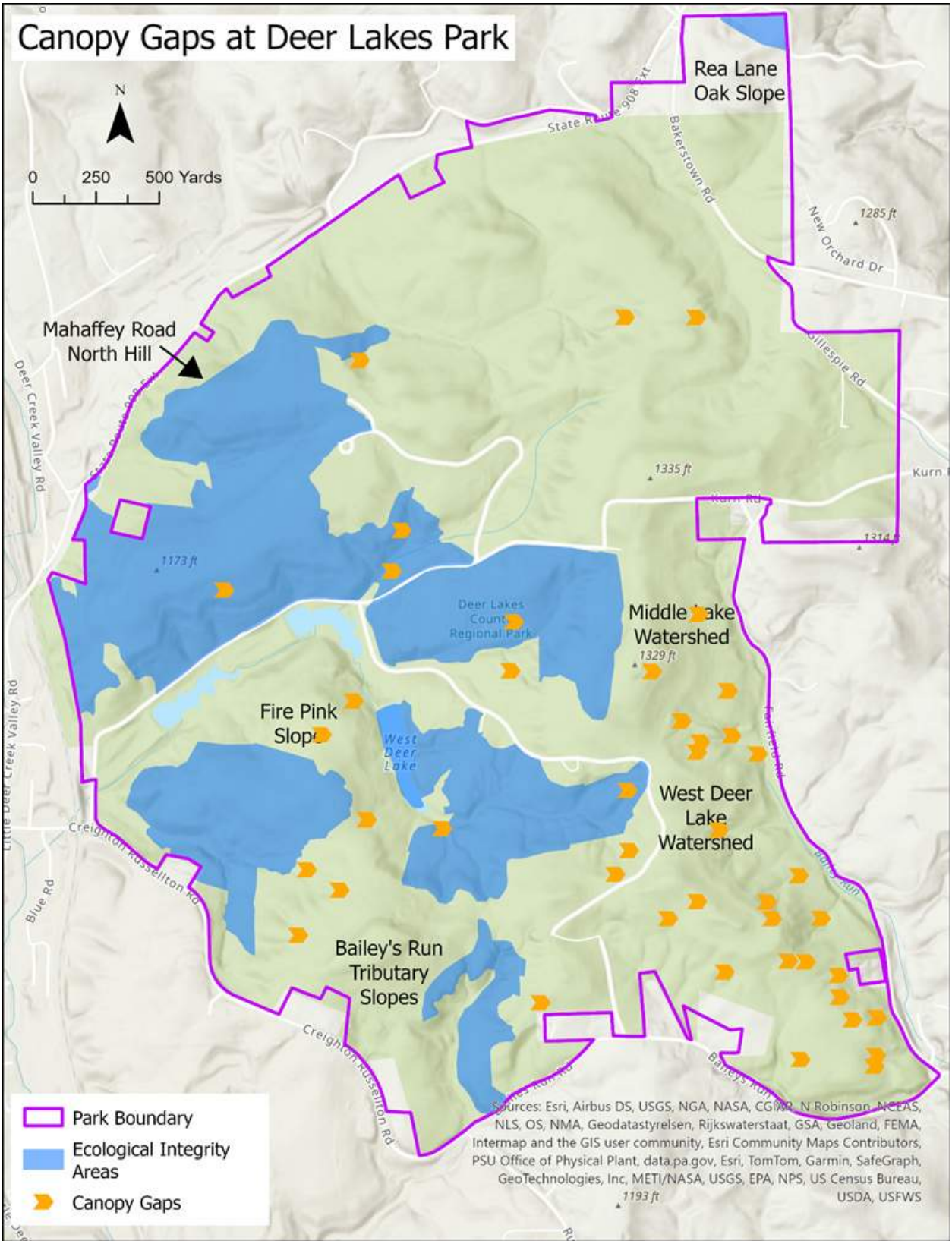
Middle Lake Watershed and West Deer Lake Watershed:
These areas contain a few parkscape areas, as well as forested communities that host the park's disc golf course. Addressing canopy gaps within these areas may be difficult due to high use and foot traffic, as well as drier, acidic soils, contributing to slow regrowth. However, this environment is also less hospitable to invasive species than more mesic settings. Oak death is noted in this area as well, and continued monitoring to prevent further increases in gap size is recommended.

One of the park's disc golf holes located within a mowed area.

Ruderal forested communities within the park:
Canopy gaps are concentrated in these areas, scattered throughout the park (see Ecological Integrity and Plant Community sections). Gaps form in part because these areas have higher tree densities as a result of old field succession. Tree mortality was observed in a variety of species, including oak, sassafras, and other mixed hardwood species; however, few standing dead trees were observed during our visits in 2024. Ash trees are common in early successional areas and the loss of ash from emerald ash borer may be a factor in the frequency of gaps in these areas. These areas are lower priority for restoration efforts, unless they are adjacent to Ecological Integrity Areas; canopy gap treatment may be difficult due to pervasive high densities of invasive species in the early successional communities.

A ruderal forest and invasive shrubland community dominated by dense Japanese knotweed (Reynoutria japonica).

FIGURE XII


Canopy Gaps at Deer Lakes Park
N
0 250 500 Yards
Rea Lane
Oak Slope
Mahaffey Road
North Hill
Middle Lake
Watershed
Fire Pink
Slope
West Deer
Lake
Watersned
Bailey's Run
Tributary
Slopes
Park Boundary
Ecological Integrity
Areas
Canopy Gaps
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, PSU Office of Physical Plant, data.pa.gov, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

2.1.3 TREE AND SHRUB DISEASES

General Reccomendations

Four tree and shrub diseases/pests were documented within the park:

Oak Decline Complex

Oak trees, particularly red oak (*Quercus rubra*) and black oak (*Quercus velutina*), are susceptible to the "oak decline complex", an interaction of difficult to identify pathogens that cause rapid mortality and tree loss.

- No treatments for this decline are currently available; oaks in the park should be monitored to keep abreast of continued decline and death, and plan for canopy gap restoration where needed.

Two recently deceased, standing dead white oak (Quercus alba) within a forested community in the park. The death of these trees has expanded an existing canopy gap.

Target Canker

Target canker is a fungal disease caused by Neonectria ditissima. It affects most hardwood trees, but usually grows slowly and does not kill them. Sassafras (*Sassafras albidum*) appears to be particularly susceptible in our area, with trees developing numerous large round cankers. Casual observation suggests the disease may be worse where sassafras grow in high density, which can occur in regrowth after complete forest clearance. Healthy trees are also less susceptible than stressed or weakened trees; infection can be fairly innocuous or can progress to a density and severity that eventually results in tree death by girdling. This pathogen is native. Significant efforts to contain it are not required at this time; it is included in the report because it is highly visible in some areas. It can be spread through infected pruning tools.

Target cankers on mature Sassafras (Sassafras albidum) trees.

- Disinfect all pruning tools each time they are moved to operate on a different tree.

Spicebush Mortality

Spicebush (*Lindera benzoin*), an important shrub to many wildlife species, is currently experiencing high mortality in Deer Lakes Park. Samples from Deer Lakes Park were assessed by DCNR forest pathologists and determined to be infected with Colletotrichum fungus. This pathogen affects spicebush foliage, causing rapid and dramatic wilting and defoliation events early in the growing season, particularly in communities where spicebush is a major understory shrub. It is not currently known why mortality from this pathogen has increased in recent years, but similar episodes of widespread mortality have been observed at many locations elsewhere in Pennsylvania, in New Jersey, and in West Virginia, with Colletotrichum believed to be the causal agent.

- Little is currently known about the long-term impacts of Colletotrichum mortality on spicebush. Monitoring and research are needed to determine how often mortality occurs, whether certain environmental or population characteristics exacerbate mortality, and whether spicebush populations can recover after infection.
- If spicebush decline is large-scale and results in significant loss without regeneration, consider adding other native shrubs that could play similar ecological roles for birds, such as native Viburnum species that are resistant to Viburnum leaf beetle (*Viburnum prunifolium*), alternative-leaved dogwood (*Cornus alternifolia*), and native hawthorne species.

An example of Colletotrichum wilt in spicebush (Lindera benzoin) within the park. Most leaves on this shrub are absent except on lower branches.

Hemlock wooly adelgid found on a hemlock (Tsuga canadensis) within the park.

Hemlock Wooly Adelgid

The invasive aphid-like insect Adelges tsugae infects hemlock trees in high numbers and causes mortality over a period of several years by sucking sap from all parts of the tree.

- Trees can either be treated before infection or in the early stages of decline with a handful of chemicals, notably imidacloprid, either injected into the tree or applied to the base of the root crown. See PA.gov for further information on approved treatment recommendations.
- Treatments must be repeated periodically, there is no permanent cure known at this time.

Beech Leaf Disease

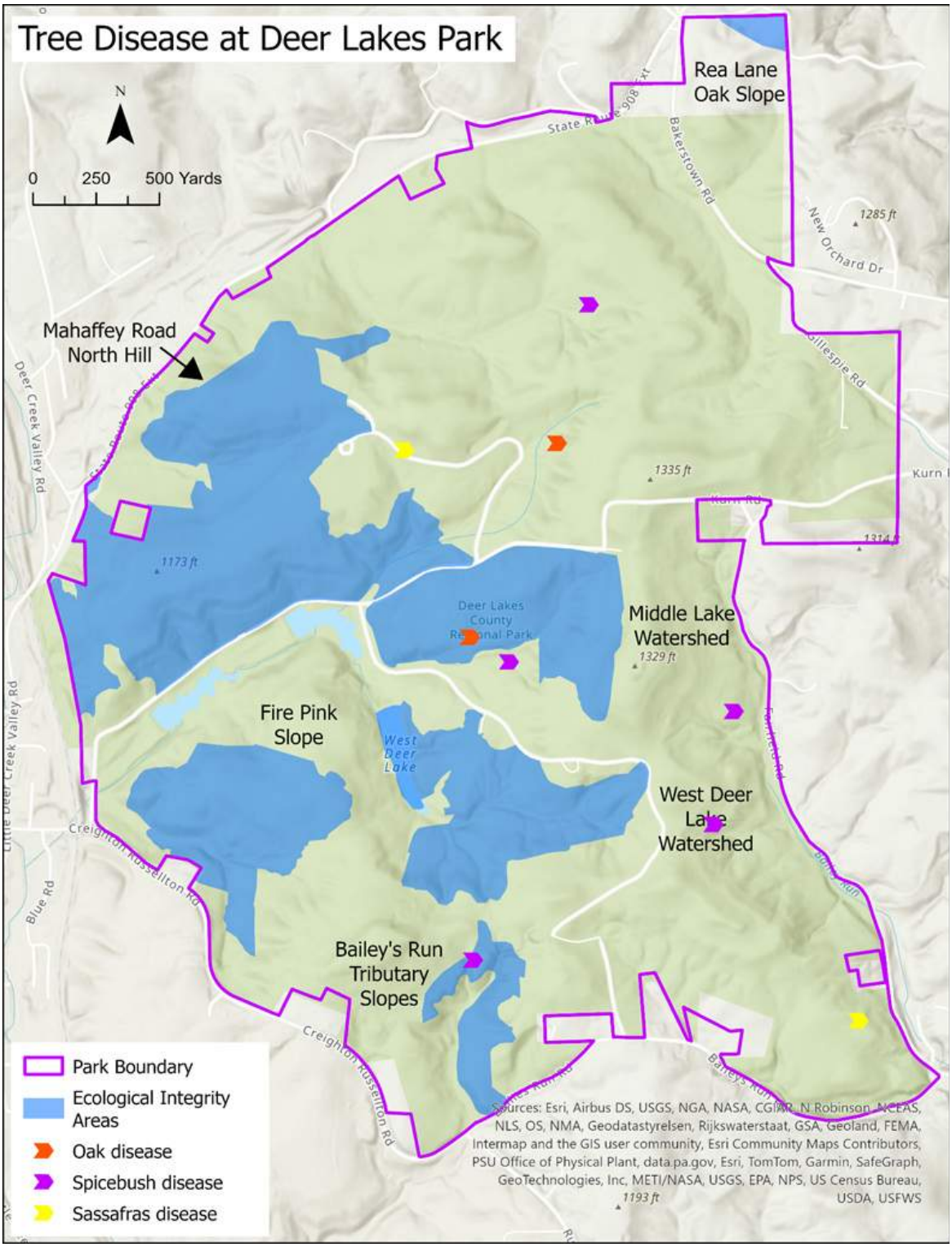
This is a high mortality disease caused by the microscopic non-native leaf nematode *Litylenchus crenatae mccannii*. It was not found to occur within the park in 2024, but the disease is spreading rapidly in our area and will almost certainly infect park beech trees eventually. There is not a lot of beech in Deer Lakes Park, but in some areas, such as the Fire Pink Slope, there are large and old trees.

- We do not recommend pre-emptive cutting of beech trees, as this eliminates any possibility of finding naturally immune or resistant trees.
- However, plans should be made now to reforest canopy gaps that occur from the likely eventual death of these trees, especially in areas of high ecological integrity.

Project Opportunities

- Plan canopy restoration for likely future mortality of large beech trees in Ecological Integrity Areas.
- Design and implement a sterilization regime for all tree pruning equipment, to be applied to cutting surfaces in between different trees.
- Treat hemlock trees with insecticide to control wooly adelgid infestation.
- Monitor future mortality of spicebush and recovery after large mortality seasons.

FIGURE XIII


Tree Disease at Deer Lakes Park
N
0 250 500 Yards
Rea Lane
Oak Slope
Mahaffey Road
North Hill
Middle Lake
Watershed
Fire Pink
Slope
West Deer
Lake
Watershed
Bailey's Run
Tributary
Slopes
Deer Lakes
County
Regional Park
West
Deer
Lake
Bakerstown Rd
New Orchard Dr
Gillespie Rd
Deer Creek Valley Rd
Little Deer Creek Valley Rd
Creighton Russellton Rd
Blue Rd
Baileys Run Rd
1285 ft
1335 ft
1314 ft
1173 ft
1329 ft
1193 ft
Park Boundary
Ecological Integrity
Areas
Oak disease
Spicebush disease
Sassafras disease
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS,
NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA,
Intermap and the GIS user community, Esri Community Maps Contributors,
PSU Office of Physical Plant, data.pa.gov, Esri, TomTom, Garmin, SafeGraph,
GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau,
USDA, USFWS

2.1.4 DEER BROWSE MANAGEMENT

When deer population densities are too high, native plants and natural communities can be severely impacted. Native plant species are their primary food. While plants can typically recover from some browse impact, when high levels of browse continue for many years, the recovery capacity is diminished, and populations begin to decline. Many native wildflowers do not disperse or re-establish quickly or easily, and if they are eradicated from an area due to overbrowsing, they may not replenish even if browsing is reduced (Goetsch et al. 2011; Pendergast IV et al. 2016). Studies have shown that long-term overbrowsing causes a permanent reduction in native species diversity, that can only be remediated through active re-introduction of lost species.

This effect is clearly visible in many of Allegheny County's forests, where the tree canopy composition and site conditions suggest a diverse array of native herbs should be present, but instead there is only bare soil with scattered herbs, or deer-resistant fern species. Deer overbrowsing also reduces other ecological functions: excessive bare soil reduces rain absorption capacity and increases soil erosion and flood vulnerability; long term overbrowse increases susceptibility to establishment and spread of invasive species (Averill et al. 2018; Knight et al. 2009); and overbrowsing also prevents forest regeneration.

