Lakeshore
NATURE PRESERVE
UNIVERSITY OF WISCONSIN

EAGLE HEIGHTS WOODS MANAGEMENT PLAN

APPROVED

APRIL 11, 2013

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Executive Summary

Eagle Heights Woods, the westernmost 28 acres of the Lakeshore Nature Preserve, is a unique area within the Preserve. For thousands of years, the area has been a significant landscape feature for inhabitants of the Yahara chain of lakes. The prominent topography, rich cultural history and diverse biological community make Eagle Heights Woods an important resource for the University and greater community. It is a part of the Lakeshore Nature Preserve (Preserve), which occupies one third of the total area of campus, an incredible investment by the University! The 300 acres are cared for by the Preserve staff within Facilities Planning & Management with assistance from volunteers, the Grounds Department, Campus Planning and Landscape Architecture and private contractors.

The vision for Eagle Heights Woods, as outlined in the approved 2006 Lakeshore Nature Preserve Master Plan, seeks to promote a healthy oak woodland community that transitions to a red oak -mixed forest on the northern slope. In this ecosystem, the varied layers of vegetation capture the sun's energy, making it available to a complex community of organisms throughout the seasons. Rain falling on the site infiltrates the rich woodland soil, which teems with its own diversity of microorganisms. Community visitors, classes, students, staff and faculty roam paths for study and research and respite from busy university life.

Key goals for Eagle Heights Woods focus on vegetation management to accomplish the protection of the Native American burial mounds and promotion of a well-functioning natural community. To that end, the plan recommends removal of invasive vegetation that is threatening both the mounds and the biodiversity of the woods. To accomplish this, the plan proposes to take on a variety of management regimes in different zones over successive years. The invasive species of highest concern, buckthorn, has seeds that remain viable in the soil for five years or more. It will be important to remove buckthorn and other undesirable plants while encouraging establishment of native species. Most importantly, the area will require continual, long-term management to maintain the natural community.

A natural community is inclusive of vegetation, wildlife, geology, soils, hydrology, topography, microclimates, historic and cultural uses, and care of all of these are addressed in this plan. As people are another component of the community, the uses and mission of the Preserve to provide for protection of resources, teaching, research and environmentally sensitive use are supported by the recommendations.

> "When we try to pick out anything by itself, we find it hitched to everything else in the universe."
>
> John Muir

Introduction

Context
Eagle Heights Woods is the western most piece of the Lakeshore Nature Preserve. The Preserve encompasses 300 acres of the University of Wisconsin-Madison campus and stretches four miles along the shoreline of Lake Mendota from North Park Street to Shorewood Hills. The entire Preserve occupies approximately one third of the area of the 935-acre main campus.

Lakeshore Nature Preserve Mission:

The University of Wisconsin-Madison Lakeshore Nature Preserve permanently protects the undeveloped lands along the shore of Lake Mendota where members of the campus community have long experienced the intellectual and aesthetic benefits of interacting with the natural world.

The Preserve shelters biologically significant plant and animal communities for teaching, research, outreach and environmentally sensitive use and safeguards beloved cultural landscape features.

The Preserve is as essential to the university as its lecture halls, laboratories, and playing fields.

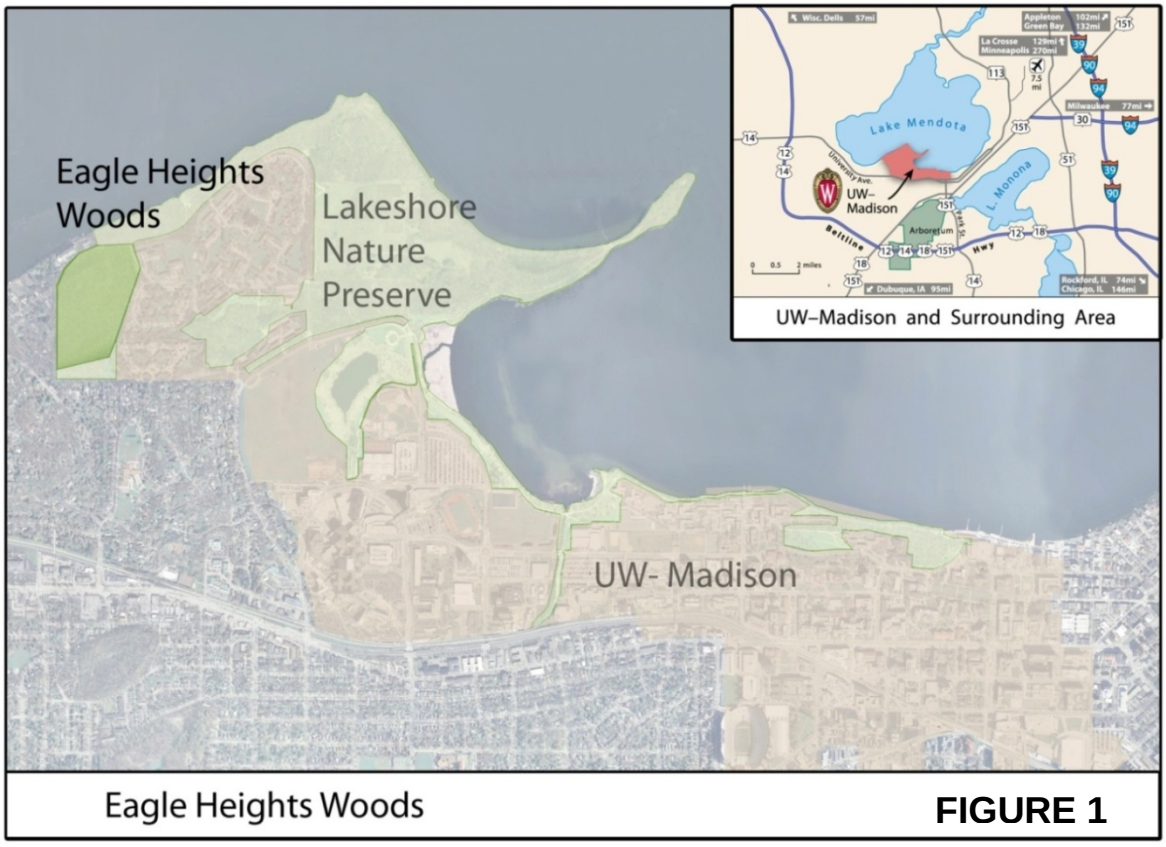
It contributes to a powerful sense of place and fosters an ethic of stewardship to promote mutually beneficial relationships between humans and the rest of nature.

University of Wisconsin – Madison, Lakeshore Nature Preserve Master Plan, June 7, 2005

Eagle Heights Woods' spring ephemerals
Photo by Glenda Denniston

Eagle Heights Woods is a 28-acre wooded area covering a high hill with slopes that face all aspects. The woods has a minimal amount of edge for its size. While the Lakeshore Nature Preserve is mostly in an urban setting, Eagle Heights Woods sits in an area with a lot of tree canopy cover. Directly adjacent to the west and south is the village of Shorewood Hills, a mostly single-family residential community with many large mature oaks and other shade trees. To the south, the University Houses Community Gardens creates a slight break in the canopy between the woods and Shorewood Hills. To the north of the woods, a steep slope leads down to the Lake Mendota shoreline. A portion of the lakefront is occupied by The Cove condominiums and a portion by Wally Bauman Woods, which forms the western extent of shoreline in the Preserve. Eagle Heights Apartments borders the woods to the east, with multifamily residential apartment buildings connected by open lawns and scattered trees. The top of Eagle Heights Woods sits an impressive 125 feet above Lake Mendota, the highest point along this lake's southern shore.

The setting is spectacular and has been prized since the time of the ancient mound builders, through the early homesteaders and into the present. Unique in its elevation, general lack of significant stormwater issues and wooded hillsides exposed to all directions, this is truly a gem. The potential for relaxation is great, as is the potential for teaching and research.



Management Plan Purpose
The Eagle Heights Woods is currently in a deteriorated condition but has great potential to become a better functioning natural community. The management plan described here will enhance the woods and lead to less labor-intensive maintenance to keep it healthy.

The 2006 Preserve Master Plan designates Eagle Heights Woods as dry-mesic woods. Due to the range of slope aspect (direction), steepness and moisture levels, the site will support a continuum of oak woods from oak woodland to red oak-mixed forest. The Master Plan also considers the area a Natural Area Management Zone, a designation which focuses on restoration and rehabilitation of naturalized landscapes. The Master Plan calls for rerouting of most of the trails on the east half of the woods. The entrances are to be tertiary at the northwest and southwest and secondary at the northeast. It calls attention to the view from the top of the hill.

This management plan summarizes the existing resources, identifies issues and opportunities, sets goals specific to Eagle Heights Woods and frames an approach for long term management.

> "The principle natural communities that have survived substantially intact after 160 years of post-European human actions are small patches of forest such as Eagle Heights Woods and Big Woods, and wetlands such as Picnic Point Marsh and University Bay Marsh. These pockets of relatively undisturbed vegetation harbor seed banks that, if given the right conditions, can help restore native plant communities."
>
> -Lakeshore Nature Preserve Master Plan 2006

Planning Process
The planning process included inventory of the site, staff and faculty input regarding teaching and research use, opportunity for stakeholder and public review at public meetings. A detailed outline of the process and schedule is given in Appendix A.

Description of Current Resources

The site's natural resources are presented below in two categories - **abiotic** (non-living) and **biotic** (living). Interactions between the abiotic and biotic form the underlying ecosystem processes that support a healthy ecosystem.

Abiotic Resources

Topography

This outstanding promontory on the south shore of Lake Mendota has steep slopes in all directions; all are greater than 6% and many are greater than 12%. There is also a flatter area along the top. This wooded area including all aspects (slope directions) is a unique topological condition in the Preserve.

Geology

Underlying the woods is a thin till over Prairie du Chien dolomite from the early Ordovician period. Underlying this layer of dolomite is a layer of Jordan sandstone, then sandy St. Lawrence dolomite and at lake level, Tunnel City sandstone. All of these date from the late Cambrian period. Some dolomitic stone is visible in rocky outcrops approximately half way up the slope on the south and west sides of the woods.

> Ecosystems are dynamic interrelated collection of living and not-living components organized in self-regulating units. Some degree of biodiversity exists in all ecosystems. An ecosystem is a unit because it has boundaries and can be distinguished from its surroundings. The living and non-living components affect each other in complex exchanges of energy, nutrients and wastes. It is these dynamic exchanges, both fast and slow, which provide ecosystems with their distinct identities. The characteristic exchanges within an ecosystem are called ecosystem functions and in addition to energy and nutrient exchanges, involve decomposition and production of biomass.
>
> - The Sustainable Scale Project web site

Stone outcrop in Eagle Heights Woods
Photo by Glenda Deniston

Soils

Although soil is an essential resource for supporting the biotic community and home to a host of microorganisms, not much is known about it at this location. According to the National Resources Conservation Service on-line soil survey, the thin till soil layer is made up of Whalan and McHenry silt loams on 6% and greater slopes. These soils are characterized as well drained and moderately to highly erodible. Fertility of this soil type is generally good.

Water

Another unique feature of the site is that it is not impacted by runoff emanating from outside of its boundaries. The only water on the site is that which falls directly on it, except for a few areas on south end of the west slope where water occasionally seeps from the hillside. Water in Eagle Heights Woods seems to follow a typical hydrologic cycle, exhibiting an erosive nature only along a few trails with long downhill stretches.