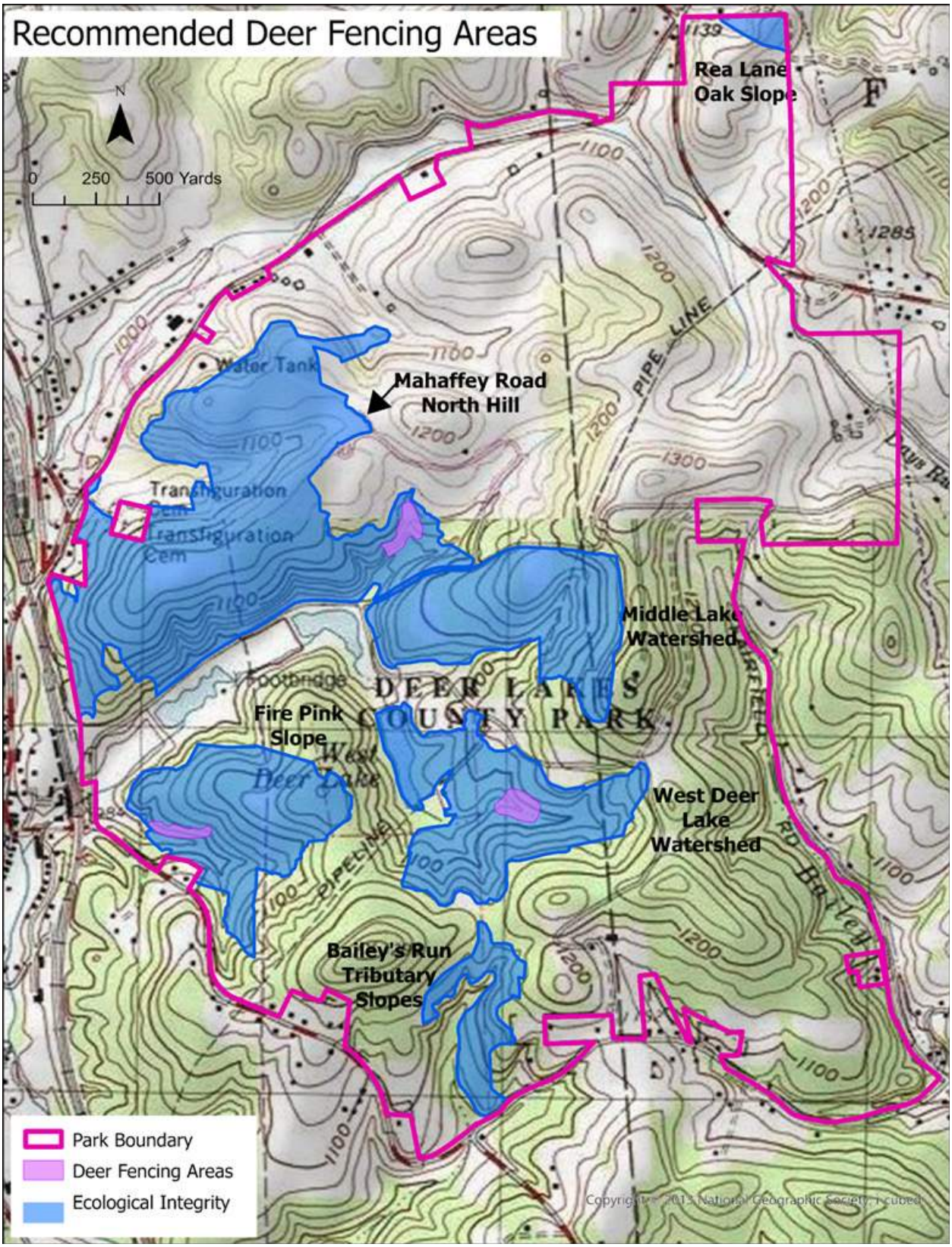
The ecological degradation caused by overbrowsing by white-tailed deer is not only harmful to the plant species which are eliminated, but degrades the habitat value for many other native animal species. If forests cannot regenerate, a wide range of birds and mammals lose their homes. Butterflies, moths, and other insects that rely on specific plant species for food or shelter are eliminated when the species they need are no longer present.

In Deer Lakes Park, current conditions show long-term overbrowsing impacts. Most forests show browse damage and diversity reduction in areas that are accessible to deer. Current forest herb populations, especially conservative herb species, are small, scattered, and lack the full complement of diversity expected in a healthy example of the same forest type. Steep slopes and outcrops are naturally inaccessible to deer, and when these show a clear difference in species composition from flat areas, it is evidence that deer browse has altered the community. Some of the conservative, long-lived perennial wildflower species are barely hanging on the park, with very small populations. If immediate action is not taken to protect these species from deer browse, they will soon be eradicated from the park.

General Recommendations:

- Continue efforts to encourage and facilitate deer hunting within the parks
- Support regional efforts to increase hunting and reduce deer populations.
- Put up deer fencing around any particularly valuable ecological areas that are showing browse impact, and around any restoration projects where new materials are vulnerable to deer browse.

FIGURE XIV

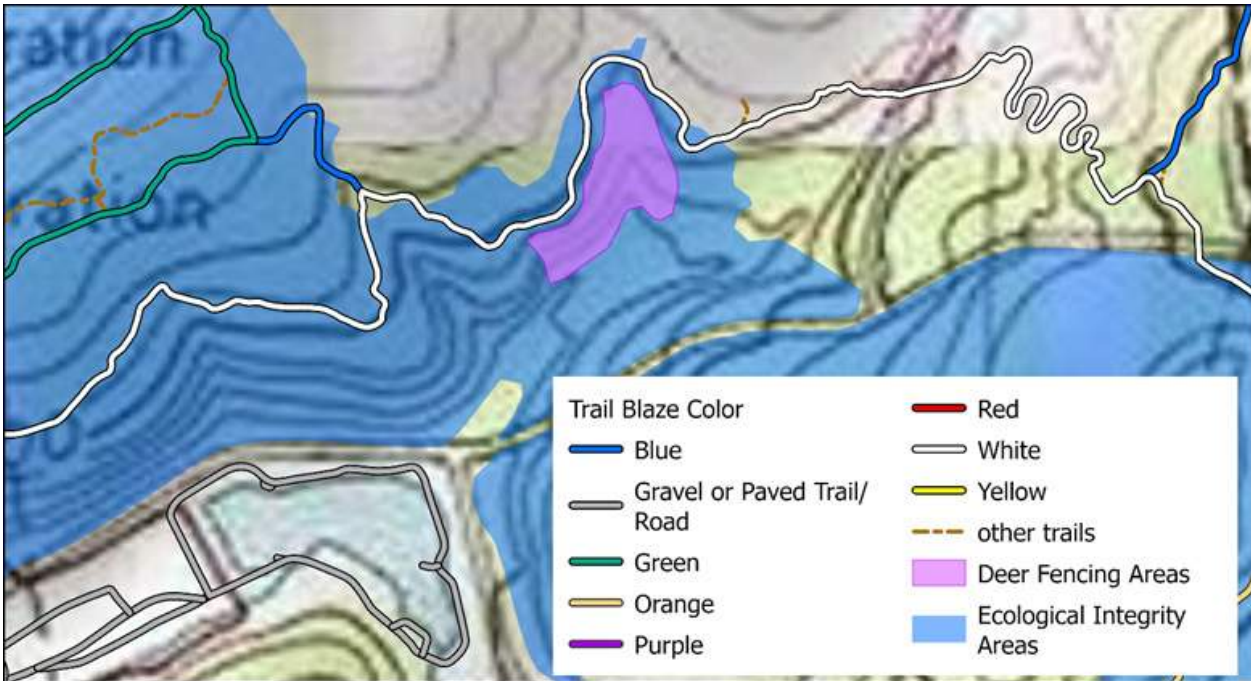

Recommended Deer Fencing Areas
N
0 250 500 Yards
Rea Lane Oak Slope
Mahaffey Road North Hill
Water Tank
Transfiguration Cem
Middle Lake Watershed
Footbridge
DEER LAKES COUNTY PARK
Fire Pink Slope
West Deer Lake
West Deer Lake Watershed
PIPE LINE
Bailey's Run Tributary Slopes
Park Boundary
Deer Fencing Areas
Ecological Integrity

Project Opportunities:
The Mahaffey Road Slopes, Fire Pink Slope, and West Deer Lake Drainage ecological areas contain the best wildflower assemblages within the park, though their composition and densities are lower than expected for their respective community types. Fencing of these wildflower areas is recommended to help alleviate browsing pressure created by deer within the park, and allow these wildflower populations to recover. We recommend enclosing large areas rather than small areas directly targeted around specific plants to avoid calling public attention to conservative wildflower species. Figure XX shows recommended fencing areas around concentrations of conservative wildflower species.

TABLE V

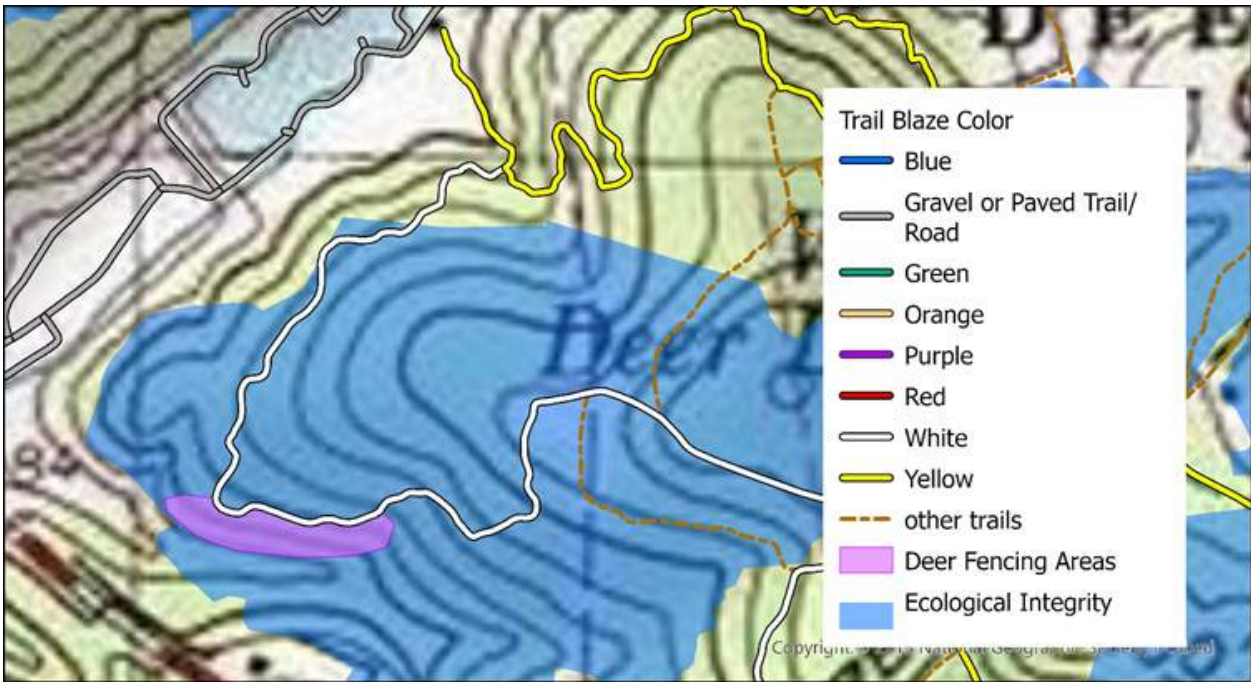
Project Area	Acreage	Perimeter	Cost estimate ($5.25-$6 per linear foot)
Mahaffey Road Slopes	2	1890’	$9,900 - $11,500
Fire Pink Slopes	1.25	1500’	$7,875 - $9,000
West Deer Lake Floodplain	2	1725’	$9,050 - $10,350

Mahaffey Road Slopes Wildflower Reserve: ~2 acres, ~630 yards in length



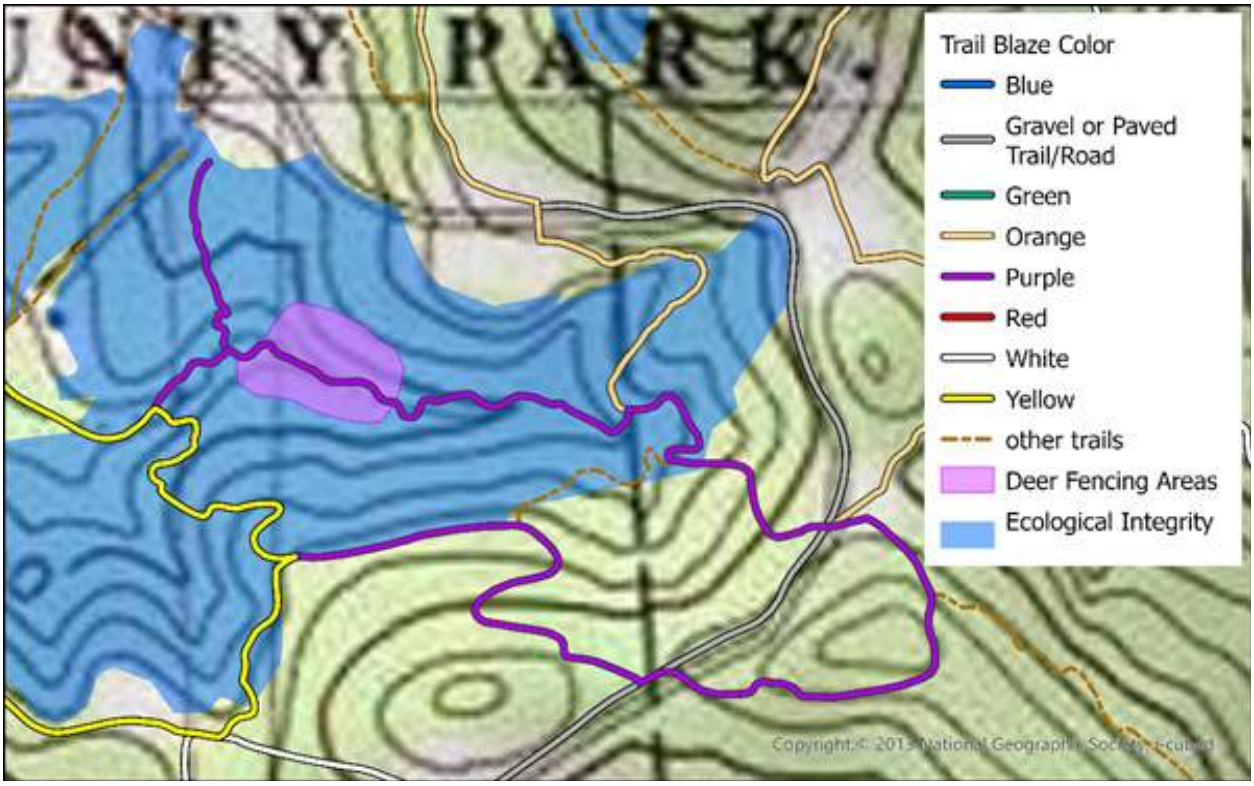
This ~ 2 acre area within the Mahaffey Road Slopes Ecological Integrity Area has a concentration of wildflower species including Virginia bluebells and several species of Trillium. The recommended fencing area crosses no trails. It encloses a small hollow around a stream tributary, and part of it follows near the White Trail. Signage along the fence, such as “Forest Restoration Area” or “Wildflower Protection Area”, could educate the public about the purpose behind the fencing.

Fire Pink Slope Wildflower Reserve: ~1.25 acres, ~500 yards in length



This ~1.25 acre area surrounds the steep slope of dry oak – mixed hardwood forest that hosts a particular concentration of fire pink (*Silene virginica*), as well as a diversity of other wildflower species. There are no trail or stream crossings within the area. Part of the northern perimeter of the exclosure follows the White Trail; this is an opportunity to education park visitors with signage such as "Forest Restoration Area" or "Wildflower Reserve Area", or even a placard with more extensive text on the impacts of deer browsing on native species. After a few years, the difference between the fenced and unfenced forest will be visibly apparent, with more lush and dense growth of native species within the exclosure than in the browsed areas directly adjacent along the trail.

West Deer Lake Floodplain Wildflower Reserve: ~2 acres, ~575 yards in length



This ~2 acre area is directly east of the eastern point of West Deer Lake. The stream valley in this area has the best mesic floodplain wildflower assemblage in the park. The recommended exclosure area does cross a section of purple trail. We recommend constructing zig-zag openings that exclude deer but allow pedestrians to cross freely without a gate. These can be seen at Trillium Trail Wildflower Reserve in Fox Chapel. Bikes and horses cannot pass through these openings. However, the segment of purple trail where the deer exclosure is recommended is a cross-trail that is fully encircled on all sides by other trails. We recommend designating this short segment of trail as pedestrian-only; cyclists can follow the yellow, orange, and purple trails around the pedestrian-only segment. Signage can be used to educate park users about the purpose and value of the fencing.

Zig-zag fence opening at Trillium Trail wildflower reserve. Pedestrians can pass freely with no gate, but deer are excluded. Overhead diagram of fencing: ---< ----

2.1.5 INVASIVE SPECIES MANAGEMENT

Because invasive species have established so extensively at this point that it is impossible to control or eradicate them in all areas, efforts must be strategically directed towards the areas where they will have the most impact. The highest management priorities are:

- Remove pioneer populations of invasive species
- Steward "Best" and "Good" Ecological Integrity Areas
- Manage invasive species in meadows & in areas recently removed from mowing or maintenance
- Manage Invasive species where they have particular impact on recreational or other park uses. Each of these priorities is addressed under its own heading, below the General Recommendations.

Invasive plant thicket at Deer Lakes Park.

General Recommendations for Invasive Control Efforts:

- Whenever control efforts are undertaken, plans should be included for subsequent revegetation, either through protection of natural seed source germination or through introduction of native plant materials consistent with the site and the surrounding natural communities.
- Restoration efforts will be most successful if time and resources are allocated for thorough invasive control before introduction of new plant materials. All restoration plans should also include long-term maintenance efforts to monitor and control invasive species while native vegetation is establishing.
- Many species commonly used in landscaping are highly invasive in natural settings, such as burning bush, yellow archangel, and Japanese wisteria. All species introduced for horticultural purposes should be reviewed for invasiveness, and excluded if they are known to be invasive in similar climates or exhibit invasive tendencies.
- Take precautions to prevent accidental introduction of invasive species from equipment and the movement of materials. Earth moving equipment should always be cleaned between sites to prevent movement of seeds in dirt on tires or blades. Fill, compost, and soil moved from other areas can also be sources of invasive plant material; know the source, and vet it before use.
- Work with nearby landowners to remove invasive species, thus reducing the flow of seed and propagules onto park land.

- Deer browse pressure makes natural areas more susceptible to the establishment of invasive species by creating bare soil areas and reducing competition from native species. Reducing deer browse pressure can strengthen the natural resilience of forest communities to invasion by non-native species.

Project Opportunities

Removal of Small Pioneer Populations:

Most of the invasive species in Deer Lakes Park are widespread and well established. However, there are a few pioneer populations that can be controlled now to greatly save on future labor (Figure XV). For many of these species, there are only a few individuals present at this time. This list includes a few species used in landscaping; if these species are in any landscape plantings in the park, they should be removed. Most of these removal projects are small; projects that do not require herbicide use can be undertaken by any staff member or volunteer. Projects requiring herbicide will need to be done by a staff member or contracted pesticide applicator.

Devil's trumpet, found on a debris pile at Deer Lakes Park.

- **Poison hemlock** (*Conium maculatum*) – An invasive relative of the carrot that is highly toxic if ingested that is often found in disturbed areas. At Deer Lakes Park, poison hemlock was only observed growing on a pile of discarded gravel and plant material. Herbicide application is recommended to ensure eradication.
- **Devil's trumpet** *(Datura wrightii*) – An uncommon non-native plant that is not known to be very ecologically-invasive, but is highly toxic and medically significant. When ingested, devil's trumpet causes horrific hallucinations and usually results in death. At Deer Lakes Park, devil's trumpet was only observed growing on a pile of discarded gravel and plant material. Herbicide application is recommended to ensure eradication.
- **Mile-a-minute** (*Persicaria pefoliata*) – A highly aggressive, fast-growing, and rapidly-spreading annual vine that is spread by birds and seedbanks for up to 8 years. A large emerging population is found within a ruderal forest at Deer Lakes Park, and a smaller patch was found growing on a pile of discarded gravel and plant material. This species has weak roots and can easily be pulled up by staff and volunteers with gloves.

- **Japanese wisteria** (*Wisteria floribunda*) – An aggressive, fast-growing vine that is sometimes used in landscaping. At Deer Lakes, there is one large, established patch that is climbing trees and smothering vegetation. This species has not yet spread outside of this patch and is not found anywhere else in the park.
- **Yellow archangel** (*Lamiastrum galeobdolon)* – A fast-growing, groundcover plant in the mint family that often forms monoculture carpets in forest understories and floodplains. Its bright yellow flowers and carpet-forming habit make it a popular landscaping plant for shady areas.

A pioneer patch of yellow archangel growing along a stream at Deer Lakes Park.

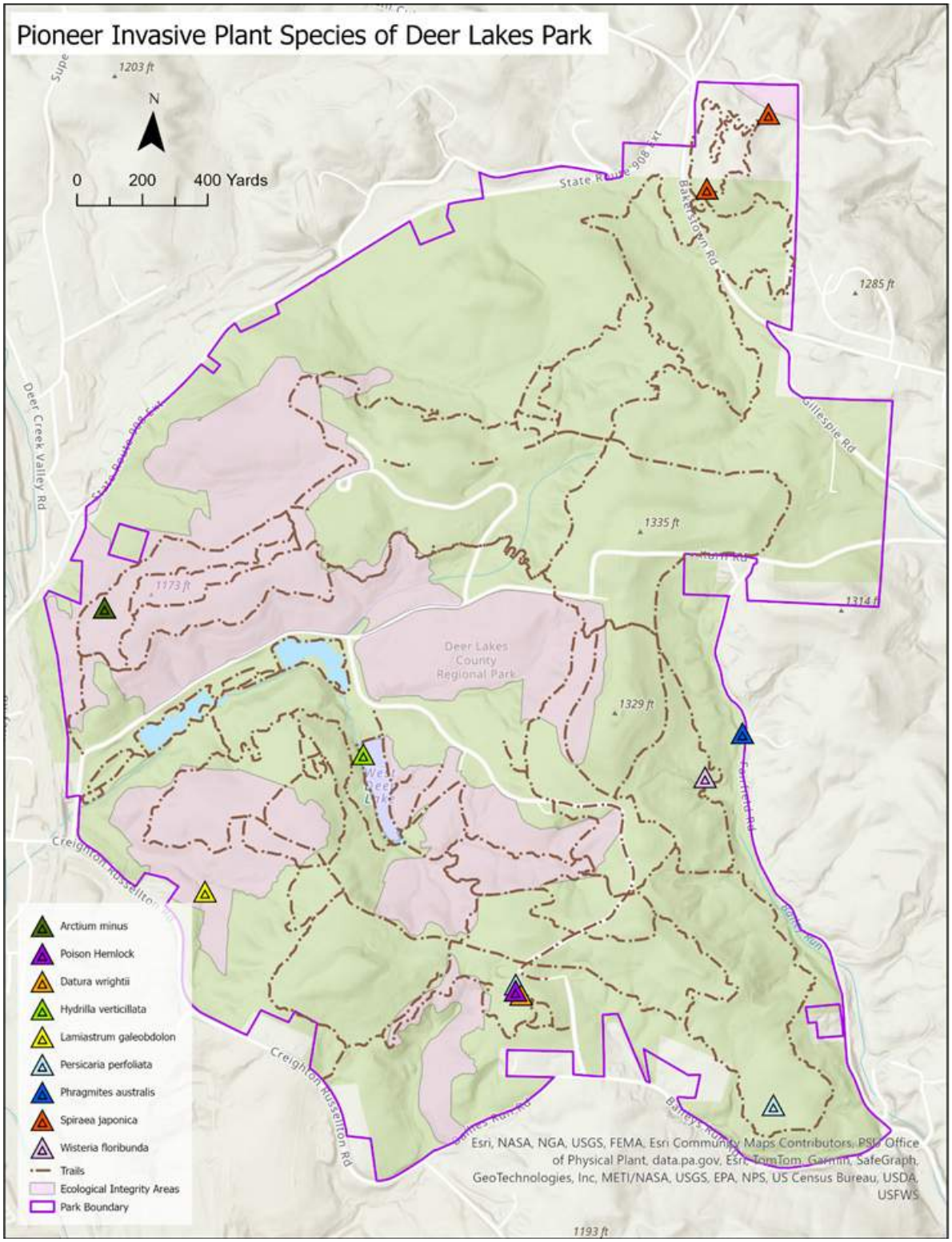
- **Lesser burdock** (*Arctium minus*) – A biennial herb that produces seed head with hooked bracts that latch onto fur and clothes, facilitating spread over long distances. Lesser burdock was only recorded from one natural location at Deer Lakes Park, but there may be additional presences along roads and around parkscapes.
- **Bohemian knotweed** (*Fallopia x bohemica syn. Reynoutria x bohemica*) – A hybrid between Japanese knotweed (*Fallopia japonica*) and giant knotweed (*Fallopia sachalinensis*), bohemian knotweed is as invasive as its parent species, forming large monocultures from rhizomes. One patch was found at Deer Lakes Park adjacent to a parking area. It can be difficult to distinguish from Japanese knotweed.

The easiest way to identify Bohemian knotweed by Japanese knotweed is to observed small triangular hairs on the undersides, or trichomes, which only appear on Japanese knotweed as small, raised bumps.

- **Japanese spiraea** *(Spiraea japonica)* – A shrub that is commonly used in landscaping and tends to escape from cultivation. At Deer Lakes Park, there is a large patch of Japanese spiraea in a powerline right-of-way and it was found escaping into adjacent natural areas.

A dense patch of Japanese spiraea growing under a powerline.

FIGURE XV


Pioneer Invasive Plant Species of Deer Lakes Park
N
0 200 400 Yards
1203 ft
1285 ft
1335 ft
1173 ft
1314 ft
1329 ft
1193 ft
Deer Creek Valley Rd
Bakerstown Rd
Gillespie Rd
Deer Lakes County Regional Park
Creighton Rosselton Rd
Arctium minus
Poison Hemlock
Datura wrightii
Hydrilla verticillata
Lamiastrum galeobdolon
Persicaria perfoliata
Phragmites australis
Spiraea japonica
Wisteria floribunda
Trails
Ecological Integrity Areas
Park Boundary
Esri, NASA, NGA, USGS, FEMA, Esri Community Maps Contributors, PSU Office of Physical Plant, data.pa.gov, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

Park-wide Suppression of Uncommon Invasive Plants

At Deer Lakes Parks, there are several species of invasive plants that are uncommon. The maps on page xx-yy show their distribution throughout the park. These species are scattered and occur more often than pioneer species, but are not as widespread or dominant as the most common invasive plants in the park. Some of these species have very few occurrences, but have mature plants in their populations that are 5-10+ years old and produce seeds. Uncommon invasive plants can be significantly controlled and suppressed with coordinated effort over moderate to long periods of time. By targeting these species for control, their impacts can be localized to small areas within the park, preventing further spread. These projects are a tertiary priority after eradication pioneer invasive plants and controlling invasive species in good-quality ecological integrity areas. Most of these species are found "ok" and "poor" ecological integrity areas, although some of these species are also found in higher quality "good" and "best" areas. In these cases, some of the recommendations may be repeated.

Japanese knotweed growing in a forest at Deer Lakes Park. Patches like this under a tree canopy are partially suppressed by the shade.

- J**apanese knotweed** (*Reynoutria japonica syn. Fallopia japonica*) – At Deer Lakes Park, Japanese knotweed is found in disturbed areas, with a larger concentration in the ruderal forests of the southeast corner of the park. Although there are some small ravines with large stands, there are several manageable small patches. Follow management guidelines from Penn State Extension for the best chance at successful control and re-establish shade trees in successfully-managed areas.
- **Burningbush** (*Euonymus alatus*) – There are only a few mature burningbush shrubs recorded throughout Deer Lakes Park. Physical removal with a weed wrench, or hand-pulling for seedlings and young shrubs, should be sufficient. Herbicide can offer a high probably of success.
- **Glossy buckthorn** (*Frangula alnus*) – There are only a few mature glossy buckthorn shrubs recorded throughout Deer Lakes Park. Removing these mature individuals will also remove the primary local seed sources for glossy buckthorn. Managing glossy buckthorn with herbicide is quick and efficient. However, physical removal with a weed wrench or hand-pulling for seedlings and young shrubs should be sufficient for controlling this species as well.
- **Tree-of-heaven** (*Ailanthus altissima*) – Tree-of-heaven is somewhat common at Deer Lakes Park, but not as abundant as the widespread invasive plants. Most individuals are young trees; very few exceed 20cm DBH. Control tree-of-heaven mapped out throughout the park following management practices from Penn State Extension. Controlling tree-of-heaven will have the secondary effect of suppression the invasive spotted lanternfly, for which tree-of-heaven is a host plant.

Several Spotted Lanterflies feeding on a tree-of-heaven sapling near the East Deer Lake.

- **Common teasel** (*Dipsacus fullonum*) – Common teasel is an invader of meadows and open disturbed places. It is resistant to physical control and is able to flower even after being cut to ground level several times in a single growing season. Herbicide is recommended for efficient control. Follow management guidelines from Penn State Extension for the best chance at success.

Japanese honeysuckle, usually found in disturbed areas, but occasionally in mature forest as sparse, trailing vines.

- **Japanese honeysuckle** (*Lonicera japonica*) – At Deer Lakes Park, Japanese honeysuckle can be found as tangled mats of vines in disturbed areas and as scattered younger vines and seedlings elsewhere. Control is recommended to prevent this species from becoming as abundant as other invasive plants. Younger vines and seedlings can be hand-pulled. Large mats will likely need to be controlled with a broadleaf herbicide.
- **Roundleaf bittersweet** (*Celastrus orbiculatus*) – At Deer Lakes Park, roundleaf bittersweet, also called oriental bittersweet, can be found as tangled mats of vines or climbing trees in disturbed areas and as scattered younger vines and seedlings elsewhere. Control is recommended to prevent this species from becoming as abundant as other invasive plants. Younger vines and seedlings can be hand-pulled. Large mats will likely need to be controlled with a broadleaf herbicide. Follow management guidelines from Penn State Extension for the greatest chance of success.
- **Callery pear** (*Pyrus calleryana*) – Callery pear only appears at two locations in Deer Lakes Park. This species spreads to form dense thickets of shrubs and small trees with stout thorns; early control is highly recommended. Physical control is not recommended because

- **Forsythia** (*Forsythia spp.*) – Forsythia only occurs at a single location in Deer Lakes Park. However, this one occurrence is a fairly large clonal shrub thicket that is likely a remnant from an old landscaping planting. An integrated approach of physical and chemical control techniques should be successful in controlling this thicket. Cut down shrubs and paint the bases with a concentrated herbicide.
- **Norway maple** (*Norway maple*) – At Deer Lakes Park, there as one mature Norway maple recorded in the northern section of the park. Removing this tree will prevent the production and spread of seeds. Norway maple forms dense stands that shade out all other growth and typically have almost bare herb layers beneath them.

A mature Norway maple found in a successional forest in the northern part of the park.