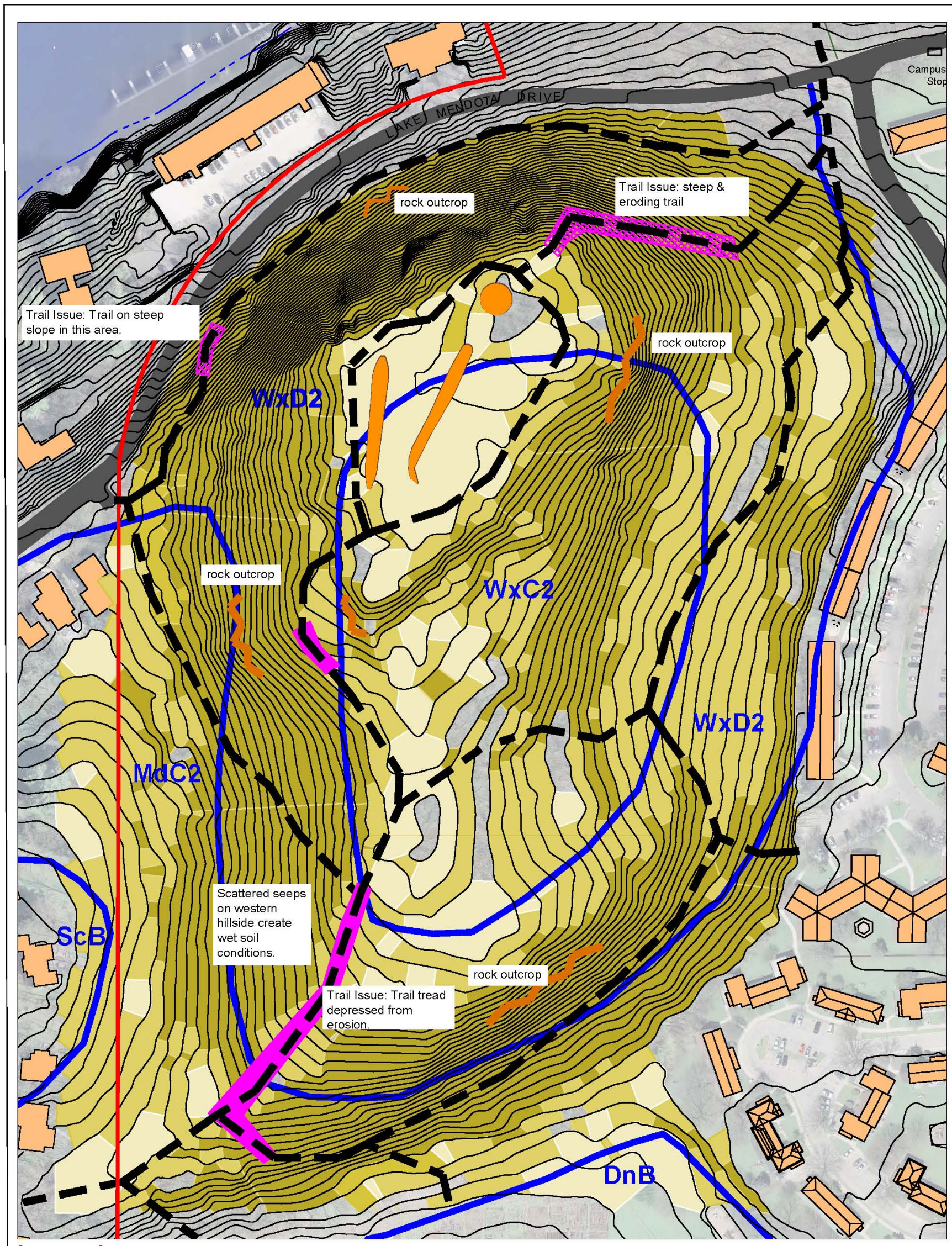
Climate

Madison has the typical continental climate of interior North America with a large annual temperature range and frequent short periods of temperature changes. There are no dry and wet seasons, but about 60 percent of the annual precipitation falls in May through September. Cold season precipitation is lighter. Soil moisture is usually adequate in the first part of the growing season. During July, August and September rainfall tends to be erratic and variable.

During the winter, on average, the ground is covered with 1 inch or more of snow about 60 percent of the time. The soil is usually frozen from the first of December through most of March. The growing season typically averages 175 days. (http://www.aos.wisc.edu/~sco/clim-history/stations /msn/msn.html)

Microclimates are small areas that have differing conditions due to the shape and exposure of the land. Here in Eagle Heights Woods, the microclimates vary with each slope aspect. The steep north slope provides a cool microclimate, while the southern slope is typically warmer and drier. This variety of climatic habitat types increases the woods' biodiversity.

Currently, there is much discussion about climate change and the extremes in long-term weather patterns it may cause. In the coming years, it will be necessary to include adaptive management approaches to changing climatic conditions that influence the community succession in Eagle Heights Woods.



Legend

Property Line
Trails
Mounds
Trail Erosion
Steep Trail

Topography
Slopes 0%-6%
Slopes 6%-12%
Slopes > 12%
2' Contour Intervals

Soil Type

WxD2	Whalan silt loam, 12-20% slopes, eroded
WxC2	Whalan silt loam, 6-12% slopes, eroded
MdC2	McHenry silt loam, 6-12% slopes, eroded
DnB	Dodge silt loam, 2-6% slopes
ScB	St Charles silt loam, 2-6% slopes

Geology

Layer of stone: thin till
Prairie du chien dolomite
Jordan Sandstone 980' elev)
Sandy St Lawrence dolomite
Tunnel city sandstone (lake level)
Shape & height due to ancient layering of sandstone & limestone. This hill is not a drumlin.

Hydrology

This is the only place in the Preserve where surface water is not draining onto the area from somewhere else.

Scale 1" = 60'
Rev. Feb. 1, 2013

Lakeshore Nature Preserve University of Wisconsin

Eagle Heights Woods-Abiotic Resources: topography, soils, geology, hydrology **Figure 2**

Biotic Resources

Vegetation

This site is wooded with a tall canopy dominated by oaks, a mid-story of various shade-tolerant trees and a shrub layer of invasive buckthorn and honeysuckle as well as some native shrubs. Due to the relative lack of disturbance in Eagle Heights Woods, the soil is likely to have a good seed bank of native ground layer herbaceous plants. In places where enough light reaches the forest floor, there remains a variety of native plant species. There is a particularly fine display of spring ephemerals in Eagle Heights Woods. The various aspects and steepness of the slopes affect the species of vegetation growing.

> Ecologists consider groups of different organisms at three levels of organization that become progressively more inclusive.
> Community – populations of different organisms that live together
> Ecosystem – a community together with the non-living factors with which it interacts
> Biome – major terrestrial assemblages of plants, animals, and microorganisms that occur over wide geographical area and have definite characteristics that identify them as distinct from other such assemblages.
>
> From ECONET website

The current canopy vegetation includes:

- South facing slope: black, white and bur oak with scattered shagbark hickory
- West facing slope: on the south end, white oak and black cherry transitioning to more red oak to the north
- East facing slope: on the south end, white oak, basswood and black cherry transitioning to more red oak
- Top of the woods: white oak, red oak, bur oak and shagbark hickory
- North facing slope: red oak, slippery elm, white ash, basswood

Understory trees in all areas are more shade tolerant species: ash, maple, black cherry, basswood and hackberry. The shrub layer is dominated by buckthorn and honeysuckle, with some interspersed red-osier dogwood, gray dogwood, chokecherry, raspberry, red elderberry and high bush cranberry. The ground layer vegetation persists especially in areas where trees have fallen or invasive shrubs have been removed and more light is reaching the ground.

Several plant inventories have been done in Eagle Heights Woods. They are included as appendices B, C, D and E.

Current vegetation at Eagle Heights Woods
Photo by Bryn Scriver

Canopy Tree Condition

Parts of the existing tree canopy are in decline. In 2005, red and black oak trees were removed along the west edge of Eagle Heights Woods to separate the root zones of oak trees on the UW side and the Shorewood Hills side of the property line. This was in the hopes of reducing the spread of oak wilt. Oak wilt is present throughout Dane County, but not all trees are affected.

Many oaks along the east trail have died as they tipped over the cause is unknown, perhaps they had weakened root systems. It has left the area with many large logs on the ground. Trees that are dead and in danger of falling onto a path or road are considered hazard trees and are cut and left on the ground.

Native American Burial Mounds

Another area of concern is the vegetation on the Native American burial mounds. Dead standing trees can tip over and turn up soil, while falling branches can create gashes, damaging the integrity of the mounds. Facilities Planning & Management staff removed the threatening trees in winter of 2012/2013 when the ground was frozen enough to complete the work without damage to the mounds, adjacent soil and vegetation.

Spring ephemerals on the conical mound
Photo by Bryn Scriver

Invasive Species

Despite heroic volunteer and staff efforts at removing buckthorn, honeysuckle and undesirable herbaceous plants, these invaders continue to be an issue. The dense shade from these plants increases the opportunity for propagation of shade-tolerant canopy trees, such as black locust, Norway maple and sugar maple. As light reaching the ground layer decreases, white and bur oak regeneration is suppressed. Thus, the woods is beginning to change in character and composition from its previous southern dry-mesic woods towards denser and more mesic woods. This is not uncommon in this type of woods. The inset to the right is a description from the Michigan Department of Natural Resources regarding the impact of invasive shrubs on forest communities in MI.

The dense monocultures created by invasive species are also a detriment to the overall biodiversity of the forest. This is of great concern because diverse ecological communities are healthier, more resilient and better able to adjust to environmental changes.

The areas where invasive understory plants have previously been removed are shown in Figure 3 along with other plants of concern. Buckthorn has returned to many of the areas previously cleared and is present in most of the rest of the woods, although not as dense. Poison Ivy can be found throughout the woods but is only considered a problem where it is adjacent to a path. Figure 3 also shows areas of black locust, Norway maple and sugar maple as well as the invasive herbaceous species.

> Prolific spread of non-native shrubs can competitively exclude oak species by casting dense shade over seedlings, preventing acorn contact with mineral soil, and altering ecosystem processes and soil chemistry. For example, common buckthorn can cause increases in soil nitrogen, carbon, pH, and moisture and modify mineralization rates (Heneghan et al. 2006) If left alone, common buckthorn becomes the dominant ecosystem driver while perpetuating itself and discouraging future oak presence.
>
> (Michigan Department of Natural Resources. 2007. Dry-mesic Southern Forest. MI Natural Features Inventory. Page 7)

Vegetation Along Edges and Trails

Edge issues at Eagle Heights Woods include undesirable species of plants, insects and animals that make their way into the woods, encroachment and human use that is not always beneficial to the woods. This is an issue particularly on the west edge where domestic plants are creeping into the woods. Some of these species, such as Japanese knotweed (*Polygonum cuspidatum*), are quite aggressive.

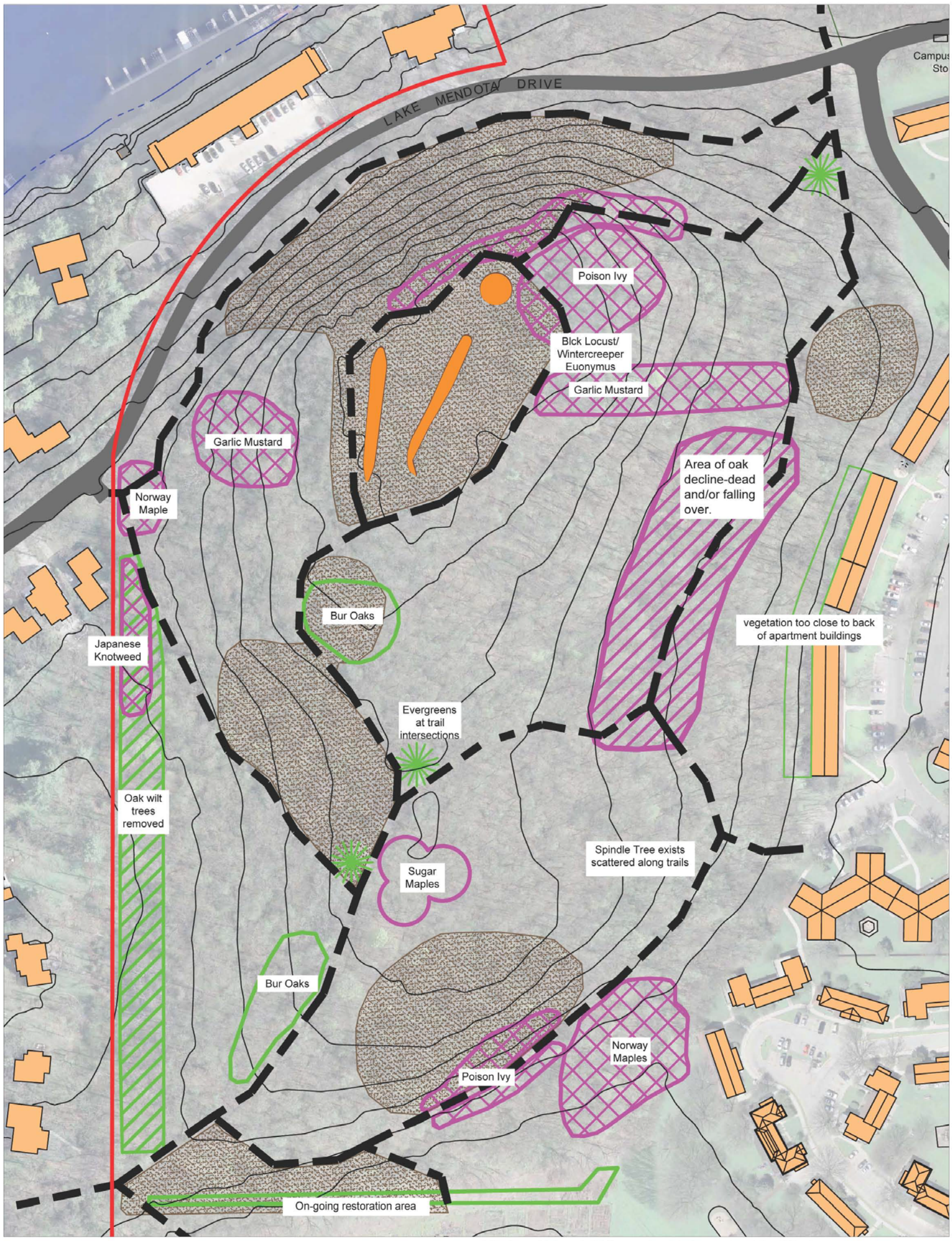
Thick buckthorn understory
Photo by Bryn Scriver

The south edge is adjacent to the community gardens, which presents issues of garden waste dumping. The southern edge has been the site of active restoration efforts by volunteers, who have removed non-native brush and planted native oak savanna species. The east and south edges back up to Eagle Heights housing and many children enter these edges to play in the woods. General use of the trails, occasional homeless camps and children playing in the woods all tend to bring in weed seed. The management plan must address all these issues.