FIGURE XVI

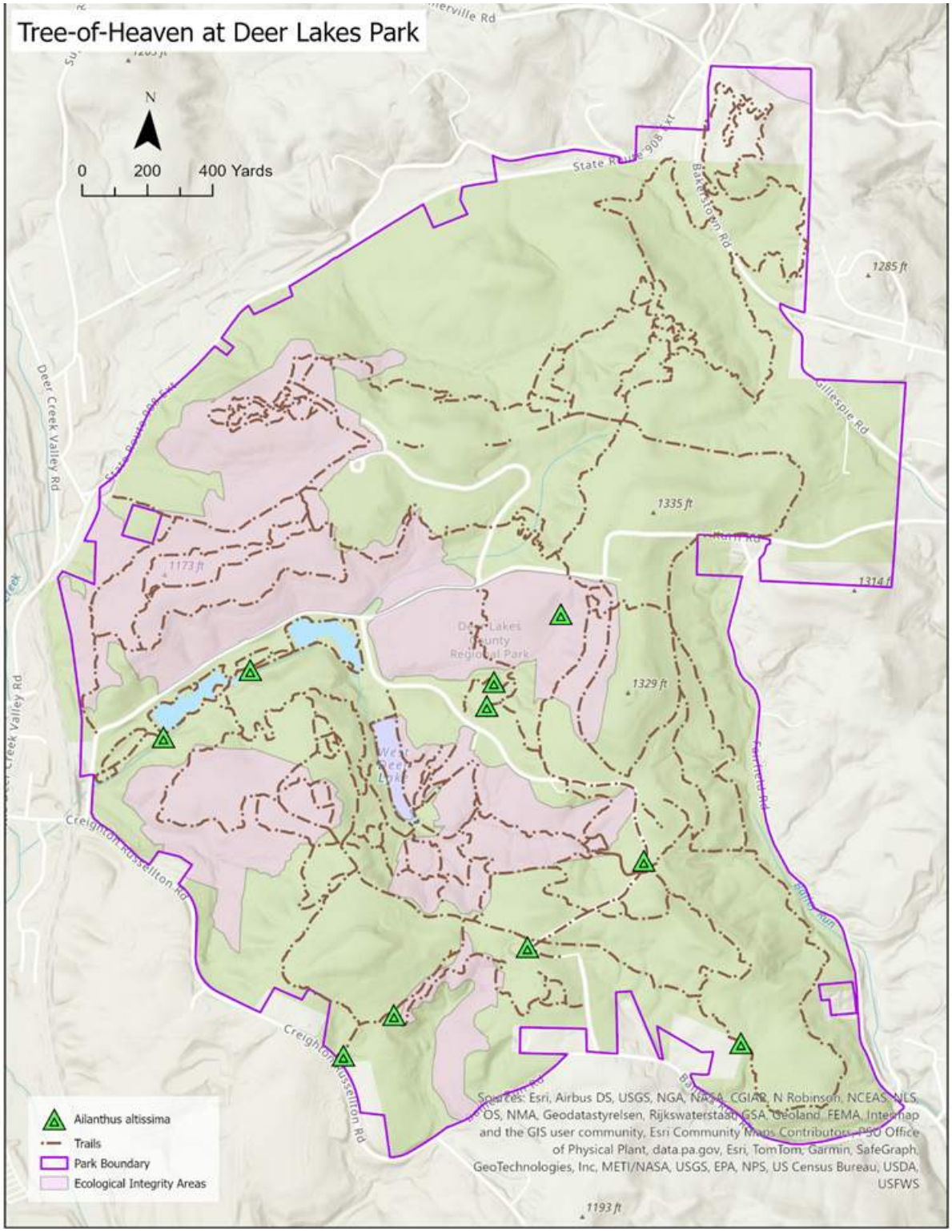

Tree-of-Heaven at Deer Lakes Park
N
0
200
400 Yards
Deer Creek Valley Rd
Creighton Russellton Rd
Blackstown Rd
Gillespie Rd
Fairfield Rd
1285 ft
1335 ft
1329 ft
1314 ft
1173 ft
1193 ft
Ailanthus altissima
Trails
Park Boundary
Ecological Integrity Areas
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, PSU Office of Physical Plant, data.pa.gov, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS

FIGURE XVII

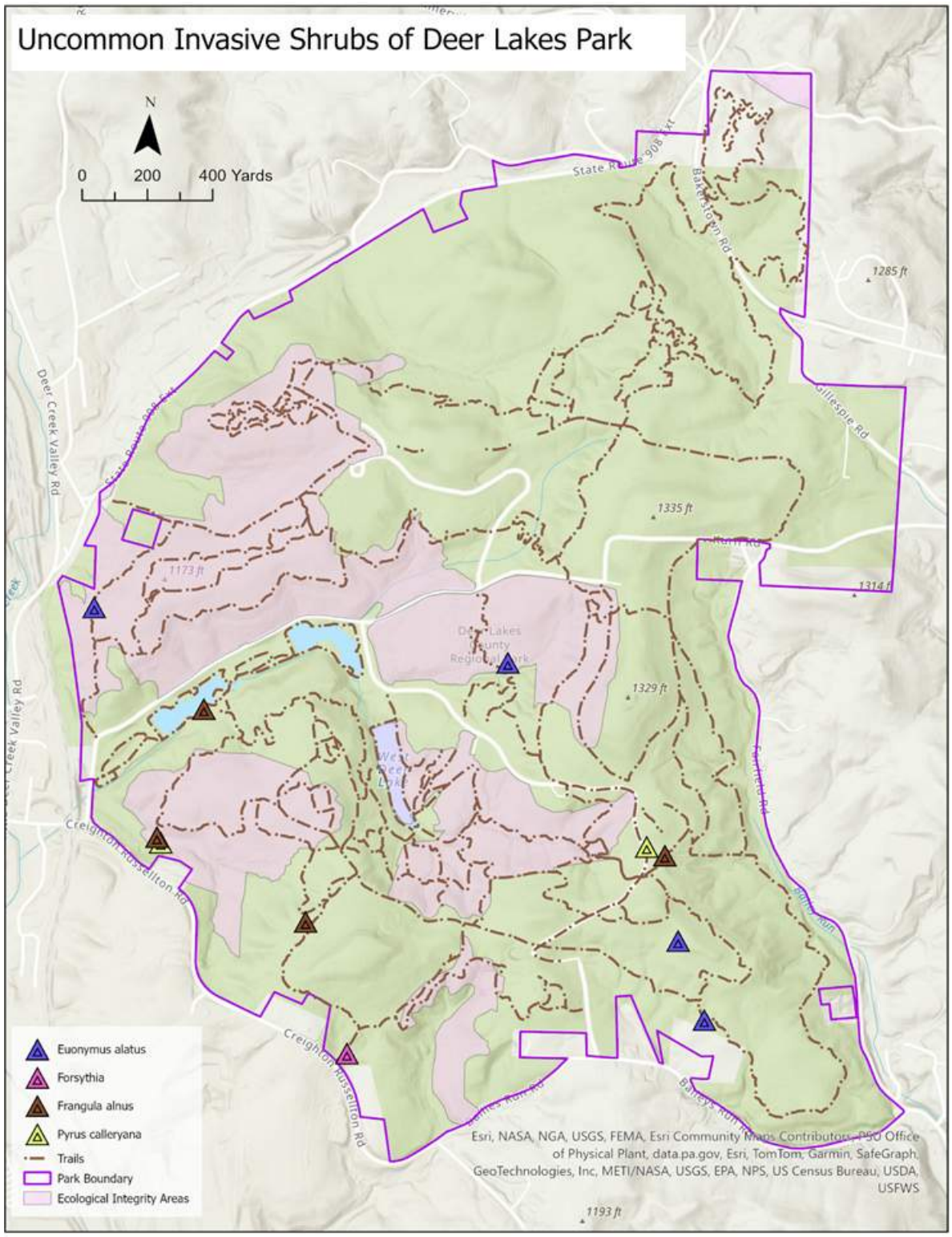
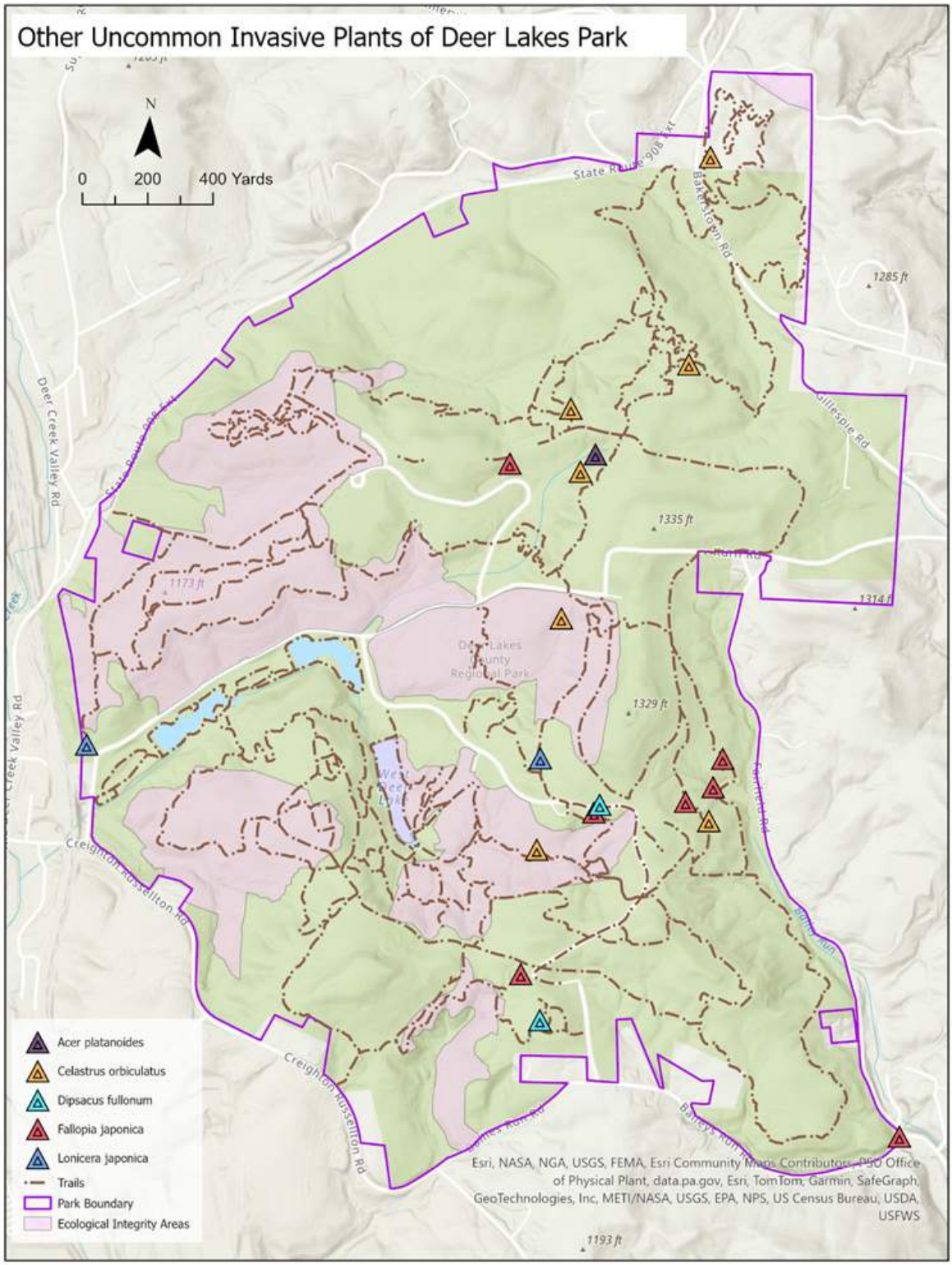

Uncommon Invasive Shrubs of Deer Lakes Park
N
0
200
400 Yards
Euonymus alatus
Forsythia
Frangula alnus
Pyrus calleryana
Trails
Park Boundary
Ecological Integrity Areas
Esri, NASA, NGA, USGS, FEMA, Esri Community Maps Contributors, PSU Office of Physical Plant, data.pa.gov, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS
1285 ft
1335 ft
1314 ft
1329 ft
1173 ft
1193 ft
Deer Creek Valley Rd
Creighton Russellton Rd
Barkeytown Rd
Gillespie Rd
Fairfield Rd
Bailey's Run Rd

FIGURE XVIII



Invasive Stewardship in "Good" and "Best" Ecological Integrity Areas:

After the pioneer species, "good" and "best" ecological integrity areas are the highest priority for invasive control efforts. This is for the purpose of protecting the existing high-quality ecological communities in the park. Some of the control work for these species can be accomplished by volunteers and staff members through physical removal. Monitoring these areas to detect and remove young plants would be particularly impactful. Other removal work requires a dedicated project effort.

- Most "best" and "good" ecological integrity areas have low to somewhat moderate levels of invasive species infestation at present. The most effective strategy in maintaining the quality of these areas is to develop a program for volunteer or staff personnel to periodically monitor these areas for new invasive species and remove them while the plants are few in number.
- Where infestations exist that cannot be controlled through casual hand-pulling efforts, a more detailed area-specific assessment and treatment plan will be needed.
- Canopy gaps are prime areas for establishment of invasive species due to high light levels, disturbance, and lack of established native vegetation. Remediating canopy gaps can help to facilitate native forest restoration and maintain ecological integrity over the long term. When canopy gaps develop naturally, monitor and manage them to prevent invasive species infestations from developing. Deer fencing can greatly facilitate regeneration.

A canopy gap at Deer Lakes Park where invasive plants have taken root.

- Japanese stiltgrass (*Microstegium vimineum*) is a species that is becoming ubiquitous in our forests. It spreads extremely rapidly, and there are no particularly effective ways of controlling it without also damaging native vegetation, especially at large scale. Penn State Extension's fact sheet offers further detail on control options. Source https://extension.psu.edu/japanese-stiltgrass.
- Many of the "best" and "good" ecological integrity areas currently have some degree of infestation, which will likely worsen over time. Disturbances that result in high-light areas and removal of vegetation greatly facilitate invasion. To slow down the progress of this invasive species:
    - Reduce deer browse pressure.
    - Avoid creating disturbances in intact forested areas
    - Follow above-listed recommendations on canopy gaps.
- Japanese barberry, autumn olive, privet, bush honeysuckles, multiflora rose, cornelian cherry, and burning bush are all non-native shrubs with similar control requirements.
    - Volunteers or patrolling staff can pull or weed-wrench younger individuals.
    - Larger shrubs will require cutting and herbicide use.
- Garlic mustard, dame's rocket, and narrowleaf bittercress are herbaceous plants that grow abundantly from seed. These can be removed by hand by volunteers. It is difficult to fully eradicate them, but they can be reduced in numbers and their spread slowed.
- Roundleaf bittersweet is often very sparse and young in good integrity areas and can easily be pulled by hand. Larger, mature vines likely need to be controlled with herbicide, ideally through a cut-stump application.

A large patch of bush honeysuckle in the Mahaffey Road North Hill area.

Project Opportunities Listed Per Ecological Integrity Area:

Mahaffey Road North Hill

The following species are general control targets for Mahaffey Road North Hill. Most of these plants are common and widespread in the park, but are appropriate management priorities in certain contexts.

- Multiflora rose
- Japanese barberry
- Autumn olive
- Privet
- Bush honeysuckles
- Japanese honeysuckle
- Roundleaf bittersweet
- Japanese stiltgrass
- Narrowleaf bittercress
- Garlic mustard
- Dame's rocket
- Cornelian cherry

Lesser burdock growing at the base of a tree.

Specific Project Recommendations

- Eradicate pioneer lesser burdock growing in the western part of the area. Lesser burdock has a strong tap root; herbicide may be necessary.
- Pull general control targets, especially garlic mustard and dame's rocket growing in or near the native wildflower assemblage in the eastern part of the area. Ideally, physical control of invasive plants by pulling, digging, and cutting should be used in preference to herbicide near populations of sensitive native plants.
- Control any general target invasive species growing in the immediate vicinity of ramps patches. Ideally, physical control of invasive plants by pulling, digging, and cutting should be used in preference to herbicide near populations of sensitive native plants.
- Suppress burningbush, a species that is uncommon throughout the park but not quite a pioneer. Young shrubs and seedlings can be effectively removed by hand pulling, but more mature shrubs may require herbicide for effective management. Eradication within this area is possible.
- Control general target invasive species in "good" integrity areas where invasive plants area already sparse and native species thrive. Use physical control methods when possible. Herbicide may be required for mature plants and larger patches, but its use should be avoided when in the proximity of sensitive native plants.

Middle Lake Watershed

The following species are general control targets for Middle Lake Watershed. These plants are common and widespread in the park, but are appropriate management priorities in certain contexts.

- Japanese stiltgrass
- Multiflora rose
- Japanese barberry
- Privet
- Bush honeysuckles
- Autumn olive
- Garlic mustard

A large burningbush found in the Middle Lake Watershed.

Specific Project Recommendations

- Suppress burningbush found within the area. This species is not particularly common or widespread at Deer Lakes Park, and is only present as seedlings within the Middle Lake Watershed. Eradication from this area is possible. Young shrubs and seedlings can be effectively removed by hand pulling, but more mature shrubs may require herbicide for effective management.
- Suppress roundleaf bittersweet, which is only found as sparse vines within this area. It is somewhat distanced from the main population strongholds for this species at Deer Lakes Park. Physical removal should be sufficient for population control if conducted at consistent intervals. Eradication from this area is not likely due to the presence of robust seed sources within the park.
- Control general target invasive species in "good" integrity areas where invasive plants area already sparse and native species thrive. Use physical control methods when possible. Herbicide may be required for mature plants and larger patches, but its use should be avoided when in the proximity of sensitive native plants.

West Deer Lake Watershed

The following species are general control targets for West Deer Lake Watershed. These plants are common and widespread in the park, but are appropriate management priorities in certain contexts.

- Japanese stiltgrass
- Multiflora rose
- Garlic mustard
- Japanese barberry
- Narrowleaf bittercress

A roundleaf bittersweet seedling, one of several appearing in the West Deer Lake Watershed.

Specific Project Recommendations

- Control any general target species growing among or around populations of sensitive species. Avoid using herbicides near sensitive native plants. Remove invasive plants by hand pulling, digging, and cutting.
- Suppress roundleaf bittersweet in this area. This species is uncommon and sparse within the West Deer Lake Watershed and is somewhat disjunct from larger population strongholds within the park. Physical removal should be sufficient for control if conducted on consistent intervals. Total eradication from this area is unlikely due to seed pressure from those population strongholds.
- Control hydrilla within West Deer Lake. Unlike the Middle and East Deer Lakes, hydrilla has not completely overtaken West Deer Lake. It was only found as a small patch in the lake's northwestern corner. Physically remove any hydrilla stems, making sure to also remove the tubers from the lake sediment.
- Control general target invasive species in "good" integrity areas where invasive plants area already sparse and native species thrive. Use physical control methods when possible. Herbicide may be required for mature plants and larger patches, but its use should be avoided when in the proximity of sensitive native plants.

The small hydrilla patch found in the West Deer Lake.

Fire Pink Slope

The following species are general control targets for Fire Pink Slope. These plants are common and widespread in the park, but are appropriate management priorities in certain contexts.

- Japanese stiltgrass
- Multiflora rose
- Privet
- Japanese barberry
- Alliaria petiolata
- Narrowleaf bittercress

A small multiflora rose shrub, one of several growing on the Fire Pink Slope.

Specific management recommendations

- Eradicate glossy buckthorn growing in the skunk cabbage seep. This species is fairly uncommon throughout Deer Lakes Park and the seedlings and small shrubs in the Fire Pink Slope area are fairly disjunct from patches of mature, fruiting shrubs. These seedlings and small shrubs can easily be pulled from the soft floodplain soils.
- Control any general control targets growing in the immediate vicinity of sensitive native plants and native wildflower assemblages. Ideally, physical control of invasive plants by pulling, digging, and cutting should be used over herbicide near populations of sensitive native plants.

A cluster of Callery pears in a floodplain within the Fire Pink Slope area.

- Target small patches of Japanese stiltgrass emerging in canopy gaps for physical removal.
- Control callery pear growing in the skunk cabbage seep. This species is found at only one other location in Deer Lakes Park. However, most plants are small trees of reproductive size. Herbicide is likely necessary to effectively control this species. On small tree-size individuals, apply herbicide by hack-and-squirt. For seedlings and root sprouts, spot-treat with a foliar herbicide spray.
- Control general target invasive species in "good" integrity areas where invasive plants area already sparse and native species thrive. Use physical control methods when possible. Herbicide may be required for mature plants and larger patches, but its use should be avoided when in the proximity of sensitive native plants.

Bailey's Run Tributary Slopes

Japanese stiltgrass and multiflora rose are the only invasive plants recorded from Bailey's Run Tributary Slopes. Their distributions are strongly correlated with the trails that run through the area. Control these two invasive species spreading along trails. Physical removal conducted in consistent intervals should be sufficient for controlling these species in the Bailey's Run Tributary Slopes area.

2.2 TREE RISK ASSESSMENT

A WPC Forester, with certifications as an arborist and in tree risk assessment with the International Society of Arboriculture (ISA), assessed trees within the parkscaped areas of Deer Lakes Park. These areas are the primary locations occupied by park visitors and are characterized by mowed lawns and facilities, such as parking areas, shelters and playgrounds. The purpose of this assessment was to identify potential conditions of concern that may or may not require attention to maintain the area within the level of acceptable risk to the property managers. Maps and spreadsheets are provided for all of the tree conditions which the WPC Forester observed at the time of his assessment. A Level Two Basic Tree Assessment was conducted for four of the trees.

Disclaimer:

This report is relevant only to the trees which the WPC Forester observed and only for the condition of the trees at the time of assessment. The condition of any of the trees included in this report can change at any time following the assessment. Furthermore, no scope of work was provided to the WPC Forester from the County Parks managers. The WPC Forester had freedom to choose which trees to assess. Therefore, additional conditions of concern or tree hazards may exist elsewhere within the park, including trees within the areas that the WPC Forester visited. This report is not intended to be a complete inventory of all trees or tree conditions within Deer Lakes Park. It is simply a compilation of observations.

WPC is not making any tree service recommendations. It is the responsibility of the property owner/manager to make tree management decisions within their own level of acceptable risk and required duty of care. WPC is only providing information on the location and nature of potential conditions of concern which the County Parks managers may or may not decide to pursue further action. For the four trees which were officially assessed according to ISA Level Two Basic Tree Risk Assessment standards, mitigation options are provided solely for the context of showing how the tree's overall risk level would change if a mitigation option was completed.

As a general rule, complete tree removal should not be the only option considered in risk reduction. The International Society of Arboriculture states within their Tree Risk Assessment Manual, "It is impossible to maintain trees free of risk; some level of risk must be accepted to experience the benefits that trees provide." Property owners should consider multiple options for risk mitigation and only resort to complete tree removal when no other option can reduce the tree's overall risk level to what is required.

Risk reduction options can be tree based, such as pruning away dead or damaged branches, installing cabling and bracing systems, or tree removal.

Risk reduction options can also be target based, such as restricting access around the tree or moving a picnic table or swing set outside of the target zone. These options can be especially appropriate for a park area, where overall human occupancy is infrequent.

Tree risk assessment considers three important factors in determining the overall risk level of a tree.

- The likelihood that a tree, or tree part, will fail
- If the tree or tree part fails, the likelihood that it will actually impact a target
- And if the tree fails, and if it does impact a target, the consequences of impact

Nearly all of the trees observed by the WPC Forester would have a low overall risk level if they were assessed according to the ISA Level Two Basic Tree Assessment. Only one of the four trees which were assessed to this standard had a moderate risk level.

The reason that most park trees will have a low risk level, even ones that may be completely dead or imminently failing, is because human occupancy of a park is normally infrequent. While park usage may peak seasonally or on certain days, tree risk assessment must look at the entire time the tree is present. With parks only open to the public during daylight hours, that leaves only around half of a day where the public can legally be near a park tree. Furthermore, public use of a park will decrease during the school year, on week days and during colder months. Trees are also more likely to fail during inclement weather events when people are less likely to be recreating outdoors. Overall tree risk can be inflated due to assuming a higher occupancy within the target zone compared to what actually occurs.

Trees that will have a higher level of risk are ones located near constantly occupied structures, business districts, or heavily traveled roadways. Deer Lakes Park does not contain any of these targets.

FIGURE XIX

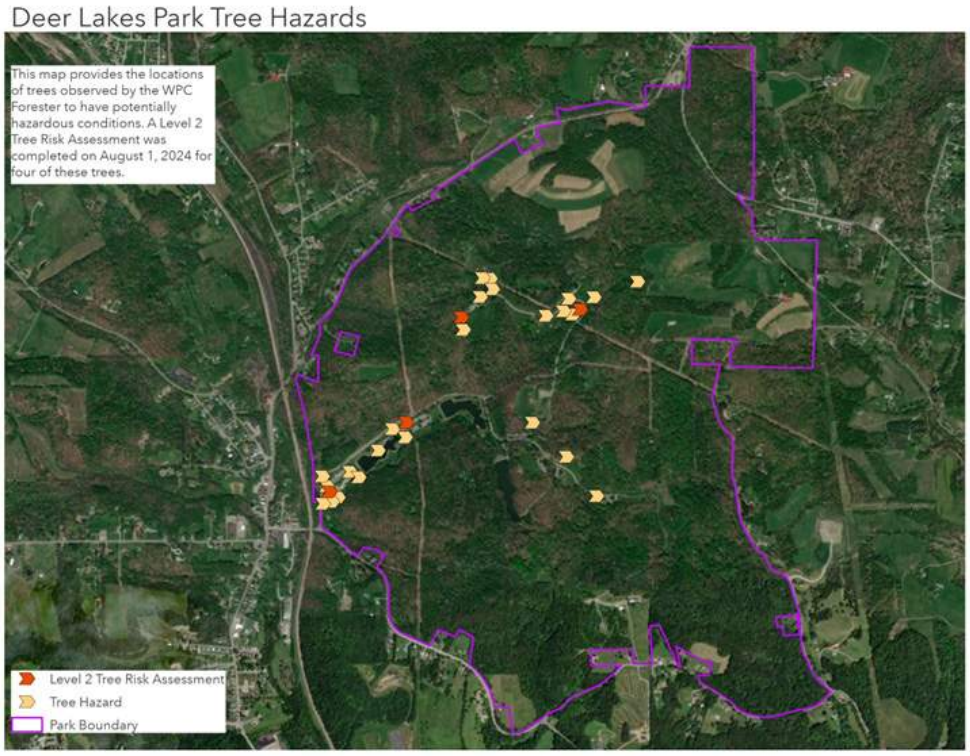


FIGURE XX

FIGURE XXI

TABLE VI

ID	Notes
102	Sugar maple at main entry to splash park parking, in decline, significant dead canopy; entry road and parking in target zone; rare to occasional occupancy by people, but likely seasonally higher in peak times
103	Multiple dead limbs, max 6-inch diameter, from multiple oaks above asphalt walking path at parking lot
104	Dead pine, but very low risk due to lack of targets in target zone, could remove and replace, or retain as wildlife habitat
105	Large elm in decline, a few feet outside of fence behind pavilion at splash pad; significant trunk decay; bacterial slime flux observed; some canopy decline; leaning away from pavilion, towards creek, most likely direction of fall is opposite of potential targets
106	Multi trunked ash in poor condition, outside of fence behind playground; park benches along fence are in target zone of dead branches
107	Multi trunk elm, dead trunk, just outside fence by playground; benches and access road are in target zone
108	Large maple, 25-inch diameter, with visible trunk decay in lower 10ft, primary leader is dead; suspect some root damage present; located above swing sets between splash pad and play-ground, recommend level 2 tree risk assessment, occupancy rate of people is rare overall, but higher during peak park use periods; ***Level 2 TRAQ completed 8/1/24***
109	Dead trees on north side of lower lake; one bench in target zone, very low risk to people due to rare occupancy, but perhaps higher in peak trout fishing times, high wildlife value of dead trees along water, consider moving bench or limiting access
110	Declining cherry tree with dead canopy, along parking lot loop and primary trail entry to reservoir bridge
111	Large red maple between main road and parking lot, significant trunk decay with large open cavity present on parking lot face of tree; large girdling roots visibly encircling the entire circumference of the base; likely direction of fall is towards parking lot due to slight lean and prevailing wind direction; ***Level 2 TRAQ completed 8/1/24***
112	Multiple white pines in decline between main road and reservoir, one tree is almost fully dead
113	Two large dead pines immediately adjacent to main road, along the curve
114	Large multi trunk cherry, dead primary lead with failure imminent, included bark and decay at base where trunks join, tree has high likelihood of failure, even under normal weather conditions, but risk to people is low due to lack of park uses in target zone. Access to any park users or staff should be prohibited as this tree is a risk to anyone within the target zone in just a lightly breezy day; ***Level 2 TRAQ completed 8/1/24*** (*tree has since had partial failures and some removal work, but risk from the remaining portion is still present)

115	Large maple tree in significant decline, most of canopy consists of dead or broken branches; decayed at lower trunk; high likelihood of whole tree failure with branch failure in canopy already occurring, but very low risk to people due to rare occupancy of people in the lawn with no park uses present in target zone
116	Large dead pine near road, with road in target zone
117	Large sugar maple in decline with dead branches throughout canopy; at intersection of parking area and road; parking should be restricted within target zone until risk is mitigated
118	Large dead branches from walnut tree above area with swing set
119	Dead tree, along trail near brief area where trail splits, dead branches fell from it onto trail while taking this waypoint
121	Utility topped pine with dead branches above picnic tables
122	Large sugar maple by parking lot, mostly dead canopy, utility line is also in target zone
123	Large dead pine at entrance to minnow shelter
124	Large white pine with substantial trunk decay; appears to have lost a primary codominant trunk; crown healthy with foliage, but trunk lean and center of mass to parking lot side, tree failure at lower trunk is likely
125	Large red oak near swings, tables, pavilion; canopy decline with many large dead branches in upper crown, significant trunk damage, and suspect internal decay, major lower branch failed previously with large open wound remaining, visible root damage from mowing; ***Level 2 TRAQ completed 8/1/24***
126	Multiple oaks in decline, on forest edge, one above playground equipment
129	Large dead pine, along road and adjacent to portable toilets
131	Large dead tree, disc golf area, picnic table, path to blue gill shelter
134	Large dead trees, with dead canopy above road
135	Several dead trees on forest edge, canopy over mowed area and path to disc golf

Level 2 Tree Risk Assessments

**Time frame: one year from assessment date of August 1, 2024*

Tree # 108

This tree is a 25-inch diameter sugar maple (Acer saccharum) located within the playground area of the Deer Lakes Splash Park. Conditions of concern include:

- Fully dead central leader
- 12-inch diameter secondary lead splitting from the main trunk
- Visible internal decay of the lower trunk
- Visible decay of primary buttress roots

Targets assessed within the target zone include:

- People occupying park facilities (benches, swing set, walking paths)
- People occupying vehicles within the adjacent parking lot

The likelihood of failure of all tree parts was probable (*under normal weather conditions within the one year time frame), except for the fully dead central leader, which was considered to be imminent failing, due to the significant presence of deadwood. The likelihood of all four tree parts impact any of the targets was low or very low, due to the infrequent occupancy of people within the target zone, within the one year time frame.

The overall risk level of this tree is 'moderate', solely due to the combination of the imminently failing dead central leader and impacting people occupying nearby benches or playground equipment. All other combinations of tree parts and targets had a 'low' overall risk rating.