In the 1940s, Edward Young cleared an area at the top of Eagle Heights Woods to build a home. Young died before the home was built, but some horticultural plants were introduced at this time. A dense groundcover of winter creeper (*Euonymus fortunei*) now marks the spot where the home was to be built.

Euonymus at Eagle Heights Woods
Photo by Bryn Scriver

Trail intersections were also marked with evergreen plantings that would not otherwise have grown in dry-mesic woods. It is suspected that the buckthorn invasion began in the 1960s spreading from hedges planted at the adjacent apartments.



Legend

- Property Line
- Trails
- Mounds
- 10' contours
- Understory cleared in the past

Birds: At least 113 regular bird species identified in a year, 45 of which breed here.
Breeding habitats include: Cavities in dead trees, mature deciduous trees, large evergreen trees and brush on edges.

Buckthorn concentrations and scattered plants exist in the woods. **Poison Ivy** exists in the woods. The areas shown are because of potential contact due to the trail. **Garlic Mustard** management occurs continuously throughout the woods.

Scale 1" = 60'
Rev. Feb. 1, 2013

Lakeshore Nature Preserve University of Wisconsin

Eagle Heights Woods-Biotic Resources: Vegetation

Figure 3

Wildlife
Wildlife inventories on this site are lacking except for the birds. Roma Lenehan, a local resident, avid birder and dedicated Preserve volunteer has been making bird observations since the 1970s, when as a child, she would spent hours in the woods bird watching. From her notes and many others' observations, much is known about the bird population. Roma led a successful campaign to have the entire Preserve designated as a Wisconsin Important Bird Area. There is a surprising number of bird species in Eagle Heights Woods for an area of only 28 acres. The continuous wooded area is a key factor in supporting the diversity of woodland birds found here. The Preserve itself has 118 acres of connected wooded area, including - places that have individual names but work together - Eagle Heights Woods, Wally Bauman Woods, Tent Colony Woods, Frautschi Point, Second Point Woods, Caretakers Woods, Picnic Point, Bills Woods and Muir Woods. In addition, the neighboring Village of Shorewood Hills has considerable tree canopy cover.

The Important Bird Area program began in Europe in the 1980's and made its way to the US in 1995. Wisconsin has 88 IBA's and the Lakeshore Nature Preserve is one of them. It is significant for the migratory bird concentrations in spring and fall as well as its resident bird populations. This program is based on voluntary participation by land owners there are no legal requirements associated with the designation.

The varied conditions of water to woods and food to shelter make the Preserve a great migratory bird stopover. Migrant neo-tropical birds (including many types of warblers) pass through Madison from late April to late May. The Preserve provides habitat to rest and forage during their long migration from the tropics to the Canadian forest breeding grounds. Likewise, the Preserve supports the fall migration from the end of August to the beginning of October, with even more birds stopping over because of young birds joining the flight.

The wooded areas of the Preserve on the south edge of Lake Mendota provide an ideal respite for the birds. When it is windy, especially from the west, birds can move from the shoreline where there are abundant insects, to Eagle Heights Woods for shelter. In the spring, they can take advantage of the food provided by early blooming trees such as oaks.

A comprehensive bird inventory was conducted in the early 2000s. More than 113 species of woodland birds were recorded each of the three years. Another 17 species were seen at least once. Thirty-six species were found to nest and breed in the woods. Twenty-two cavity-nesting species use mature or dead trees with holes as nest sites. Eleven generalist species use edge, brush or other habitat.

Neo-tropical birds have been declining for quite a few years and destruction of habitat in all parts of their journey is partly to blame. Eagle Heights Woods connects with other areas of the Preserve to form a largely uninterrupted canopy featuring a multi-level structure, with a good diversity of native plants. The Eagle Heights unit also has the most interior woodland habitat found in the Preserve.

One insect population reported is many millipedes along the east edge of the woods behind the apartment buildings. This causes some concern for the residents.

Cultural Resources

In addition to the rich natural resources of this site there are outstanding cultural resources. It is a restful place, where a visitor can find solitude with very little outside noise penetrating the woods. Views overlooking the

Around 2800 years ago, Native Americans began to construct earthen mounds for ceremonial use, often associated with human burial. About 1200 years ago, a unique form of burial mound was build. These effigy mounds were in the shape of spirit beings, animals and sometimes human-like figures and.

Mounds were frequently located in view of water and on an elevated site. It is generally believed that the mounds had important ceremonial, spiritual astronomical and territorial functions. As such, it was important that one could view the mounds from a distance, as well as looking outward from the mounds to the sky, water and beyond. The mounds were intended to be experienced within the context of the surrounding landscape as a whole.

Native American burial mound sites are a rare, endemic and endangered cultural resource.

lake from the top of the hill are spectacular in the winter. During the remainder of the year it is difficult to see beyond the trail due to the thick understory vegetation. Eagle Heights Woods is rich in historic and cultural resources and has been an attractive area to people since the Native Americans inhabited the region. At the top of the hill are three Native American burial mounds. They are officially referred to as the Eagle Heights Mounds Group, a catalogued Native American human burial site, Archeological Site Inventory number 47-DA-130. The protected site includes one conical mound, two linear mounds and an area extending outward for approximately 25 feet from the edges of the visible mounds. Regulatory protection of the mound groups is overseen by the Wisconsin Historical Society. Soil disturbance is to be avoided; if management requires soil disturbance it must be reviewed by the society prior to any work.

According to Charles E. Brown, archeologist, the Winnebago name for Eagle Heights hill was Sh-heta-ka (horse hill). The Winnebago believed that this highest hill on the shore was inhabited by a spirit horse, which could be heard neighing and stamping its feet at times. On cloudy or misty days the Native Americans believed the horse could sometimes be seen on top of the hill. They were said to climb this sacred hill to fast and dream and to gain inspiration and power form the spirit horse.

Brock, Thomas D. 1995. Eagle Heights. Historic Madison: A Journal of the Four Lakes Region. Volume XII. Page 39.

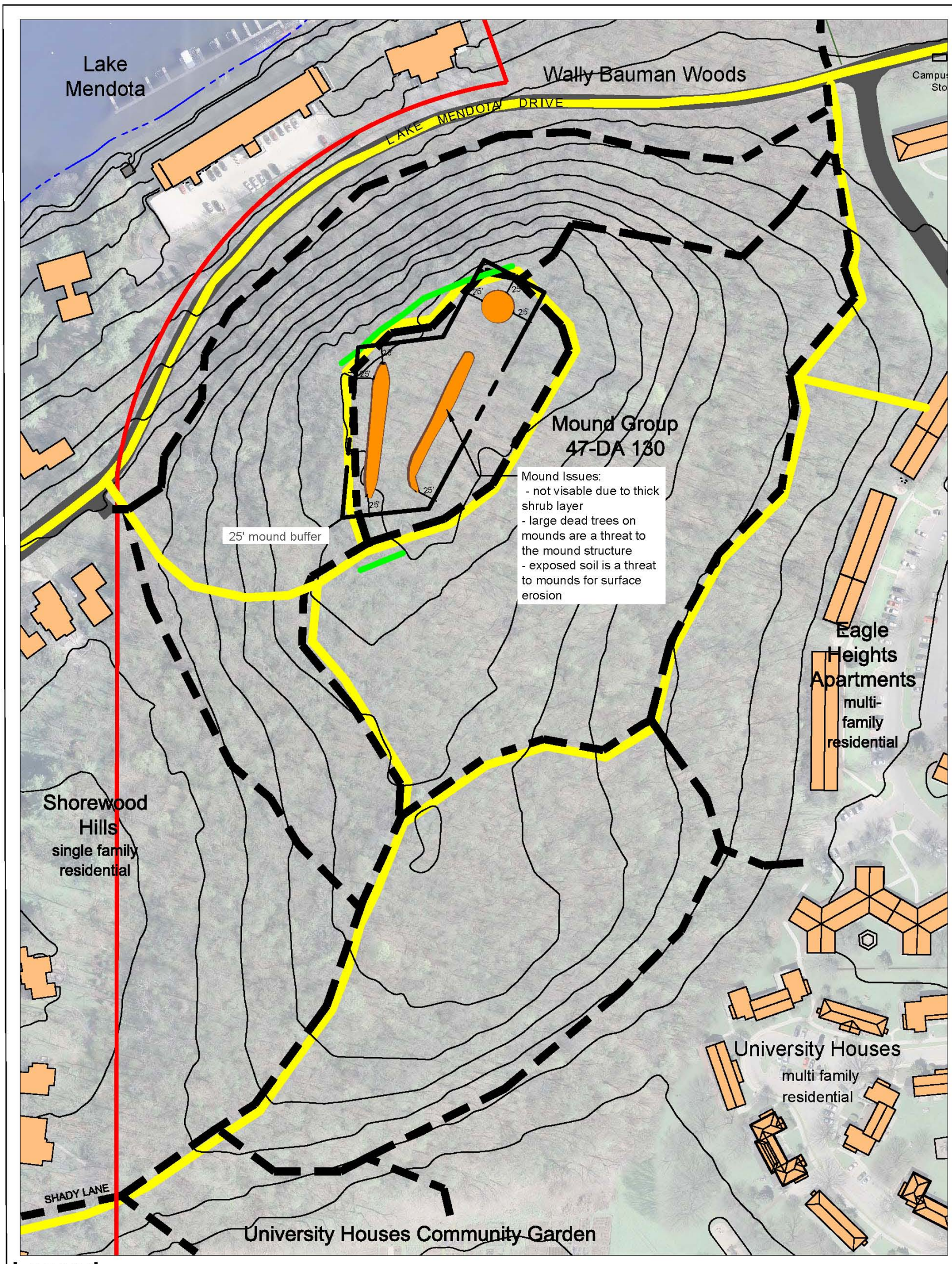
During a 2001 Phase I Archeological Survey, shovel tests turned up no prehistoric cultural materials around the mounds. The mounds themselves were not tested. The survey made the following recommendations:

- Move the trail at least five feet from the visible edge of the mounds.
- Do not disrupt the historic Raymer Drive when the trail is reconstructed.
- Survey and catalog the mound group.

Conical mound at Eagle Heights Woods
Photo by Bryn Scriver

Formerly, this land was part of the George Raymer farm, which extended north to Lake Mendota and east to Lake Mendota Drive. In 1911, Raymer sold the land to the university. In 1941 the university traded Eagle Heights Woods in a land/cash deal with the Edward Young family in order to acquire Picnic Point. Young had planned to build a home on the hill. But in 1951, after Edward Young's death, Thomas Brittingham bought the "Upper Eagle Heights Woods" portion of the Young property and donated it back to university.

In the late1860s during his ownership of the area, George Raymer created driving paths across the land, to the top of the hill and around the Native American mounds. At a similar time, the university was expanding to the west and created horse and buggy drives of its own. In 1892, a group of citizens began the effort to connect the two sets of drives to form a very popular system of paths used by the general public for recreational drives in the countryside. By 1894, this lead to the organization of the Madison Park and Pleasure Drive Association. Portions of current trail system in Eagle Heights Woods and the Lakeshore path appear to follow the original Park and Pleasure Drive in this area. The route is shown on Figure 4.



Legend

- Property Line
- Trails
- Mounds
- 10' Contours
- Park & Pleasure drive
- Concrete Cradle

Ownership History

1887 Purchase by George Raymer (part of Raymer Farm which extended north to the lake and east to Lake Mendota Drive)

1911 Raymer sells to UW

1941 UW includes Eagle Heights Woods in a land/cash deal with the Edward Young family to acquire the Picnic Point parcel

1951 Thomas Brittingham acquires a portion of the Young property. The Young estate retains the portion of the property on the north side of Lake Mendota Drive (this is the area later acquired and named Wally Bauman Woods). Brittingham turns the property back to UW.