If the dead central leader was removed, the overall risk level of the tree would decrease from 'moderate' to 'low'. Park managers may wish to consider the risk of this tree during a shortened time frame that is specific to seasonally higher occupancy.

Tree # 111

This tree is a 25-inch diameter red maple (Acer rubrum) located adjacent to the parking lot at the Fishing Lakes Entrance from Kurn Rd/Mahaffey Rd. Conditions of concern include:

- 8-inch diameter secondary lead, on parking lot side, with visible decay and evidence of previous branch failure
- Visible internal decay of the lower trunk

Targets assessed within the target zone include:

- Vehicles occupying the parking lot (handicap spaces are closest to the tree)
- Vehicles occupying Kurn Rd/Mahaffey Rd

The likelihood of failure of the 8-inch diameter secondary lead was possible, and the decayed lower trunk probable (*under normal weather conditions within the one year time frame).

The likelihood of all these tree parts impacting any of the targets was very low, due to the rare occupancy of cars within the target zone.

The overall risk level of this tree is 'low'. The branches with decay could be removed and/or access restricted within that area of the parking lot. The residual risk rating will remain unchanged at 'low', excluding complete tree removal. Park managers may wish to consider the risk of this tree during a shortened time frame that is specific to seasonally higher occupancy.

Tree # 114

This tree is a 29-inch diameter black cherry (Prunus serotina) located within the horseshoe bend of Crayfish Dr, directly south of the Pike shelter. Conditions of concern include:

- Codominant union of the two primary trunks
- 4-6 foot long open cavity in the southwestern trunk
- Significant visible decay of the northeastern trunk
- Fully dead secondary lead of the northeastern trunk

Targets assessed within the target zone include:

- People occupying the lawn area (no facilities or infrastructure of any kind present within the target zone)

This tree was assessed on a breezy day and was actively failing at the time of assessment. The fully dead secondary lead of the northeastern trunk was in danger of failing at any time, even in the absence of wind. Likelihood of failure was extended to the entire northeastern trunk failing as a whole, due to the significant quantity of decay in the lower trunk. Failure of the southwestern trunk was probable from the codominant trunk union at the base, as well as the long open cavity in the lower trunk.

Despite the substantial conditions of concern present at the time of assessment, the overall risk level of this tree is 'low', because there are no targets occupying the target zone outside of an occasional park visitor or staff maintenance for lawn mowing. When any of portions of this tree fail, it will most likely just fall onto the open lawn, without a person present in the target zone. The WPC Forester drove by this area one week after the assessment and observed that part of the northeastern trunk had failed. Following this, County Parks staff removed the remainder of this trunk, leaving only the southwestern trunk of the tree present. This Level 2 tree risk assessment is relevant to the original status of the tree. If County Parks staff would like to know the current risk level of the tree, a new assessment should be completed.

Tree # 125

This tree is a 28-inch diameter red oak (Quercus rubra) located near the Carp Shelter. Conditions of concern include:

- Large dead branches in the upper canopy
- Large trunk cavity with visible decay from previous primary trunk failure
- Buttress root decay

Targets assessed within the target zone include:

- People occupying the picnic tables directly underneath the tree
- People occupying the nearby swing set
- People occupying the pavilion

The likelihood of failure was imminent from the large dead branches in the upper canopy, as well as from the large trunk wound from a previous trunk failure. The likelihood of total tree failure from the decayed buttress roots is probable. (*under normal weather conditions within the one year time frame). The likelihood of all of these tree parts impacting any of the targets was very low, due to the infrequent occupancy people within the target zone.

The overall risk level of this tree is 'low'. The picnic tables could be easily moved so that park visitors do not feel invited to gather within the target zone. Similarly, the swing set could be moved or be closed off to restrict access. Large dead branches throughout the canopy could be pruned away. The residual risk rating will remain unchanged at 'low', excluding complete tree removal. Park managers may wish to consider the risk of this tree during a shortened time frame that is specific to seasonally higher occupancy.

Landscape Tree Management

The WPC Forester observed widespread tree decline within mowed areas along Crayfish Drive, with an especially high concentration of damaged trees across the large field to the south of the Carp shelter. The primary tree species in these locations is black cherry (Prunus serotina).

While disease and fungal decay are occurring within the trees currently, the initial cause of this tree decline is a prolonged history of mower damage to the lower trunk and root system. The repeated removal of outer tree tissue and the creation of exposed wounds result in consistent pathways for tree pests and diseases to infest the tree. Furthermore, the blades of the mowers can transport disease from one tree to another. The stress of from weakened root systems and disease can then compound with heat, drought, or storm damage to cause tree failure.
Damage was also observed on the trunks, as mowing equipment is likely scraping against the bark in attempts to drive between trees.

Root and trunk damage can be easily avoided by maintaining a mulch ring around every landscaped tree within a mowed area. Many tree service companies have difficulty finding inexpensive local areas to dispose of wood chips. The County Parks staff could consider developing a relationship with nearby companies to acquire chippings. Tree mulching activities are appropriate for a wide range of ages and experience. The County Parks staff could then annually host volunteer community engagement events to spread mulch around landscaped trees. This methodology could be applied to any location within the County Parks system.

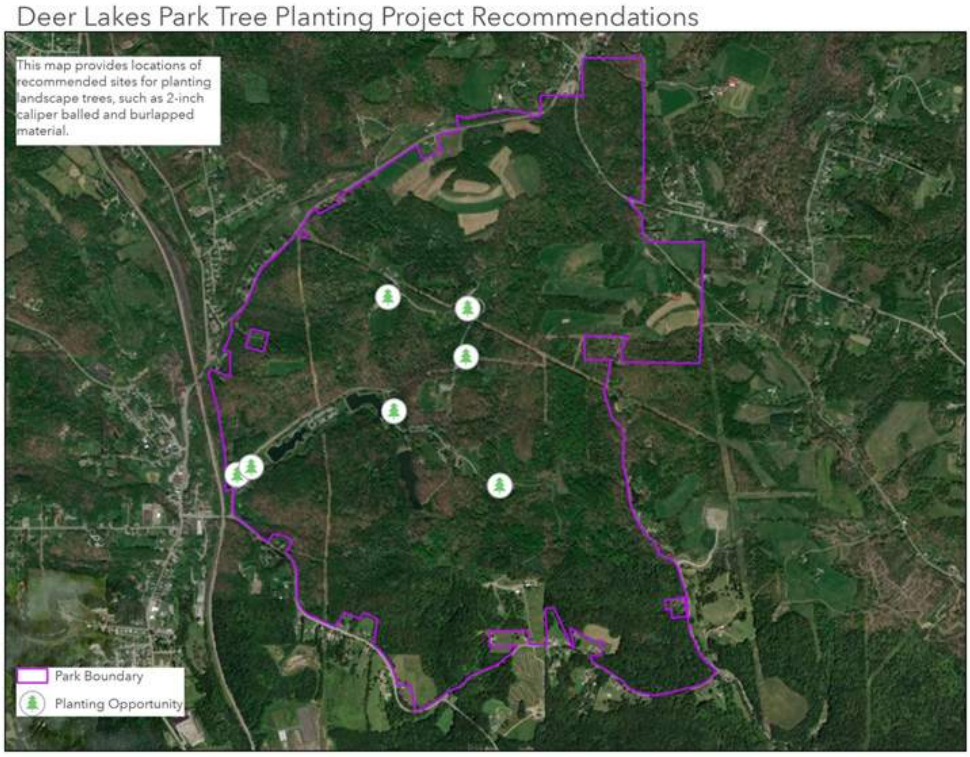
Tree mulching in Harrison Hills County Park

Landscape Tree Planting

Trees provide an incredible amount of benefits to park visitors and the surrounding community. Therefore, it is highly recommended that new tree plantings should be planned for replacing any past or planned tree removals. The cooling shade cast by these trees allows playground equipment and benches to be usable during hot weather, lengthens the life of asphalt on roads and parking areas, and creates a more attractive setting for jogging and dog walking. A list of suggested tree species for replanting is provided below.

- Redbud (Cercis canadensis)
- Hackberry (Celtis occidentalis)
- Yellowwood (Cladastrus kentukea)
- Ginkgo (Ginkgo biloba) –male only cultivars for no fruit production
- Kentucky coffeetree (Gymnocladus dioicus)
- Dawn redwood (Metasequoia glyptostroboides)
- Black tupelo (Nyssa sylvatica)
- Hophornbean (Ostrya virginiana)
- Eastern white pine (Pinus strobus)
- Swamp white oak (Quercus bicolor)
- Chinkapin oak (Quercus muehlenbergii)

FIGURE XXII



The estimated cost for a standard two-inch caliper balled and burlapped tree, along with expenses for delivery and supplementary planting materials such as bark guards, arbortie, stakes and mulch is $275/tree. Therefore the maximum recommendation of replacement tree plantings would cost up to $27,500.


Tree planting at the Deer Lakes Splash Park (left) compared to the playground near the Pike shelter (right)


Opportunities to replace tree removals near the Carp shelter (left) and along Cattail Drive above Middle Deer Lake (right)


A large open lawn along Crayfish Drive that could accommodate many new trees, including replacing past and potential future removals, and combined with a meadow restoration project.

2.3 GREEN INFRASTRUCTURE APPROACHES FOR STORMWATER MANAGEMENT

In collaboration with the Allegheny County Parks Department and the Allegheny County Parks Foundation, WPC has identified locations within Deer Lakes Park where green infrastructure facilities can help address stormwater runoff and its impact on the landscape and water quality. Staff members from WPC, ACPF, and Allegheny County Parks identified locations where stormwater runoff is creating issues including non-point source pollution, erosion, and sedimentation. The issues present within the park are consistent with stormwater management problems throughout the region, wherein wet weather runoff damages the landscape, water quality, stream morphology, and wildlife habitat. Excessive runoff typically stems from large areas of impermeable surfaces such as parking lots, roads, buildings, and sidewalks. Even lawn areas can create similar runoff issues where compacted soils can act much like pavement and other impermeable surfaces. Throughout the Allegheny County Parks system, this runoff is typically discharged to open greenspaces such as fields, forests, and lawn areas where the flush of hot, dirty water from impermeable surfaces results in these negative impacts.

Properly designed green infrastructure facilities such as rain gardens, bioswales, green parking lots, permeable pavement, and green roofs are effective and affordable at controlling excess stormwater runoff through retention, slow release, and infiltration facilitated through natural features including plants and rocks. Design of these facilities should be based upon hydrologic analyses by qualified professionals (typically engineers) to determine runoff rates and the capacity of the facilities. The design of the facilities should be completed by landscape architects that specialize in green infrastructure design and have the expertise to develop appropriate planting plans, design specifications, and monitoring and maintenance plans for green infrastructure approaches. Designs can vary greatly based on the need, budget, location, and association with other features of the built environment. They can be very basic and low maintenance like a mowed swale or be elaborately landscaped or complex like large bioswales, green parking lots, or green roofs. Regardless of the design, the engineer and landscape architect should develop short- and long-term operating and maintenance plans for the facilities to ensure optimal function and sustainability.

"Conventional" stormwater infrastructure focuses on capture and conveyance via catch basins and pipes and concentrates runoff for retention, release, and/or treatment. Conventional infrastructure approaches provide the single service of stormwater management and are typically and purposely not visible or accessible. Conversely, green infrastructure approaches to stormwater management provide a multitude of benefits. Green infrastructure is typically designed to intercept stormwater runoff before it enters the conventional sewer system. In general, the function is to mimic natural processes through the use of plants, rocks, pools, and/or weirs and to promote infiltration into the ground rather than conveyance into a storm sewer. The use of natural materials and the design approaches for green infrastructure make the facilities conducive to enhancing the appearance and function of a landscape, parking lot, or building. Unlike conventional sewer infrastructure, people can enjoy and interact with green infrastructure facilities through plantings, maintenance, or simple observation. The plants and trees can provide habitat and food for wildlife, improve air quality, and provide seasonal interest through blossoms and foliage. Green infrastructure can also be an added-value investment in high profile or high-use areas including park gateways, trail heads, playgrounds, picnic shelters, buildings, and more.

2.3.1 GREEN INFRASTRUCTURE APPROACHES

Green infrastructure approaches are widely recognized as effective, affordable, and attractive ways to address stormwater runoff, water quality, and other environmental issues. The U.S. Environmental Protection Agency (EPA) has developed definitions for the most common green infrastructure approaches as described below.

Rain Gardens

Rain gardens are small, shallow, sunken areas of plantings that collect stormwater runoff from roofs, streets, and sidewalks. Also known as bioretention cells, they are designed to mimic the natural ways water flows over and absorbs into land to reduce stormwater pollution.

Bioswales

Bioswales, often found along curbs and in parking lots, use vegetation or mulch to slow and filter stormwater flows.

Green Parking Lots

Many green infrastructure elements can be seamlessly integrated into parking lot designs. Permeable pavements can be installed in sections of a lot and rain gardens and bioswales can be included in medians and along the parking lot perimeter. When built into a parking lot, these elements also reduce the heat island effect and improve walkability in the area.

Permeable Pavement

Permeable pavements infiltrate, treat, and/or store rainwater where it falls. They can be made of pervious concrete, porous asphalt, or permeable interlocking pavers. This practice could be particularly cost effective where land values are high and flooding or icing is a problem.

Green Roofs

Green roofs are covered with growing media and vegetation that enable rainfall infiltration and evapotranspiration of stored water. They are particularly cost-effective in dense urban areas where land values are high and on large industrial or office buildings where stormwater management costs are likely to be high.

Examples of Green Infrastructure in the Allegheny County Parks

The Allegheny County Parks Department and the Allegheny County Parks Foundation have implemented several substantial green infrastructure projects, guided by recommendations provided by WPC through previous ecological assessment projects in other county parks. As described above, these projects not only serve the function of stormwater management but provide an array of complementary benefits including beautification, habitat enhancement, and air quality improvement. Their presence in high profile locations has the added benefit of educating the public on the concept and benefits of green infrastructure.

Round Hill Park Rain Garden.

Green parking lot with perimeter bioswales and rain gardens in South Park.

Watershed Modeling Data

For project planning purposes, WPC utilizes the free online "Model My Watershed" tool to estimate the efficacy of green infrastructure modifications to the project recommendations in this report. As stated on the Wikiwatershed website, "Model My Watershed is part of Stroud Water Research Center's WikiWatershed initiative. WikiWatershed is a web toolkit designed to support citizens, conservation practitioners, municipal decision-makers, researchers, educators, and students to collaboratively advance knowledge and stewardship of fresh water."

This data is intended only for planning purposes. Hydrologic analyses and runoff models should be undertaken by qualified professionals prior to construction of any green infrastructure facility. Modelling data generated by the Wikiwatershed "Model My Watershed" web toolkit is required for several Pennsylvania state agency grant programs that fund watershed protection analysis and implementation projects.

2.3.2 POTENTIAL GREEN INFRASTRUCTURE PROJECTS FOR DEER LAKES PARK

At 1,180 acres, Deer Lakes Park is the fourth largest of the nine Allegheny County parks with landcover consisting of 70% forest (820 acres) and 21 acres of paved, impermeable surfaces such as roads and parking lots. The lakes for which the park is named include three lakes—the Upper or "West" Deer Lake, the Middle, and Lower Deer Lakes. The upper lake existed prior to the founding of the park, while the middle and lower lakes were constructed in the 1960s and '70s with the development of the park. These lakes were ecologically assessed most recently in 2022. Sedimentation and invasive species significantly affect the health and function of the lakes, with the middle and lower lakes being more impacted. The lakes are major assets for the park, but their current condition impedes their intended use for fishing. Notable to the lakes is the presence of freshwater sponges that were identified through 2022 ecological assessment of the lakes. The assessment specifically calls for the treatment of the invasive white waterlily and dredging the lakes to a depth that would promote greater species diversity and ecological function.
Deer lakes Park is also home to the only disc golf course in the Allegheny County Parks system. The course includes 18 holes over approximately 250 acres, consisting largely of mowed fairways that are compacted and mimic impermeable paved surfaces, in terms of generating stormwater runoff, in some areas identified through this analysis. Overall, there are significant opportunities to implement green infrastructure facilities throughout the park for water quality improvements and the many ancillary benefits provided by these approaches. Below are some green infrastructure concepts that can be pursued for implementation.