Park & Pleasure Drive

In the late 1860's the university created drives on its westward expansion. In the late 1880's George Raymer created drives on his land a few miles to the west. In 1892 a group of citizens decided to make a link between the two with a bridge over Willow Creek , then called University Creek. The drive was very popular and in 1894 lead to the organization of the Madison Park and Pleasure Drive Association.

Mound Group 47-DA 130

Catalogued Native American burial site. UW has a "Burial Sites Management Policy".

Scale 1" = 60'
Rev. Feb. 1, 2013

Lakeshore NATURE PRESERVE UNIVERSITY OF WISCONSIN

Eagle Heights Woods-Cultural & Historic Resources

Figure 4

Human Use

Current use of the site is less intensive than other locations in the Preserve but encompasses all aspects of the Preserve mission. Research in the area has focused on birds and forest productivity. Instructional use dates back to the 1950s when John Curtis brought students to observe characteristics of red oaks in various light and soil conditions. Since 1986, General Ecology 460 (Bot/Zoo/FEW 460) has brought a class of 90 students here every other year to conduct a gradient analysis on different faces of Eagle Heights Woods. Landscape Architecture 666 uses the area as a case study for ecological restoration plans. During the summer of 2012, Field Ecology Workshop (IES 375) collected data on tree species and sizes. In fall of 2012, a First-year Interest Group (FIG) used Eagle Heights Woods as a laboratory. They studied interactions between soil, anthropology, vegetation and chemistry.

Ecology class at Eagle Heights Woods
Photo by Bryn Scriver

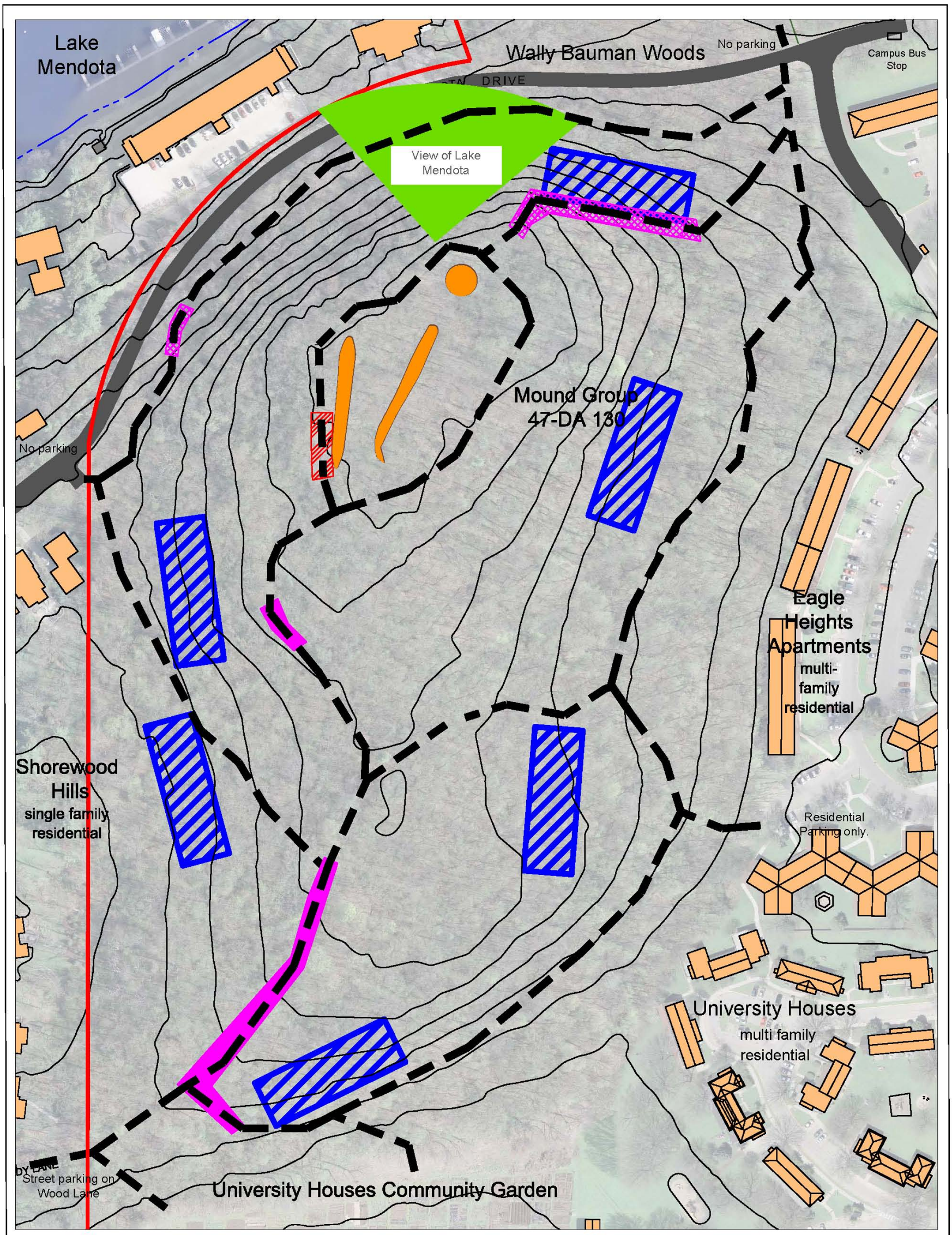
The recreational uses of the site are intended to be environmentally sensitive. A series of pedestrian trails navigate two loops around the hill and connect to the adjacent neighborhoods of Shorewood Hills and Eagle Heights. The trails are narrow footpaths composed mostly of native soil, though a few show signs of cinders or old asphalt. Some trail sections are steep and head straight up the slope, causing erosion. The trails at the top of the hill intrude upon the 25-foot mound buffer zone. Short portions of the trail are even within the 5-foot buffer zone required by state law as a protection area.

Hiking, nature study, bird watching and cross country skiing are encouraged. Problems with off-leash dog walking and biking have decreased through education and peer pressure but still occur.

There is a long history of involvement by the Friends of the Lakeshore Nature Preserve and other volunteers in efforts to remove buckthorn and weeds on the Native American

mounds. Volunteer efforts have also focused along the south edge of the woods to remove weed species and plant native oak savanna species.

Work party in Eagle Heights Woods
Photo by Cathie Bruner



Legend

- Property Line
- Trails
- Mounds
- Steep Trail
- Trail Too Close to Mound
- Trail Eroding
- 10' Contours
- Transect line
- Entrances
- Ecology 460 Study Areas since 1987

Trails
Hiking, birding, cross country skiing, dogwalking

Volunteer Efforts:
Bucktorn removal, planting natives, mound weed removal, south edge weed removal, and native planting.

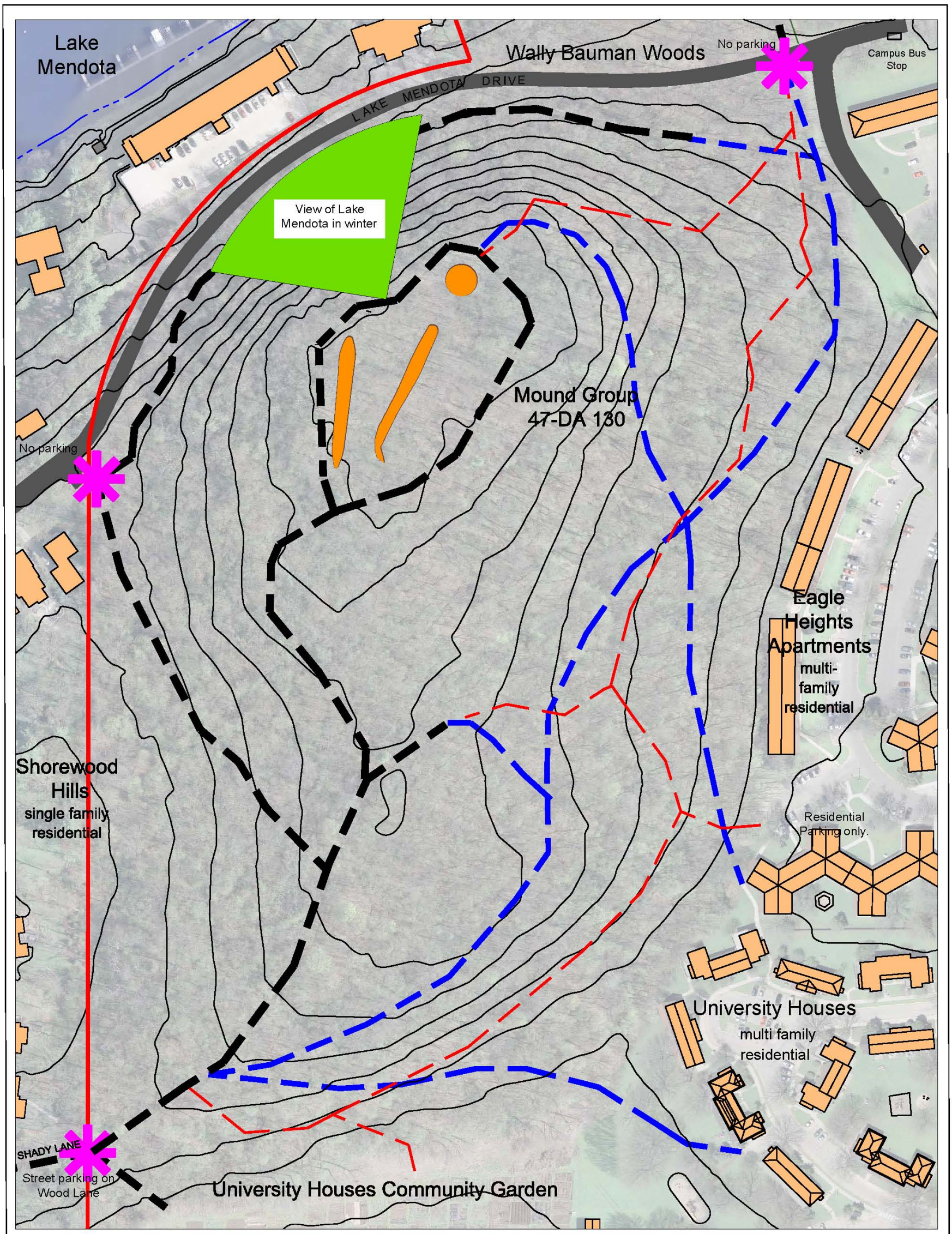
Master Plan calls for Natural Area Management Zone- focus on restoration & rehabilitation.

Scale 1" = 60'
Rev. Feb. 1, 2013

Lakeshore Nature Preserve University of Wisconsin

Eagle Heights Woods-Use Inventory

Figure 5



Legend

- Property Line
- Trails
- Mounds
- 10' Contours
- Entrances
- Remove Trail
- Construct New Trail

Master Plan calls for Natural Area Management Zone- focus on restoration & rehabilitation.

Future Vegetation shown as Dry Mesic Woods.

Scale 1" = 60'
Rev. Feb. 1, 2013

Eagle Heights Woods - Recommendations from 2006 Preserve Master Plan

Figure 6

Infrastructure Management Approach

The steep slopes and potentially erodible soils throughout the woods mandate careful attention when undertaking any soil disturbing activities, such as pulling buckthorn, removing or trimming trees and grading or modifying trails. Measures that will minimize soil disturbance include: using silt socks on steep slopes, disturbing the smallest area possible, avoiding use of large machinery, installing erosion blankets or mulch promptly in areas with exposed soil and undertaking brush and tree removal in the winter.

A few sections of the trail system need attention as shown on Figure 5. The trail along the bottom of the north edge has a short piece that is perched along the steep slope, which can become dangerous in winter. A section of trail from the southwest entrance up the hill is eroding due to foot traffic and water movement. The trail starting at the northeast entrance and ending at the conical mound travels up a very steep slope where erosion and safety are an issue. A short section of trail is too close to the burial mound. The northeast entrance exits directly onto Lake Mendota Drive at a location with poor sight lines. Classes that use the woods often gather here and people stand in the road. The unsafe situation can be corrected by moving the entrance slightly south and east to exit toward Eagle Heights Drive where there is more space. Corrective management actions, such as redirection of surface water or trail realignment, are proposed in the plan.

The Native American burial mounds offer an educational opportunity that will increase with awareness and enhanced visibility. Currently, views of the mounds are blocked by buckthorn. Large dead and declining trees are potential threats to the mounds. Previously, there has been an issue of people climbing to the top of the conical mound for a view of the lake. Without a diverse year-round ground cover, the bare soil settles to the edge of the mound resulting in a less-defined edge and a “melting” effect that over time reduces the height of the mound. The plan addresses establishing a protective herbaceous ground layer on the mounds as well as keeping pedestrians and woody vegetation from damaging the mounds.

Wildlife in Eagle Heights Woods is not well documented, except regarding birds. When implementing land management activities, it is important to consider timing to avoid disruption of wildlife habitat leaving pockets of refugia adjacent to management units can help reduce negative impacts on wildlife populations. The overall vegetation plan for the woods will keep the 100% canopy cover on the important north slope as well as 50 to 90% canopy cover on the east and west edges. As the center of the woods becomes slightly more open, conditions will more variety of plants and wildlife while still supporting the bird populations.

As land management changes are made, neighbors and faculty that use Eagle Heights Woods for class projects and instruction will be engaged in discussions to help minimize impacts on their curriculum. Visitors to the area have mentioned that path maintenance and lack of seating are issues to be addressed. The paths are intended to remain as foot paths – narrow with natural soil and cleared of fallen trees. Hazard trees are removed as part of routine maintenance. Benches (which tend to attract trash) are not called for in the 2006 Master Plan and are not in keeping with the Natural Area Management principles included there. Therefore, they will not be suggested as part of this plan. Recommendations based on the 2006 Preserve Master Plan are shown in Figure 6.

Neighboring Eagle Heights Apartments
Photo by Bryn Scriver

Activity at the edges of the woods is a concern, particularly people, pets or wildlife unintentionally bringing in weed seeds on their feet. This plan suggests installing boot brushes at the entrances.

Private residential areas and University Housing directly adjacent to the woods may be a constraint on the use of prescribed burns as a management tool. However, proper burn planning and implementation, as well as public education about the nature of and importance of woodland prescribed burns can make this possible. Woodland fires tend to be slow moving and relatively low intensity, as the fire spreads through oak leaf litter. Specific desirable plants can be protected by timing of the burn and/or watering and raking away the leaf litter prior to a burn. Attention to wind direction and smoke dispersal will be a critical part of any burn plan for this area.

Vegetation Management Approach

Vegetation management issues are at the center of most of the concerns in Eagle Heights Woods. Portions of the area are thick with buckthorn and honeysuckle, Norway maple (which spread from one tree on south slope), sugar maple (south slope), mulberry (east slope), *Euonymus* species, motherwort, garlic mustard and others. These plants change forest structure and function. Buckthorn and garlic mustard have been implicated in degrading soil quality for native plant communities.

Hazard tree at Eagle Heights Woods
Photo by Bryn Scriver

Many dominant oaks are declining from age and oak wilt. Adding to the concern about oak decline is the lack of oak regeneration resulting from increased canopy cover and the absence of fire. The cessation of fire that historically maintained the area as a mix of oak savanna/woodland community has allowed the establishment of shade-tolerant tree species – a process termed "mesophication" (Nowacki & Abrams, "The Demise of Fire and Mesophication of Forests in the Eastern United States; BioScience February 2008; Vol. 58 No. 2). The reduction in light available to oak seedlings and native ground layer plants has diminished the quality of the oak woodland community. Invasive species have further degraded the woodland.

As the community shifts to more shade-tolerant species – especially maple and buckthorn – nutrient cycling within the system is altered. Mesic (maple and bucthorn) leaf litter differs from oak leaf litter in specific leaf mass, carbon content, leaf chemistry and packing ratio (White 1987, Scarff and Westoby 2006 in Nowacki & Abrams 2008). The thin leaves lay flat and are easily compressed along the ground and trap moisture. This all allows mesic leaf litter to decompose quickly. Nutrients in the leaves are quickly returned to the soil, where they are made available to nutrient-loving species, such as buckthorn. This generates a positive feedback loop, which reinforces the dominance of maple and buckthorn in the system. Disrupting this feedback loop will be key in restoring a healthy oak woodland community. Past volunteer efforts to remove buckthorn made great dents in the population; however, the lack of resources to continue with follow-up management allowed buckthorn to re-sprout and to re-grow from seed.

Despite these challenges, native plants persist in the woods, providing a local native seed stock for the future, which must be protected. This includes marking native trees and shrubs to save when working in an area and avoiding disturbance of the potential seed bank in the soil.

The vision for Eagle Heights Woods is an oak woodland/red oak–mixed forest community. The canopy is dominated by oak. Differences between oak woodland and oak forest are

primarily the density of oak trees and the resulting canopy closure but also include the type of oaks and other tree species present. Differences are the result of soil type, moisture and available nutrients, the slope of the land and its orientation to the sun, fire history, fire frequency. Where soil moisture is higher and there is less disturbance the oaks are mixed with more moist soil tree species, especially on the north slope. Shrubs and oak seedlings and saplings are common throughout Eagle Height Woods but height and density vary with the amount of light penetrating the canopy and frequency and intensity of disturbance. Wildflowers and grasses create a dense ground layer where the canopy is more open. Where the canopy is more closed grasses do not form a turf and spring blooming flowers are more common. The areas of each community are illustrated in Figure 7. The transitions between areas are intended to blend from one to the next rather than consisting of hard edges.

Implementation steps toward the desired oak woodland/red oak-mixed forest plant and animal community include: structural restoration, control of invasive species, ground layer encouragement and oak regeneration where appropriate.

Structural restoration for these areas involves selectively removing trees and all invasive shrubs to let in sunlight. Currently, the woodland is too shady for a healthy herbaceous ground layer to persist and there is not enough light for oak regeneration. Restoring the appropriate light conditions and fire regime will help stimulate the native seeds that have been suppressed by the dense shade and competition from invasive species. It will also encourage the survival of young oak seedlings, as well as invigorate the existing mature oak trees, by reducing competition for light, nutrients, water and space. This makes the remaining trees more resistant to disease and insect attacks.

Non-native vegetation control will be a main focus of the structural restoration. Buckthorn, honeysuckle, lilac and other shrubs have formed thickets through much of the woodland and will be targeted for removal. Non-native trees of most concern include Norway maple and black locust. These plants must be removed because they tend to create thick monocultures that shade and compete with native species. Ground layer plants of most concern are creeping euonymus, motherwort and garlic mustard.

Invasive species removal will be implemented in several phases to limit the area of disturbance at any one time. This will also allow the field managers to monitor the effects of initial restoration activities and use adaptive management approaches for future zones. Tree removal will be approached incrementally, removing select trees from specific areas over the course of several years. If the location does not pose safety hazards to trail users, trees can be killed (girdled or basal bark treated) and left standing as snags for wildlife. If at all possible, major removal of trees and shrubs will be completed in the winter when the frozen ground can protect the woods from soil compaction, weed seed distribution and oak injury. This will also help protect existing native herbaceous plants.

Ground layer enhancement will take place throughout the oak woodland. The mound zone will receive particular focus on protection from erosion and protection of spring ephemerals. Work will include vegetation monitoring, encouraging existing native species, cover crop seeding, and in time establishing desired species that are not currently present. In the mound area a cover crop of native, short-lived perennial grasses (*Elymus virginicus* and *Elymus viubus)* will be applied to protect them from erosion once the rain interception provided by the shrubs is removed. Loose, clean straw mulch will be used for protection until germination of the seed. Ground layer plants help to build soil, curb erosion and provide animal and insect habitat.

Securing the long-term presence of oaks naturally follows these first three steps. Once invasive species have been controlled and the ground layer is building soil and infiltrating water and pockets of sunlight reach the woodland floor, small oaks can begin to take

hold. Oaks are encouraged because they are native and valued as wildlife food which encourages diversity in the woods. The approach is to focus on clearing around existing small oaks and planting in areas that have been cleared of trees and non-native shrubs.

The west and east edges of the woods, green in Figure 7, will also be managed as oak woodland, with a denser 50% to 90%canopy cover. Here, projects will focus on invasive species removal especially buckthorn, box elder and honeysuckle; Norway maple is a canopy level invasive that requires removal. The east zone will also include downed wood management where there is an overabundance of trees on the ground.

The north slope will be managed as a red oak-mixed forest with 70% to 100% canopy cover. Due to the steep slopes and fragile soils, work in this zone will focus on removal of invasive species without soil disturbance. Norway maple, buckthorn and honeysuckle will be removed over two-years. Followed by continued management. A more detailed description of oak woodland and red-oak-mixed forest is included in Appendix H.

Oak canopy at Eagle Heights Woods
Photo by Rhonda James

The objectives described above involve a long term process that requires use of a variety of techniques, such as controlled burns, cutting and herbicide application. The need for resources to continue management in the long term needs to be acknowledged.

Summary

In addition to the aesthetic pleasures of the site, including the spectacular view over the lake and the quiet atmosphere, numerous attributes make Eagle Heights Woods an ideal teaching and research area. The presence of Native American burial mounds serves to remind students and visitors of the cultural importance this location has held for thousands of years. The interesting geology, soils and microclimates afford students the opportunity to learn how to sample, analyze, theorize and test various solutions and ideas. Preserve managers can benefit from the information collected to improve future management decisions.

The continuum of plant communities transitioning from mesic forest on the northern slope to oak-hickory woodland on the southern slope will continue to provide instructors with a prime example of the impact that slope aspect has on plant community composition. As restoration of the site proceeds, student groups will be able to research and document the changing structure and function of faunal and floral populations. All these provide abundant teaching opportunities and research topics. The interdisciplinary collaboration can benefit all who participate.

In Eagle Heights Woods, all aspects of the Lakeshore Nature Preserve's mission can be fulfilled. From protecting the natural and cultural resources, to providing a place for teaching, research, outreach, sensitive use and respite from the built environment, all of these objectives will foster the land ethic for which the University of Wisconsin is well known.
Eagle Heights Woods has both challenges and tremendous potential. This plan will make managing, focusing interest and raising funds achievable.

Eagle Heights Woods Management Plan Recommendations

Purpose

In further defining the goal set forth in the 2006 Preserve Master Plan, this plan describes a long term strategy for returning Eagle Heights Woods to a healthy ecosystem in its urban context. This approach then allows us to carry on practical, less labor intensive management into the future. The current degraded condition disguises the promising potential for becoming a healthy natural community. The area contains very rare cultural resources that need to be protected and managed effectively. Careful, planned attention is necessary to achieve a woodland that represents a vegetation continuum sustained by the site resources and protects the Native American burial mounds. The area should primarily support teaching, research and environmentally friendly recreational use.

Vision for Eagle Heights Woods

Manage Eagle Heights Woods in its urban context to achieve a progression from oak woodland to red oak-mixed forest. Eagle Heights Woods supports a diverse population of plants and animals and is a place where the university's mission of teaching and research is encouraged. The culturally rich Native American burial mounds are protected and celebrated. Visitors enjoy quietly observing a healthy natural community with its plants and wildlife.

Summary of Goals and Objectives

Goal 1: Protect the Native American burial mounds.

- Objective 1.1: Protect the surface of the mounds from erosion, from woody vegetation growth and from disturbance due to tipping of the large existing trees.
- Objective 1.2: Protect mounds from pedestrian traffic.
- Objective 1.3: Provide the historical landscape context of the mounds.
- Objective 1.4: Provide education/interpretation/outreach about the mounds.

Goal 2: Protect the physical and biological resources.