Blue Gill Shelter Rain Garden, Stormwater Berm, and Check Dams
The Blue Gill Shelter is adjacent to the 7th, 8th, and 9th fairways of the Deer lakes Disc Golf Course. Runoff from the course makes its way from the mowed, compacted fairways, passes the shelter, and flows downhill toward the Blue Gill Shelter parking lot. The runoff creates modest erosion near the shelter, then results in substantial erosion as it flows downhill to the parking lot. This runoff enters storm drains that discharge into the streams and ultimately the lakes of the park, adding to sedimentation. Allegheny County Parks Department and Parks Foundation staff indicated a few potential remedies for controlling the runoff at the Blu Gill Shelter location, including the installation of a rain garden and a vegetated berm to intercept the runoff near the Blue Gill shelter, the use of retentive grading, and check dams on the steep slope descending to the parking lot.

Partners evaluating green infrastructure options near the Blue Gill Shelter adjacent to the disc golf course.

Deer lakes Disc Golf fairways 7, 8, and 9 adjacent to the Blue Gill Shelter. The mowed fairways are compacted and generate stormwater runoff.

Other recommendations for reducing stormwater runoff in this area include biannual aeration of the fairway turf to promote infiltration and creating mulched beds around the clusters of trees along the fairways. These are simple, low-cost solutions that could be completed by park staff with park equipment.

Erosion between the disc golf course and Blue Gill Shelter. Stormwater runoff flows toward the steep slope to the parking lot. Retentive grading could be used in this area.

Substantial erosion on the slope between the Blue Gill Shelter and the parking lot. Check dams would slow and retain any runoff not managed by the introduction of the rain garden, berm, and retentive grading above.

FIGURE XXIII

Rain Garden Approach for the Deer Lakes Blue Gill Shelter Area

The simple map above was produced with the "Model My Watershed" application described earlier in this section of the report. The application can provide basic information on the amount of runoff controlled by particular types of green infrastructure approaches like rain gardens, porous paving, vegetated basins, and green roofs. This modelling scenario represents the installation of a rain garden. It does not include the berm, retentive grading, or check dams discussed among the partners, although those elements could be part of an effective green infrastructure approach to the site.

For project implementation, hydrologic analysis, landscaping, and construction design would need to be completed by certified professionals for project implementation, but the Model My Watershed application can give park staff a good tool for estimating and demonstrating the impact of a green infrastructure project on stormwater management capacity and water quality improvements. Project implementation should include the following:

- Hydrologic analysis to determine runoff volume from nearby impermeable surfaces
- Infiltration testing
- Land survey
- Design of the rain garden (contracted or in-house) to meet desired stormwater runoff capture goals. Controlling 100% of the first inch of runoff is a common approach in this region.
- Construction—excavation, grading, connection to existing sewer/catch basin if present, stone and plants installations
- Maintenance and monitoring
- Informational signage

Based on the Model My Watershed application, the Blue Gill Shelter rain garden would intercept 98% of a 24 hour 1" storm.

Specific Metrics:

- The drainage area is approximately 74,000 square feet.
- The addition of a 2,230 square foot rain garden near the shelter would intercept and infiltrate 76% of a 1" 24-hour wet weather event and eliminate runoff altogether.
- Infiltration would increase from 73% to 76% (the other 22% is evapotranspiration)
- The rain garden would completely remediate suspended solids, Nitrogen, and Phosphorous during a 1" wet weather event
- Modeling data specific to this project can be accessed online at https://modelmywatershed.org/project/48430/

TABLE VII

Deer Lakes Park Blue Gill Shelter Rain Garden				
Category	Description	Unit Cost	# of Units	Total
Plants & Supplies				
Shrubs	Native shrubs appropriate for GI	$40.00	200	$8,000.00
Perennials & Grasses	Native grasses & perennial flowers for bioswales	$35.00	2500	$87,500.00
Planting supplies	Mulch, soil, stakes, fencing, tie	$5,000.00	1	$5,000.00
Subtotal				$100,500.00
Contracted Professional Services				
Landscape Architect	Design services, plant selection and sourcing, drawings, meeting coordination and facilitation, planting oversight	$150.00	150	$22,500.00
Civil engineering	Construction Drawings	$150.00	100	$15,000.00
Construction of GI	GI facilities--rain garden, berm, retentive grading, check dams	$100,000.00	1	$100,000.00
Develop and implement monitoring GI, including equipment	Monitoring protocol developed to integrate into the construction and operation of the GI facility. Monitoring all facilities for at least one year.	$7,500.00	1	$8,000.00
Survey	Land survey for construction	$4,000.00	1	$4,000.00
Subtotal				$149,500.00
Total				$250,000.00

Crayfish Drive Rain Garden

There is an additional, high visibility opportunity to control stormwater runoff and reduce erosion near the intersection of Kurn Road and Crayfish Drive. Stormwater runoff from Kurn Road flows into the adjacent, sloped area near Crayfish Drive, passes under Crayfish Drive through a culvert, and enters the wooded area on the other side of the road. The runoff creates significant erosion at and around the outfall and enters the small unnamed stream.

Erosion present at the culvert going under Crayfish Drive. Kurn Road is in the upper right corner of the photo.

Erosion at the culvert under Crayfish Drive, with the wooded area beyond.

Significant erosion from stormwater runoff in the wooded area below Crayfish Drive.

FIGURE XXIV

Based on the Model My Watershed application, the Crayfish Drive rain garden would intercept 98% of a 24 hour 1" storm.

Specific Metrics:

- The drainage area is approximately 18,100 square feet.
- The addition of a 670 square foot rain garden above the culvert would intercept and infiltrate 78% of a 1" 24-hour wet weather event and eliminate runoff altogether.
- Infiltration would increase from 73% to 78% (the other 20% is evapotranspiration)
- The rain garden would completely remediate suspended solids, Nitrogen, and Phosphorous during a 1" wet weather event
- Modeling data specific to this project can be accessed online at: https://modelmywatershed.org/project/48431/

TABLE VIII

Deer Lakes Park Crayfish Road Rain Garden				
Category	Description	Unit Cost	# of Units	Total
Plants & Supplies				
Shrubs	Native shrubs appropriate for GI	$40.00	50	$2,000.00
Perennials & Grasses	Native grasses & perennial flowers for bioswales	$35.00	750	$26,250.00
Planting supplies	Mulch, soil, stakes, fencing, tie	$2,000.00	1	$2,000.00
Subtotal				$30,250.00
Contracted Professional Services				
Landscape Architect	Design services, plant selection and sourcing, drawings, meeting coordination and facilitation, planting oversight	$150.00	50	$7,500.00
Civil engineering	Construction Drawings	$150.00	30	$4,500.00
Construction of GI	GI facilities--rain garden, berm, retentive grading, check dams	$30,000.00	1	$30,000.00
Develop and implement monitoring GI, including equipment	Monitoring protocol developed to integrate into the construction and operation of the GI facility. Monitoring all facilities for at least one year.	$3,000.00	1	$4,000.00
Survey	Land survey for construction	$4,000.00	1	$3,750.00
Subtotal				$49,750.00
Total				$80,000.00

Pike Shelter Parking Lot

The Trout Shelter parking lot is one of the most heavily used parking lots in Deer lakes Park. Half of the lot could be converted to permeable paving and/or perimeter rain gardens could be installed to help control stormwater at this location. The planning, design, and construction process would follow the same protocols as outlined above for the rain gardens, including the analysis, landscape design, engineering, construction design, construction, and monitoring and maintenance components.

Culvert Improvements

Culverts discharging runoff from parking lots and roads are an opportunity for small green infrastructure facilities. The culverts are common features throughout the Allegheny County Parks system and typically discharge into lawn areas around park shelters, playgrounds, and restrooms. This approach was described in detail in the Ecological Assessment and Action Plans for White Oak and Round Hill Parks. While individually small in scale, these culverts are widespread and present a cumulative issue on erosion and sedimentation in nearby streams. The culvert pictured below, with outfall from the Minnow parking lot, creates erosion with the hot flush of stormwater runoff and negatively impacts water quality.

Minnow Parking Lot Storm Drain.

Culvert outfall in nearby forest.

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Japanese knotweed: https://extension.psu.edu/japanese-and-giant-knotweed
Tree-of-Heaven: https://extension.psu.edu/tree-of-heaven
Common Teasel: https://plantscience.psu.edu/research/projects/wildland-weed-management/publications/working-lands-factsheets/common-teasel
Roundleaf bittersweet: https://extension.psu.edu/oriental-bittersweet
Callery pear: https://extension.psu.edu/callery-pear
Japanese stiltgrass: https://extension.psu.edu/japanese-stiltgrass

SECTION III - GENERAL RECOMMENDATIONS

Adult spotted lanternfly. Credit: Jon-Marc Burdick, Cameron County Conservation District (Pennsylvania iMapInvasives Database - Presence record #1071021

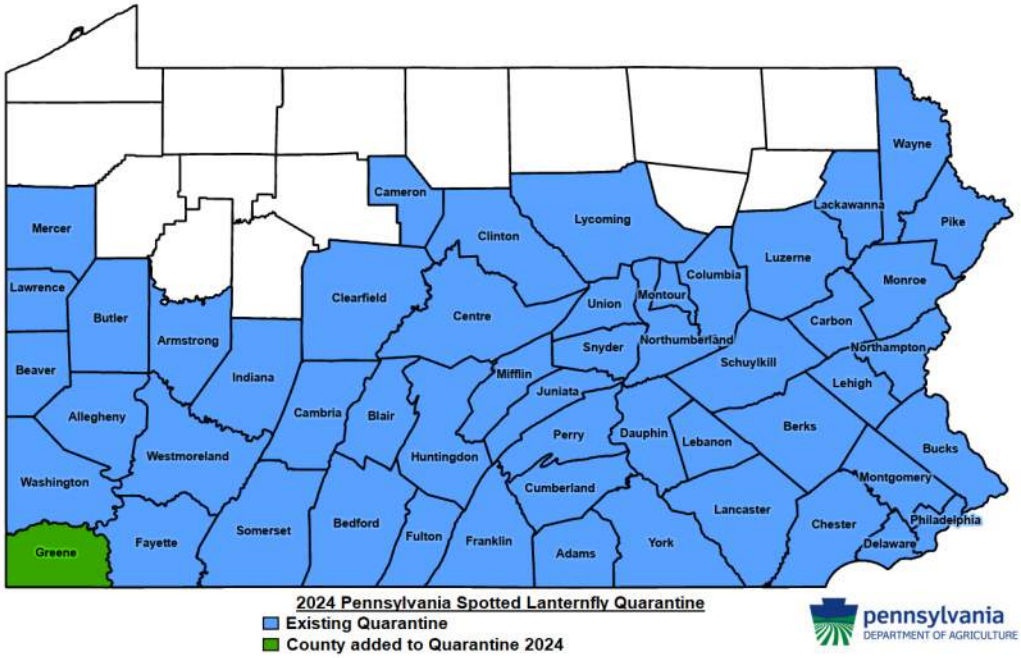
3.1 SPOTTED LANTERNFLY IN PENNSYLVANIA

The spotted lanternfly (*Lycorma delicatula*) (SLF) is an invasive pest native to China, India and Vietnam. This insect is a type of planthopper with colorful markings on its wings and body. Though it may appear attractive on the surface, the spotted lanternfly continues to cause significant economic damage to the agricultural, forestry and tourism industries and poses a severe threat to our local and regional ecosystems. It's also a nuisance to business and homeowners due to the sticky "honey dew" it excretes that encourages the growth of a black, sooty mold. This mold is not harmful to humans, but can cause damage to plants and make outside recreational areas unusable.

Spotted lanternflies are often found on vegetation and are known to feed on the sap of over 70 different plant species. These include grapevines, maple trees, black walnut, birch, willow and other trees. It also has a strong preference for the invasive tree-of-heaven (A*ilanthus altissima)* which is (unfortunately) quite prevalent in much of Pennsylvania.

Spotted lanternfly was first found in the United States in September 2014 in Berks County, PA. It has since spread to 34 counties in Pennsylvania (or half of the state), as well as several other states.

FIGURE XXV

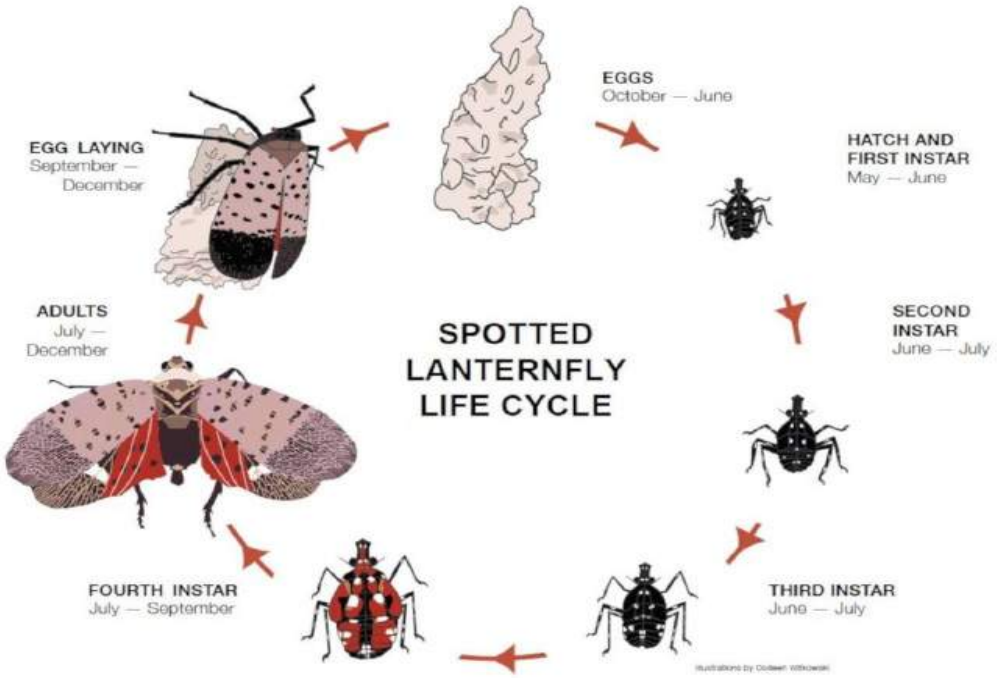


This map shows the current extent of the spotted lanternfly quarantine zone in Pennsylvania as of 2024. Credit: Penn State Extension

The lifecycle of spotted lanternfly begins with a female laying her eggs (i.e., an egg mass) on any hard surface she can find such as a tree, picnic bench, car, truck, trailer, etc. Eggs are laid from September through December and will overwinter into spring. The first instars (or nymphs) of spotted lanternfly are black in color with white dots on their back. These nymphs emerge from an egg mass in May-June and molt into larger instars throughout the summer months. They eventually change their color from black to red and beginning in July, will transform into adults that resemble colorful moths. Adult spotted lanternflies are noticeable from July through December, and beginning in September, will begin the life cycle over again with the females laying their eggs.

If any life stage of a spotted lanternfly is observed (egg mass, instars, adults), it's important to report your finding to the Pennsylvania Department of Agriculture and Penn State Extension. An easy-to-use online tool has been developed for this specific purpose and is accessible at https://services.agriculture.pa.gov/SLFReport/.