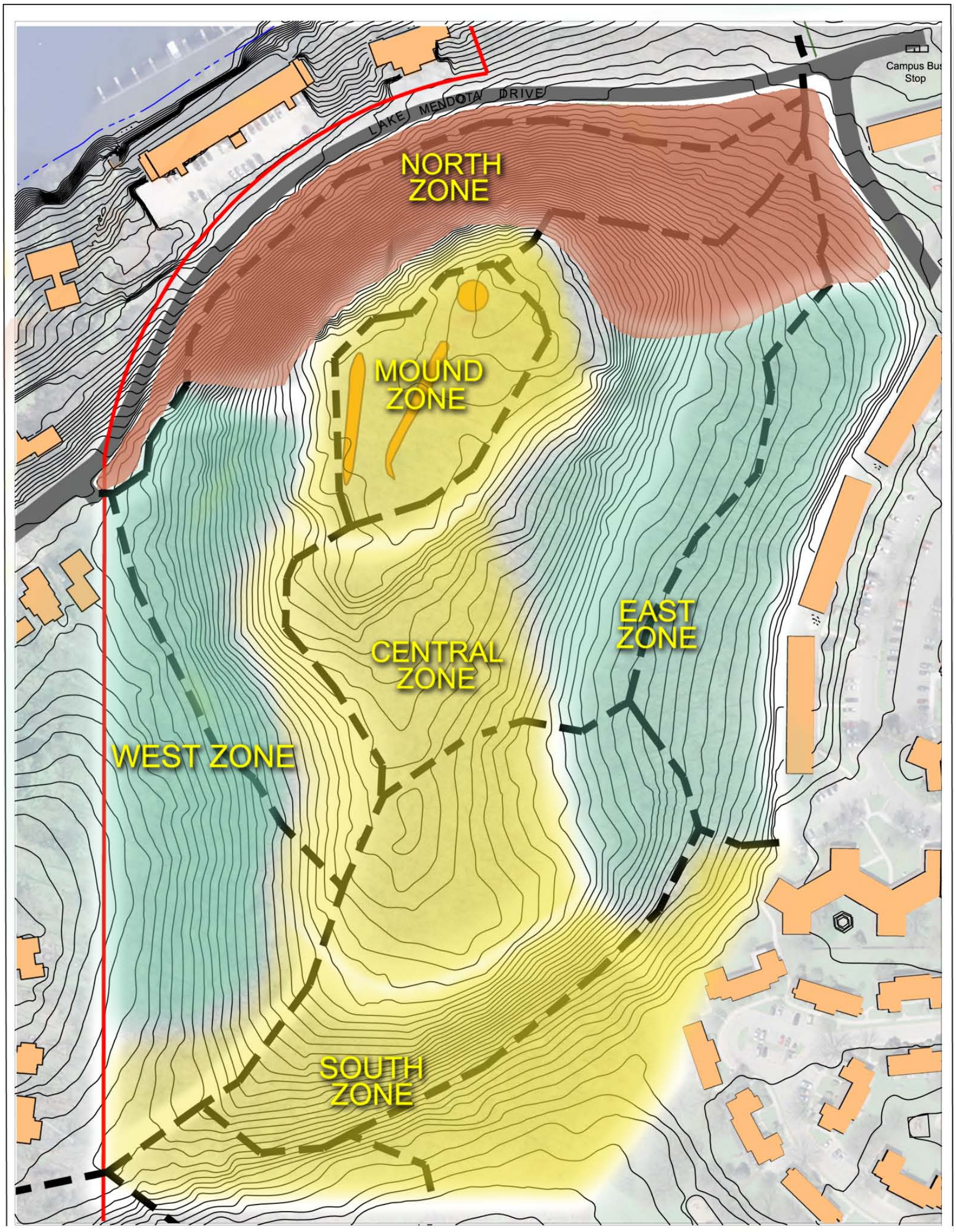
- Objective 2.1: Protect soil and steep slopes from erosion.
- Objective 2.2: Protect the native plant species.
- Objective 2.3: Preserve and enhance existing wildlife habitat.
- Objective 2.4: Deter weed species from entering the woods.

Goal 3: Restore the oak woodland at Eagle Heights. Manage the woods in zones, preserving the most sensitive (irreplaceable resources) zone first while protecting the other zones from further degradation.

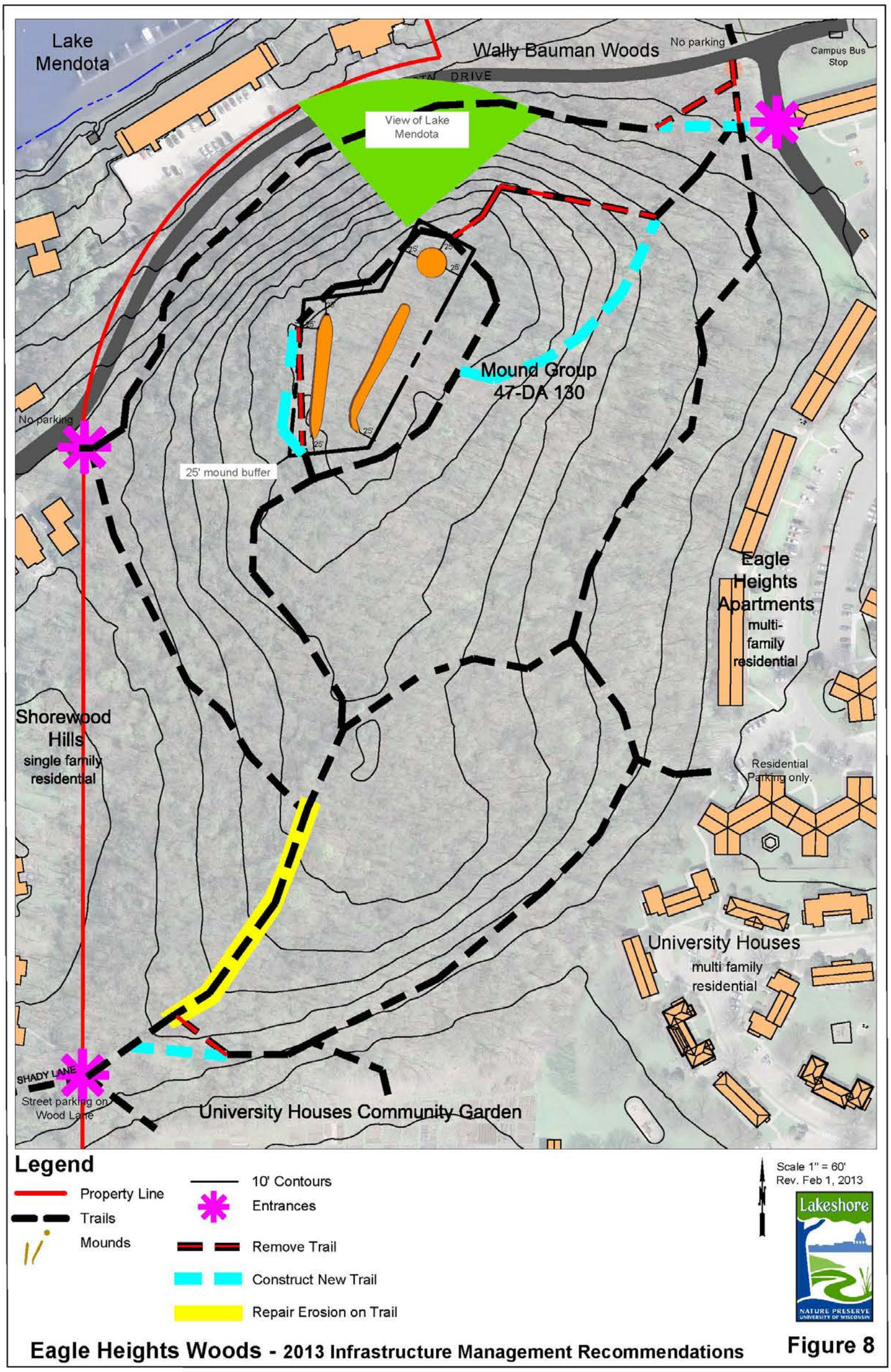
- Objective 3.1: Manage the central core (mound, central and south zones – yellow on Figure 7) as an open oak woodland.
- Objective 3.2: Manage the east and west edges (green on Figure 7) as an oak woodland.
- Objective 3.3: Manage the north slope (brown on Figure 7) as a red oak-mixed forest.

Goal 4: Support environmentally sensitive uses.

- Objective 4.1: Assure trails are safe for use.
- Objective 4.2: Manage area as called for in the 2006 Master Plan: Natural Area Management Zone.
- Objective 4.3: Carry out management in a sustainable way.



Eagle Heights Woods-Vegetation Management Recommendations Figure 7


Lake Mendota
Wally Bauman Woods
No parking
Campus Bus Stop
DRIVE
View of Lake Mendota
Mound Group 47-DA 130
No parking
25' mound buffer
Eagle Heights Apartments
multi-family residential
Shorewood Hills
single family residential
Residential Parking only.
University Houses
multi family residential
SHADY LANE
Street parking on Wood Lane
University Houses Community Garden
Legend
Property Line
Trails
Mounds
10' Contours
Entrances
Remove Trail
Construct New Trail
Repair Erosion on Trail
Scale 1" = 60'
Rev. Feb 1, 2013
Lakeshore
NATURE PRESERVE
UNIVERSITY OF WISCONSIN
Eagle Heights Woods - 2013 Infrastructure Management Recommendations
Figure 8

Management Recommendations

Goal 1: Protect the Indian burial mounds

Objective 1.1: Protect the surface of the mounds from erosion, from woody vegetation growth and from disturbance due to tipping of the large existing trees.

1. Implement the Hazard Tree Removal for Eagle Heights mound group plan as presented in Appendix G, which includes removing dead trees from the mounds and adjacent area. There will be a few smaller trees as well as buckthorn and honeysuckle requiring removal in the fall zone of the large dead trees.
2. When implementing Objective 3.1 work on the mounds and within the 25' mound buffer must follow the UW-Madison Indian Burial Mound Vegetation Management Guidelines.
    a. Work in the Catalogued Burial Site only when the ground is thoroughly dry or frozen to avoid compaction and disturbance of the soil and mound features.
    b. Soil surface should not be disturbed.
    c. Protect spring ephemerals.
    d. Ideally in late summer or fall, cut invasive species, treat stumps with herbicide and remove cut vegetation from the area.
    e. On the same day as cutting and herbicide application, seed the area with *Elymus virginicus* and *Elymus vilosus* and mulch immediately with clean, loose straw. Do not rake the mounds.
    f. The following spring as snow is melting, check the mounds and any sloping area in the Cataloged Burial Site for bare spots. If found, spread a light covering of clean straw mulch. Monitor site for native and non-native plants. Manage weed species with techniques that minimize soil disturbance and do not damage spring ephemerals.
    g. In summer, continue to monitor the plant community. Manage weeds as needed.
    h. In fall, cut and or herbicide any herbaceous weeds and woody resprouts.
    i. During the second yea, repeat the first year's activities.
    j. During the third year, if the invasive species are under control, supplement the native ground layer by seeding in spring and fall from the list of species in Appendix F.
    k. Revisit once each fall and remove woody sprouts.
3. Continue annual follow-up of woody material removal on the mounds. The UW-Madison Indian Burial Mound Vegetation Management Guidelines (currently being developed) allow the mounds to be included in a controlled burn. Invasive vegetation may be spot treated with herbicide.
4. Remove all trees from the mounds in a phased manner.
    a. The first phase included the dead trees.
    b. The second phase may include undesirable trees such as black locust and ash.
    c. Desirable trees for the community may remain as long as they are healthy. When they die or become a hazard they should be removed.

Objective 1.2: Protect mounds from pedestrian traffic.

1. Move the path that parallels the western edge of the western most mound.
2. Realign the path from the northeast entrance to the top of the hill. It will intersect with the mound loop farther to the southeast than it does now, as shown in Figure 8. This avoids the trail ending directly in line with the conical mound and better navigates the steep slope. The realigned trail will also pass by an outstanding rock outcrop.
3. If needed, increase the post and chain barrier to signal visitors to keep off the mounds. Add signs only if needed. Keep both of these to a minimum to allow the mounds to be seen in the context of the natural landscape.

Objective 1.3: Provide the historical landscape context of the mounds. Create a landscape where the mounds are visible from the trail on top of the hill and provide a filtered view of the lake in the background, looking through the trunks and larger branches of trees.

1. Clear invasive shrubs and maintain with a minimum of invasive shrubs in the area inside the upper trail loop (roughly the 25-foot buffer area).
2. Plant scattered groupings of desirable native shrubs in the area to maintain cover for wildlife.
3. Manage for a filtered view of the lake.
    a. Evaluate the view after invasive species are removed. Determine whether minimal tree trimming is needed to accomplish the goal.
    b. Tree removal for view creation should be done only by removing unhealthy, undesirable or non-native species.
    c. The view of the lake is intended to be a filtered view and should not be a clear cut. Continued maintenance will be required to keep it open.

Objective 1.4: Provide education/interpretation/outreach about the mounds.

1. Add a sign and description as part of the Preserve's existing audio trail system.
2. Celebrate the mounds on the website.
3. Continue tours of the mounds as requested.

Goal 2: Protect the physical and biological resources.

Objective 2.1: Protect soil and steep slopes from erosion.

1. First, avoid soil disturbance if at all possible.
2. Provide appropriate additional erosion control measures when soil disturbance is required.
3. Seed and place erosion blankets as necessary to prevent erosion.
4. Divert stormwater away from erosive soils and steep slopes.
5. Re-route steep trails where erosion is occurring (see Objective1.2.2 and 4.1).

Objective 2.2: Protect the native plant species.

1. Spring ephemerals
    a. Locate and map the existing spring ephemerals.
    b. Remove invasive shrubs to allow for spring ephemerals to survive/flourish.
    c. Be sure introduced mound cover does not interfere with spring ephemerals.
    d. Protect the spring ephemerals during prescribed burns.
2. Native shrubs and trees
    a. Identify and mark existing natives in areas where invasive plants are to be removed.
    b. Minimize damage to natives when buckthorn and other invasives are removed.
    c. Promote oak and hickory by clearing around small trees and seedlings as they are found. As areas of light open from dead trees target these for potential acorn planting. (see Objective 3.1.4).

Objective 2.3: Preserve and enhance existing wildlife habitat.