FIGURE XXVI



The lifecycle of a spotted lanternfly involves several different stages including an egg mass, various instars (nymphs), and finally an adult insect.

Spotted lanternfly is just one of several other tree pests to be on the lookout for in the Commonwealth. Other insects that can cause harm to our urban and natural forests include:

TABLE IX

Common Name	Scientific Name	Notes
Asian Longhorned Beetle (ALB)	*Anoplophora glabripennis*	To date, ALB has not been found in PA.
Hemlock Woolly Adelgid	*Adelges tsugae*	-
Elongate Hemlock Scale	*Fiorinia externa Ferris*	-
-	*Lymantria Dispar*	Formerly known as Gypsy Moth
Oak Wilt	*Ceratocystis fagacearum*	Also known as Bretziella fagacearum
Root Rot	*Phytophthora spp.*	Also known as Sudden Oak Death

More information about the spotted lanternfly can be obtained from:

Penn State Extension
Pennsylvania Department of Agriculture
Cornell College of Agriculture and Life Sciences

Spotted lanternfly nymphs. Credit: Nicholas Macelko (Pennsylvania iMapInvasives Database - Presence record #955014)

3.2 IMPROVING PERSONNEL RESOURCES FOR ECOLOGICAL STEWARDSHIP

The following recommendations address the development of personnel capacity to implement the ecological stewardship recommendations in our report. Ecological management is a relatively new focus for the county parks department, and it is being added on top of existing functions and duties for staff. Implementation can be improved through addition of staff expertise and capacity.

General Recommendations

Add Dedicated Ecological Stewardship Staff

Park rangers and landscape architects have done a tremendous job in adding ecological expertise and capacity to the County Parks organization. The development of native meadows, vastly improved management of trail systems to prevent ecological degradation, ecological interpretation for the public, and initial efforts at invasive species control are some of their accomplishments. However, needs for invasive species management, deer exclusion from sensitive areas, native species restoration, and green infrastructure development continue to expand, and there is a large gap between these needs and current staff capacity. Hiring staff with expertise in these areas will add capacity, and dedicated personnel can develop long-term plans to meet these ongoing needs and improve the ecological health of the parks.

Expertise can be configured in various ways. Most of the above-mentioned tasks require a fair amount of labor that can be provided by staff or volunteers with fairly minimal training. However, adding some staff with more extensive training and experience in ecological restoration will be important to developing long-term site plans grounded in ecological science, and effectively managing and training technicians and volunteers. Retaining and advancing staff hired at technician levels can allow for development of in-house expertise and improved long-term implementation.

Consulting other park systems that manage their lands for public recreation and also have well-developed ecological stewardship programs may be helpful in creating a long-term vision for building ecological stewardship capacity. The following organizations fit these criteria. They have a variety of staffing structures in terms of managers vs technicians and their training and background, which could be useful to explore. Their managers may be able to help assess staff needs for various tasks per managed acreage.

- Cleveland Metroparks
- St. Louis City Parks
- Lake County Forest Preserves (Illinois, Chicago area)
- Cleveland Museum of Natural History preserve management division.
- Chesapeake Wildlife Heritage (Maryland)

Offer Training to Build Stewardship Capacity in Existing Staff

Ecological stewardship introduces new tasks and sometimes requires changing existing practices. The Parks system can facilitate existing staff taking a more active role in meeting these challenges by offering trainings and incentives. Evaluate what tasks various staff groups are most likely to be able to contribute to, or have interest in, ie invasive species management, green infrastructure construction, improved mowing practices, etc., and offer customized trainings.

Standardize Best Practices Within the Parks System

Across the Allegheny County Parks system, innovative staff have developed ways to implement best practices around various aspects of sustainability and ecological stewardship. Successfully incentivizing maintenance staff to avoid tree collisions during mowing, seeding rights-of-way and other early successional areas with native species, implementing runoff BMPs, and converting mowed areas to native meadows are all examples. The park system should inventory these practices and take steps to standardize them across the organization.

Continuing to recognize and encourage innovation will also help the Parks system to build on these successes and continue to transform as needed in a more sustainable direction.

Share Expertise Regionally

Many local organizations face similar environmental and ecological stewardship challenges in managing properties open to the public. Local and regional park systems and land trusts all must contend with invasive species, deer management, and ecological restoration, while also balancing public use, education, and engagement. Many have similar aims to increase the overall sustainability of their operations in terms of energy use, infrastructure impacts, and consumption/waste production. Sharing best practices across organizations locally could further build expertise and capacity. Possibilities could include:

- A regional gathering or conference
- Staff skill shares or work exchanges
- Local working groups on specific topics, ie green infrastructure development, invasive species management, deer management etc.
- Periodic group calls or meetings exploring different topics, with organizations each sharing expertise.
- Site or project tours hosted by different organizations.

3.3 PARK STAFF TRAINING

Tree Planting and Care (Tree Tender Training)

WPC has been working with the non-profit Tree Pittsburgh since 2008 through the TreeVitalize Pittsburgh project. An important component of the success of that project has been the training of volunteers through Tree Pittsburgh's "Tree Tender" program. Tree Pittsburgh has trained over 1,600 Tree Tenders in Allegheny County through an eight hour workshop that covers everything from the benefits of trees to communities to the planting and care of trees over the long term. Based on past recommendations from earlier Ecological Assessments, the Allegheny Count Parks staff have undergone Tree Tender training to support the long term health of newly planted trees. WPC continues to recommend that new Allegheny County Parks Maintenance staff undergo Tree Tender Training to promote the sustainability of ongoing tree plantings in the parks.

Volunteers and staff plant and protect restoration trees during a planting along a river trail in Pittsburgh's South Side.

3.4 ECOLOGICAL MANAGEMENT RECCOMENDATIONS FOR THE DISC GOLF COURSE

The disc golf course at Deer Lakes Park is a major component of the park's appeal. It attracts numerous disc-golfers from the region to play an 18-hole course that spans through mature forest. Unfortunately, the high amounts of foot traffic associated with the course result in significant impacts to the park's ecosystem. There is currently severe devegetation, soil compaction, and erosion in much of the course.

There are now several examples of disc golf courses that have been developed in partnership with conservation organizations, with the explicit goals of avoiding ecological impacts and even improving ecological health, while creating an interesting and aesthetic course. We recommend building a similar partnership of stakeholders to re-evaluate the Deer Lakes course, by bringing in professional course design expertise and engaging ecological experts, Allegheny County Parks staff, and representatives of the local disc golf community in an evaluation and redesign process.

An example of significant erosion occurring in a small stream ravine as a result of high foot traffic from disc golf course usage.

Conservation & Disc Golf Partnerships

Toronto & Region Conservation Authority Courses: The local conservation authority worked with ChainLink disc golf, a course design and consulting company, to design a course on one of TRCA's reserve properties. Course designers Cara Hovius and Jeff MacKeigan reflected on the experience (Williamson 2023):

Finalizing plans that all stakeholders approved and the eventual installation of the TRCA courses took over 2.5 years. During the process, Hovius and MacKeigan [of ChainLink disc golf] learned from various experts in conservation and property management fields.

"We've worked with ecology, archaeology, ornithology, the operations team, and their operations maintenance team," MacKeigan said. "We learned how to consider things like creating a fairway so they could cut grass without impacting trees while reinforcing the protection of butterfly habitat."

Hovius said the experience has made them adept at designing courses whose construction restores areas to more natural states.

"We're able to identify invasive species and go about properly removing those invasive species," Hovius said. "It's amazing. There are times where you go through a piece of land and when you remove the invasive species, it totally changes the look and might totally change where you place your hole. So rather than removing a perfectly good tree, you have the opportunity to remove invasives that might otherwise choke out the native plants."

MacKeigan added that they sometimes altered fairways significantly to target invasive species.

The ChainLink Disc Golf consultants summarized their experience in an article for Disc Golf magazine (MacKeigan and Hovius 2024)

McHenry County Conservation District in Illinois: another partnership to develop a course on conservation district land. *"The course is very low impact....It's located in an area that was overgrown with thick brush and non-native trees. It's not intruding on any sensitive areas and is so much less impactful than traditional golf. We don't use any fertilizers whatsoever."* (McGlynn 2022)

PDGA's Throw Green initiative: the Professional Disc Golf Association's environmental committee is researching and compiling best practices in sustainable course design and management. https://www.pdga.com/throwgreen

Current Conditions at Deer Lakes

The majority of the Deer Lakes course spans across the Middle Lake Watershed and the West Lake Watershed, two ecological integrity areas which are noteworthy for their mature forest stands of oaks and other hardwoods. Although these mature forests generally have "good" ecological integrity overall, the fairways where disc-golfers travel between tee-off spots and baskets are heavily trampled, resulting in significant soil compaction, de-vegetation, and soil erosion. Compacted soils have fewer natural voids and small spaces for air, as soil particles are tightly packed compared to natural, undisturbed soils. These soil conditions are not ideal for plants to take root, and the few plants that are able to establish in the fairways are further trampled by foot traffic. This has resulted in large areas in the forest understory that significantly de-vegetated and have very low diversity. This loss of vegetation led to significant soil erosion from both foot traffic and stormwater runoff, especially on slopes.

Some herbaceous species emerge within an impacted understory area within the disc golf course. Note significant absence of leaf litter and duff, and presence of exposed, bare soil.

General Recommendations

There are several options available to mitigate these impacts. These options would be most effective if implemented together. Consider consulting a professional disc golf course designer to implement these recommendations for the best possible outcomes that address the ecological impacts while maintaining a course that is interesting and appealing to disc golfers.

- Mulch the fairways, starting with the ones that are most impacted by soil compaction. This will cushion the soil to reduce impaction overall and replenish organic matter and nutrients to the forest understory. Take care to source mulch that is not contaminated with invasive seed.
- Clearly define trails through fairways to concentrate the impacts to narrow, manageable sections. Players will still need to leave these trails to retrieve discs, but having dedicated trails should narrow the fairway's overall foot print the understory. Apply trail design and maintenance BMPs to these fairway trails. Currently, several fairways are routed across slopes that are far steeper than a trail would ever be sited on, with the expected result that there is significant erosion.
- Monitor fairways for thorny and thicket-forming invasive shrubs and remove them as they appear. By controlling these species, the forest understory can remain navigable for players that need to retrieve their discs. Species to target for removal include: multiflora rose, Japanese barberry, privets, and bush honeysuckles.
- Re-map and rework holes to use them as a restoration tool. Clear areas that are dense with successional and invasive vegetation and re-align holes to go through these clearings. This utilizes the high foot traffic and trampling to prevent the regeneration of invasive plant species. Avoid steeply-sloped areas and apply trail design and management BMPs.
- When trail definition or course movement results in a decrease in foot traffic in an area that has been heavily devegetated or eroded, develop restoration plans for that area. Deer browse protection will likely be necessary to obtain significant regrowth. If restoration plantings are considered, select species that are consistent with the naturally occurring plant community type found in the area.

3.5 REDUCE MOWING, PRIORITIZE ECOLOGICAL MANAGEMENT AND MAINTENANCE OF CAPITAL PROJECTS

As staff time availability increases with reduced mowing obligations, staff capacity should be re-allocated more heavily toward ongoing maintenance and management of the capital projects mentioned above.

- Invasive Weed Management
    - As described in previous sections of this report, managing invasive weed infestations of Deer Lakes Park is a priority management concern, and will continue to be into the future. Investments in tools and staff training are priority recommendations also mentioned in this section.
- Trail System Maintenance
- Green Infrastructure Maintenance
- Meadows and Reforested Areas Maintenance

3.6 PROCURE TOOLS AND EQUIPMENT

For invasive weed management, trail maintenance, meadow management, tree planting, fence building and maintenance. Procuring an adequate supply of the tools listed below will cost approximately $20,000 total, although the tools could be acquired as needed over the course of several months/years.

Hand Tools:

Hedge shears:	$20-$75 each (depending on size)
Hand pruners:	$15-$45 each
Loppers:	$20-$80 each (depending on size)
Bow saws:	$15-$30 each
Long reach pruners:	$75-$150 each
Picks mattock:	$15-$40 each

Specialty Tools:

Tree and root puller (Pullerbear):	$200
Root Talon:	$70
Root Buster:	$45
Tree planting dibble bar:	$35-$45 each

Power Tools:

Professional-grade chain saws:	$350-$600 each (depending on size and brand)
Professional-grade Pole saws:	$400-$700 each (depending on size)
Walk-behind brush cutter:	$1,500 - $3,000
Brush hog tractor attachment:	$2,000 - $4,000
Tree hole auger:	
Attachment for tractor with 3-point hitch:	$450-$1,000
Hand-held:	$200-$400

Goat herd:

- Use of goat herds to graze on invasive weeds has emerged locally as a potentially high impact, low cost strategy to be used in combination with other treatment methods, either chemical or mechanical. For example, spraying a systemic herbicide (i.e. tryclopyr or glyphosate) immediately following grazing by goats can create good conditions for herbicide absorb into the plants' vascular system, increasing the chances of a total kill of the unwanted vegetation.

- There is one location non-profit organization that uses goats as a way to manage invasive and unwanted plant species - Alegheny GoatScape - that used to to business as Steel City Grazers. WPC engaged Steel City Grazers on one project to control a small patch of Japanese knotweed and other invasives in the City of Pittsburgh that proved to be highly effective. The fee for that project was based on a $500 base fee plus $100 per day for a 10-goat herd with an expectation that it could take two to three weeks per acre to be cleared. Those fees included transportation of the goats, temporary electric fencing to contain the goats to the area being managed, a donkey whose role was to protect the goats from predators such as coyotes and feral dogs and daily care of the animals.

- Interest was also raised by County Park staff and others during the meetings conducted in conjunction with this project about the possibility of acquiring a permanent goat herd (or herds) to manage invasive weeds across the County Parks system. Because of recent notoriety, demand is quite high for privately owned goat herds. Acquiring a goat herd would help to ensure goats are always available for weed management.

- Goats themselves are relatively inexpensive to buy (sometimes even free). However, they do require good fencing, food and shelter during winter and inclement weather, transportation to and from weed management projects, protection from predators, and a knowledgeable caretaker.

3.7 DEVELOP A SUSTAINABLE TRAIL MANAGEMENT PLAN

In conjunction with training Parks staff on trail management and maintenance, developing a sustainable trail management plan that provides a comprehensive vision and management framework for all trails in Deer Lakes Park is a top priority. Such a plan should include broad stakeholder and public input, as well as engagement of trail design, construction and maintenance professionals.

The scope of the plan should include the following:

- Survey and evaluation of current and future trail usage.
- A comprehensive assessment and evaluation of the existing trail system by trail consultants.
- Identifying most appropriate trails for each permitted use.
- Identifying locations for development of new trailheads.
- A plan for interpretive signage and other outreach and educational ssets.
- Prioritizing trails/trail sections will be the focus of future maintenance efforts and developing detailed work logs.
- Garner broad stakeholder and public input.
- Training and project oversight for County Parks staff on trail construction and maintenance BMPs.
- Identifying trails to close/eliminate due to redundancy, illegal vehicle use or other problems.
- Plan for accessibility in compliance with the ADA.

A more detailed budget estimate should be developed based on soliciting proposals from outside consultants, but the total cost to develop the plan is likely to cost fanywhere from $25,000 to $120,000 depending on the contractor. The planning process would likely take at least two years to complete. For fundraising purposes, developing the Sustainable Trail Management Plan could be packaged with other recommended initiatives to develop an interpretive plan for Deer Lakes Park and to train County Parks' staff on trail management and maintenance.

Based on discussions held in conjunction with this project, it was also mentioned that the plan could be done in conjunction with a broader County Parks system wide trail planning effort that leverages the skill and expertise of the Allegheny County Park Rangers and Trail Pittsburgh, an organization that conducts extensive volunteer activities to protect and enhance trails for all park user groups.

3.8 LITERATURE CITED

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