1. Protect existing bird habitat.
    a. Maintain canopy cover on north slope to protect birds as they move from shoreline to woodland.
    b. Maintain the cavity nesting opportunities provided in large standing dead trees. Keep dead trees standing as long as they are not hazards to those using the trails or nearby roadways, parking lots or apartments.
2. Improve vegetative diversity in order to increase wildlife diversity.
    a. Removing invasive shrubs and planting native shrubs will increase the diversity and provide a better food source for a wider variety of wildlife.

Objective 2.4: Deter weed species from entering the woods.

1. Install boot brushes at all trail entrances and provide information explaining the effort to keep weed seed out of the area.
2. Do not create wide open ground at the edges of the woodland. If invasive species are removed in these areas, replant immediately with appropriate native species.
3. Long-term management will target non-native species that invade from the edges.

Goal 3: Restore the oak woodland at Eagle Heights.

Objective 3.1: Manage the central core as an oak woodland with 50% - 70% canopy cover. Implement in three phases: mound zone, then central zone, and then south zone (yellow areas in Figure 7).

1. Remove invasive species.
    a. Eradicate creeping euonymus with repeated herbicide applications.
    b. Eradicate and remove buckthorn, honeysuckle, lilac, winged euonymus and privet.
        i. In the mound zone follow the process outlined in Objective 1.1.2.
        ii. Methods: cut, treat cut stem with herbicide, remove brush, follow up next growing season.
    c. Eradicate Norway maple and black locust. Those that are not a hazard can remain standing as wildlife habitat. Hazard trees will be taken down.
        i. Methods: girdle the tree or basal bark and treat with herbicide.
    d. Manage the brush created due to removal of invasive species.
        i. Methods: chipping, stacking, burning or hauling away.
2. Restore the structure of the woodland.
    a. Selectively remove canopy trees that are hazards, interfere with oak canopy or are declining. Leave trunks in a naturalized state for habitat if possible.
        i. Methods: girdle the tree or basal bark and treat with herbicide.
    b. Tree removal will be approached incrementally, removing only select trees from specific areas over the course of several years. Patches may vary in canopy cover from less to more than the 50-70% but on average across the area it will be 50-70%.
    c. Plant groupings of fire-tolerant native shrubs.
3. Enhance the ground layer plants.
    a. Conduct vegetation monitoring to determine whether supplemental planting is needed.
    b. Seed mounds and other fragile soils or steep slopes with a native short-lived perennial grass mix.
    c. Plugs may not be planted in the mound area.
4. Encourage oak regeneration.
    a. Locate and mark existing small oaks and hickories to aide in protecting them.
    b. Plant seedlings or acorns or nuts in the openings created by steps 1 and 2 above.
5. Follow-up with annual management as needed.
    a. Methods: cut, treat cut stem with herbicide, remove brush, conduct controlled burn, follow up next growing season.

Objective 3.2: Manage the east and west edges of the woods as an oak woodland with 50%-90% canopy cover (green in Figure 7).

1. Remove invasive species.
    a. Eradicate and remove the scattered buckthorn, honeysuckle, box elder, lilac, winged euonymus and privet.
        i. Methods: cut, apply herbicide, remove brush, follow up next growing season.
    b. Eradicate ground layer invasive species invading from adjacent areas.

i. Methods are species dependent and may include: pulling, cutting and/ or applying herbicide.

c. Eradicate Norway maple. Those that are not hazards can remain standing as wildlife habitat. Hazard trees will be taken down.
   i. Methods: girdle the tree or basal bark and treat with herbicide.

d. Manage the brush created.
   i. Methods: chipping, piling, burning or hauling away the brush or chips.

2. Restore the structure of the woodland.
   a. Selectively remove canopy trees that are hazards or interfere with oak canopy. Leave trunks in a naturalized state for habitat if they are not a hazard.
   b. Methods: girdle the tree or basal bark and treat with herbicide.
   c. Tree removal will be approached incrementally, removing only select trees from specific areas over the course of several years. Patches may vary in canopy cover from less to more than the 50-90% but on average across the area it will be 50-90%.
   b. Remove ash if they become a hazard. Follow Campus Emerald Ash Borer Policy.
   c. If it is determined there is too much downed wood, remove to allow other plants to grow.
   d. Controlled burning can be used if beneficial to the community.
3. Follow-up with annual management as needed.
   a. Methods: cut, treat cut stem with herbicide, remove brush, conduct controlled burn, follow up next growing season.
4. Communicate the importance of the wooded area with neighbors and if encroachment, dumping or misuse occurs determine a solution with the neighbors.

Objective 3.3: Manage the north slope as a red oak-mixed forest with 70% to 100% canopy cover (brown in Figure 7).

1. Remove invasive species.
   a. Eradicate buckthorn, honeysuckle, box elder, lilac, winged euonymus and privet.
      i. Methods: cut, apply herbicide, remove brush, follow up next growing season.
      ii. Do not pull plants on the steep north slope.
   b. Eradicate Norway maple. Those that are not a hazard can remain standing as wildlife habitat. Hazard trees should be taken down.
      i. Methods: girdle the tree or basal bark and treat with herbicide.
   c. Manage the brush created due to removal of invasive species.
      i. Methods: chipping, stacking, burning or hauling away.
2. Restore the structure of the woodland.
   a. Remove canopy trees only if they are hazards.
   b. Remove ash if they become a hazard. Follow Campus Emerald Ash Borer Policy.
   c. If it is determined there is too much downed wood, remove to allow other plants to grow.
   d. Controlled burning can be used if beneficial to the community.

Goal 4: Support environmentally sensitive uses.

Objective 4.1: Assure trails are safe for use.

1. Two locations are identified for trail rerouting. See Figure 8.
2. Repair trail treads damaged by erosion and redirect runoff as needed. See Figure 8.
3. Maintain trails at current single person width. Do not widen or groom trails for winter uses such as snowshoeing or skiing.
4. Relocate the northeast entrance around the corner onto the grass area along Eagle Heights Drive so it does not exit directly on to Lake Mendota Drive.

Objective 4.2: Manage area as called for in the Master Plan.

1. This area sis designates a Natural Area Management Zone, which means it is managed mostly for restoration.
2. Incorporate planned views with invasive plant removal as stated in Objective 1.3.3.a.
3. Do not provide benches. Log near the trail can be secured for informal seating.
4. Suggest that visitors with groups use the grass at the new northeast entrance or the small gravel area at the southwest entrance as gathering places.

Objective 4.3: Carry out management in a sustainable way.

1. Record observations of starting conditions, changes and effects of the management in an organized way.
2. Remain flexible and adaptive with management techniques.
   a. Approach land care in small, manageable pieces.
   b. Manage in a variety of ways and find what works best.
   c. If the solution to an issue is not known, suggest research to investigate/determine an answer.
3. Be a good neighbor – and communicate with neighbors about management activities. Explain expectations/outcomes for each step.
4. Be efficient with time, effort and money in the management of this area and keep it in balance with the entire Preserve.
5. Use the tools and techniques best suited for the tasks and long-term management goals.
   a. Potential tools include: cutting, pulling, herbicide application, girdling, mowing and controlled burning.

Implementation Phasing

For the Lakeshore Nature Preserve, a project of this size is best implemented in phases over time. Phasing keeps the tasks manageable, allows for adaptive management and provides wildlife refuge. The implementation of the phases will progress from the center outward and will be referred to as the zones shown on Figure 7. The progression will be: mound zone, central zone, south zone, west zone, east zone and north zone.

During the early years when the first zones are being focused on the other zones will continue to receive standard monitoring and management. This is a less concentrated effort where very invasive species are scouted for and removed and where hazard trees and trail conditions are addressed.

Major work in a zone is referred to as an active project. Each zone will need similar tasks as they progress. To start, specific inventories, monitoring and site specific plans will be created to direct the work. Each zone will require some level of invasive species removal, structural restoration and ground layer encouragement. In zones where it is appropriate, encouragement of oak regeneration will follow. The active project is expected to last two to three years in each zone. As the active project winds down the zone will move into a continued management level of effort. This is the commitment to continue managing the invasive species so they do not return in damaging quantities and to continue encouragement of native species.

The active project phases of the zones may overlap in the same year; however, no more than one zone will be in its most intense invasive species removal at anyone time.

Parting Thought

As the spring sun rises in the distance beyond Lake Mendota, its rays strike the eastern slope of Eagle Heights Woods. The morning dawns first high in the canopy, where flower buds of oak are illuminated in the still morning air. An ovenbird alights atop one of the glowing buds and teeters momentarily. It has been a long trip, and the respite is well deserved. In the understory below, drops of dew glisten on the leaves of Dutchman's breeches and early meadow rue nestled amongst the watchful eye of scattered elderberry, dogwood, and chokecherry preparing for their emergence into a new season. The sharp call of a cardinal pierces the damp morning air and grabs the attention of a squirrel, who briefly pauses to look up from her morning treasure hunt in the duff.

Now the sun ascends toward its southern zenith and spring gives way to summer. The south slope of Eagle Heights Woods baths in sunlight, resplendent in lush new growth. On the knoll of the hill, a whimsical patch of shooting stars reaches out from the sedge-carpeted sacred burial mounds to embrace the generous offering of energy. Soon, the shooting stars will be overwhelmed by the upwelling of plants all around. Thimbleweed and columbine, Jacob's ladder and wild geranium, purple milkweed and Desmodium, all display their floristic artwork. Love is in the air, and the woods throbs with the sound of ritual courtship. The midday sun is hot in the scattered pools and glades of sunshine, but beneath the craggy outstretched arms of an oak tree, a student finds the atmosphere perfect for nature study.

Autumn now looms and the sun hangs heavy in the sky, weary from the summer's long climb. The western slope of Eagle Heights Woods still welcomes the warm afternoon rays. A gentle breeze kicks up and drifts through a grove of wise old bur oaks perched amongst a rock outcrop along the upper slope. Woodland sunflowers and asters dance at their feet. Stoically, a red-tailed hawk awaits the toll of the dinner bell. Growing tired of the wait, the hawk stretches its wings and glides down through the bur oak grove. Angling downslope toward Lake Mendota, the hawk drifts up to the branch of a large red oak, outlined by the warming glow of neighboring sugar maples in the midst of their showy seasonal senescence. The hawk pauses momentarily and then decides it best to move on. A sentinel crow has spotted the hawk, and the requisite heckling "caw" soon echoes through the golden woods. Squirrels ignore the commotion, for there's no time to waste with the impending harvest moon.--

With the arrival of the first snow, the north slope of Eagle Heights Woods knows the time has come to rest in cold darkness. It will be several long months before the sun pays its next visit to this shade-loving community. Ample time to contemplate the possibilities of the coming spring. When the spring indeed does arrive, it is startled from its slumber by the resonant crack of Lake Mendota breaking out of its winter shell. True spring, however, arrives last for the inhabitants of the northern slope. Drifts of snow persist tenaciously in sheltered pockets of the hill, but a bloodroot deems the world fit to poke its nose out of the nearly-frozen earth. Bellwort and early meadow rue promptly follow suit. Golden wisps of smoke, backlit in the midday sun, curl off the knoll of Eagle Heights Woods. They waft down over nascent flower bud nostrils. Fires once again breathe life into the woodland of Sho-heta-ka. Spring has indeed arrived.

Adam Gundlach
Field Technician
Lakeshore Nature Preserve
University of Wisconsin-Madison

Appendix A
Eagle Heights Woods Management Plan
Proposed Process and timeline: revised 1/25/2013 rhj

TASKS	**SCHEDULE**	**UPDATE**
Define/verify the planning area.	First day	
Collect background information regarding the area and the issues: (from master plan and discussions with campus stakeholders)	Summer 2011	
Site Inventory and Analysis (from master plan and discussions) - look at vege in all seasons, info will be added to throughout the entire process	Summer 2011	
Use Analysis (from master plan and discussions)	Fall 2011	
List known issues / opportunities - from master plan and any others (collect input from FPM Staff, campus experts, P&I subcommittee, others)	Fall 2011	
Prepare information to present to stakeholders: [FPM Staff]	Jan/Feb 2012	
P & I Subcommittee Meeting: Pre-view planning process	Jan 31, 2012	
Preserve Committee Meeting: introduce planning process	Feb 14, 2012	
Stakeholder Meeting: collect thoughts & ideas, find out what is important to them.	Feb 21, 2012	
Summarize Stakeholder comments Write the *Draft Management Plan Outline*		
P&I Subcommittee Meeting: Review *Draft Management Plan Outline*	March 6, 2012	
Preserve Committee Meeting: progress report	Mar 13, 2012	
Write *Draft Management Plan*		
P&I Subcommittee Meeting: Review Draft Management Plan	~~Mar 20, 2012~~	Oct 31, 2012
Revise *Draft Management Plan*		
~~**Post *Draft Management Plan* on website** and invite stakeholder review comments E-mail link to all in attendance or given input~~	~~Mar 27, 2012~~	
P&I Subcommittee Mtg: review updated Draft Management Plan		Jan 30, 2013
Send draft Management Plan to Preserve Committee		Feb 7, 2013
Preserve Committee Meeting: Present *Draft Management Plan* and collect comments	~~April 10, 2012~~	Feb 14, 2013
Post Draft Management Plan on website for review		Feb 18, 2013
Stakeholder Meeting: Present *Draft Management Plan* and collect comments	~~April 10, 2012~~	Feb 26, 2013
Incorporate comments into *Proposed Management Plan*		
P&I Subcommittee Meeting: discuss comments on *Proposed Management Plan*	~~April 17, 2012~~	Feb 27, 28, 2013
Finalize *Proposed Management Plan*		
Post *Proposed Management Plan* on website for Committee and Public Review	~~May 1, 2012~~	March 7, 2013
Preserve Committee Meeting: Present *Proposed Management Plan* for action	~~May 8, 2012~~	March 14, 2013
Prepare *Final Management Plan*		
Post *Final Management Plan* on website	~~July 2012~~	April 2013

Appendix B

Description of Eagle Heights Woods from the UW Madison Campus Natural Areas Management Plan 1996 by Virginia Kline and Brian Bader:

Existing Vegetation

North slope:
Canopy – red oak, slippery elm, white ash, basswood.
Sub-canopy – slippery elm, white ash, black cherry, basswood. Patch of black locust near top. Shrub layer – grey dogwood, chokecherry , honeysuckle, buckthorn.
Ground layer – viginia creeper, poison ivy, moonseed vine, wild yam rot, bloodroot, early meadowrue, solomon's seal, false solomon's seal, jack-in-the-pulpit.

East slope:
Canopy – white oak, red oak, white ash, basswood, slippery elm, shagbark hickory, black cherry.
Sub-canopy – box elder, black cherry, hackberry. Shrub layer – gray dogwood, honeysuckle, buckthorn, red-berried elder, highbush cranberry.
Ground layer – Virginia creeper, zig-zag goldenrod, enchanter's nightshade, solomon's seal, false solomon's, bloodroot, wild geranium, early meadowrue, virginia waterleaf.

South and west slopes:
Canopy – scattered large trees – black oak, white oak, black cherry, bur oak and to a lesser extent - red oak, slippery elm, white ash.
Subcanopy – white ash, black cherry, box elder, slippery elm, hackberry. Shrub layer – denser than north and east slopes – buckthorn, honeysuckle, gray dogwood, red-oiser dogwood, chokecherry, red-berreid elder, highbush cranberry.
Ground layer – virginia creeper, mayapple, solomon's seal, wild geranium, widl strawberry, woodland tick-trefoil, sweet joe pye weed, jack-in-the-pulpit.

Recommendations for Management

General: control erosion – discontinue bicycle use in preserve

General: remove honeysuckle, buckthorn & garlic mustard and other exotics as they suppress the native shrubs and ground layer

General: improve and maintain the trail system

General: leave standing and fallen dead trunks unless a risk

Appendix C
Update of Description of Eagle Heights Woods from the UW Madison Campus Natural Areas Management Plan 1996 by Susan Will-Wolf

Will-Wolf vegetation updates are in red and reflect Ecology 460 class data for woody plants (note: not expert taxonomists!).

Existing Vegetation

North slope:
Canopy – red oak, white oak, ~~slippery elm, white ash~~, basswood.
Sub-canopy – basswood, ~~slippery elm~~, green and white ash, sugar maple, box elder, black cherry, slippery elm, ~~basswood. Patch of black locust near top.~~
Shrub layer – gray dogwood, chokecherry, honeysuckle, buckthorn.
Ground layer – Virginia creeper, poison ivy, moonseed vine, wild yam, bloodroot, early meadowrue, solomon's seal, false solomon's seal, jack-in-the-pulpit.

East slope:
Canopy – white oak, red oak, ~~white ash~~, basswood, ~~slippery elm, shagbark hickory~~, black cherry.
Sub-canopy – box elder, black cherry, basswood white ash, hackberry.
Shrub layer – gray dogwood, chokecherry, honeysuckle, buckthorn, red~~ berried~~ elderberry, highbush cranberry.
Ground layer – Virginia creeper, zig-zag goldenrod, enchanter's nightshade, solomon's seal, false solomon's seal, bloodroot, wild geranium, early meadowrue, Virginia waterleaf.

South and SW to WSW~~west~~ slopes:
Canopy – scattered large trees – black oak, white oak, ~~black cherry~~, bur oak, with some~~and to a lesser extent~~ shagbark hickory, ~~– red oak, slippery elm,~~ black cherry, white ash.
Sub-canopy ~~– white ash, black cherry,~~ box elder, black cherry, green and white ash, ~~slippery elm,~~ hackberry.
Shrub layer – denser than north~~ and~~ east, and west/WNW slopes – buckthorn, honeysuckle, gray dogwood, raspberry, ~~red-oiser dogwood~~chokecherry, red~~berreid~~ elderberry, highbush cranberry.
Ground layer – Virginia creeper, mayapple, solomon's seal, wild geranium, wild strawberry, woodland tick-trefoil, sweet joe pye weed, jack-in-the-pulpit.

West to WNW slopes:
Canopy – white oak, black cherry, scattered red oak, Spreading oak wilt patch has left the canopy more open than other slopes.
Sub-canopy – box elder, black cherry, white and green ash, hackberry.
Shrub layer – red-osier, gray, and pagoda dogwood. honeysuckle, Evidence of moisture seeps about halfway upslope, making the lower slopes more moist.
Ground layer – Virginia creeper, zig-zag goldenrod, enchanter's nightshade, solomon's seal, false solomon's seal, bloodroot, wild geranium, early meadowrue, Virginia waterleaf.

Top:
Canopy – white oak, red oak, shagbark hickory, bur oak. Patch of black locust near top. Tree density slightly less than on slopes.
Sub-canopy – box elder, black cherry, white oak, green ash.
Shrub layer – buckthorn, honeysuckle, gray dogwood, raspberry, chokecherry.
Ground layer – Virginia creeper, enchanter's nightshade, solomon's seal, false solomon's seal, wild geranium, goldenrods, sedge spp, several species of native spring ephemerals and other summer herbs.

Appendix D

Native Vascular Plant Inventory of Eagle Heights Woods, Wally Bauman Woods and North Shore Woods

Joshua Sulman

July 25, 1998

This plant inventory includes the species seen during the period from late April to late July, 1998, on walks at weekly intervals through the western three sections of the Campus Natural Areas. Also included are some species seen other years and some not yet blooming at the end of July, but observed in a vegetative state.

The three areas observed were Eagle Heights Woods, Wally Bauman Woods, and the western part of North Shore Woods. Each section has a unique topography and microclimate resulting in different sets of plant communities and species for each area. Eagle Heights has a steep north-facing hillside and a shallower slope to the south, and is entirely wooded. The north-facing side is so steep in some areas that there are exposed rock ledges, with characteristic cliff plants on them. The cooler microclimate allows for plant species not found on the south face of the hill. The woods is a characteristic Southern Dry-Mesic Forest, with a tall canopy dominated by red oak. The top of Eagle Heights is drier with a canopy of mainly white oak, and a groundlayer characteristic of a Southern Dry Forest. The other sides of the hill grade between these two forest types, with some species found on some sides and not others. In the spring, plants of the same species bloom about a week earlier on the south slope than on the north slope of Eagle Heights.

Wally Bauman Woods continues in the Dry-Mesic Forest of the north side of Eagle Heights down toward the lake. The slope is not quite as steep as in Eagle Heights, but is still a good climb. Lake Mendota is about 150 feet lower than the top of Eagle Heights. There are some cliff-like areas of erosion along the shore with associated cliff species.

To the east into North Shore Woods, the forest grades into a Mesic Forest of mostly sugar maple. In the interior, the groundlayer is sparse except for a few spring ephemerals. Along the shore, there are hints that the area was once more open, with some open-grown oaks and savanna wildflowers. Near the parking lot, around the small beach and cliff are a number of interesting plant species not found in the rest of the three sections observed. The situations are associated with Shaded Cliff and Exposed Cliff communities. Along Lake Mendota Drive on the south side of North Shore Woods, there are plants that arrived there and had an advantage growing in the disturbance of the road embankment that are not found elsewhere in the areas observed.

Numbers following native and lower-case letters following non-native plant species correspond to the map, for local species.

W= Wally Bauman Woods
E=Eagle Heights Woods
N=North Shore Woods, the part west of the parking lot

Letters follow names of plants with a wide distribution in the specified areas. (These distributions may not be completely accurate!)

Native Species

Acer negundo (box elder) W, E, N
Acer rubrum (red maple) 1
Acer saccharum (sugar maple) W, N
Actaea rubra (red baneberry) W,E,N
Adiantum pedatum (maidenhair fern) W,E
Agrimonia gryposepala (agrimony) W,E,N
Amelanchier spicata (serviceberry) 2
Amphicarpa bracteata (hog peanut) W,E
Anemone virginiana (thimbleweed) W,E,N
Anemone quinquefolia (wood anemone) E
Apocynum sp. (dogbane) E
Aquilegia canadensis (columbine) W,E,N
Arabis hirsuta (hairy rock cress) 3 **needs verification**
Aralia nudicaulis (wild sarsaparilla) W,E,N
Aralia racemosa (spikenard) 4
Arisaema triphyllum (jack-in-the-pulpit) W,E,N
Asclepias exaltata (poke milkweed) 5
Aster spp. W,E,N
Athyrium filix-femina (lady fern) W,E
Betula papyrifera (white birch) 6
Carex cephalophora E
Carex convoluta W,E,N
Carex pennsylvanica (Pennsylvania sedge) E
Carex sprengelii 7
Carex needs verification
Carya ovata (shagbark hickory) W,E,N
Caulophyllum thalictroides (blue cohosh) E
Celastrus scandens (bittersweet) W,E
Celtis occidentalis (hackberry) W,E,N
Circaea quadrisulcata (enchanter's nightshade) W,E,N
Clematis virginiana (virgin's bower) 8 **needs verification**
Cornus alternifolia (alternate-leaved dogwood) W,E,N
Cornus racemosa (gray dogwood) W,E,N
Cornus rugosa (round-leaved dogwood) E
Corylus americana (hazelnut) E
Cystopteris fragilis (fragile fern) 9
Desmodium glutinosum (tick trefoil) W,E,N
Dicentra cucullaria (Dutchman's breeches) W,E,N
Diervilla lonicera (bush honeysuckle) 10 **needs verification**
Dioscorea villosa (wild yam) W,E
Dodecatheon meadia (shooting star) 11
Elymus canadensis (wild rye) 12
Elymus villosus (wild rye also) 13
Epilobium coloratum (willow-herb) 14
Erechtites hieracifolia (burnweed) E
Erigeron annuus (fleabane) W,E,N
Eupatorium purpureum (sweet joe-pye-weed) E
Eupatorium rugosum (white snakeroot) W,E,N
Fraxinus americana (white ash) W,E,N
Galium aparine (cleavers) E
Galium concinnum (bedstraw) E
Geranium maculatum (wild geranium) W,E,N
Geum canadense (white avens) W,E,N
Hackelia virginiana (stickseed) E
Helianthus strumosus (woodland sunflower) W
Hepatica acutiloba (sharp-lobed hepatica) W,E
Heuchuera richardsonii (alum root) E,N
Hydrophyllum virginiana (virginia waterleaf) W,E,N
Impatiens pallida (pale touch-me-not) 15
Juglans spp. (walnut, butternut) W,E
Juncus tenuis (trail rush) W,E,N
Juniperus virginiana (red cedar) W,N
Lonicera prolifera (wild honeysuckle) E
Menispermum canadense (moonseed) E
Monarda fistulosa (wild bergamot) W,E,N
Monotropa uniflora (Indian pipe) W
Osmorhiza longistylis (sweet cicely) 17
Ostrya virginiana (ironwood) W,E,N
Oxalis stricta (yellow wood-sorrel) W,E,N
Parietaria pennsylvanica (pellitory) W,E,N
Parthenocissus vitacea (Virginia creeper) W,E,N
Pellaea atropurpurea (purple-stemmed cliffbrake) 18
Phytolacca americana (pokeweed) 19
Phryma leptostachya (lopseed) W,E,N
Pilea pumila (clearweed) E
Podophyllum peltatum (mayapple) W,E,N
Polygonatum biflorum (Solomon's seal) W,E,N
Polygonum virginianum (jumpseed) E
Populus grandidentata (bigtooth aspen) N
Populus deltoides (cottonwood) 20
Potentilla simplex (old-field cinquefoil) W
Prenanthes sp. (white lettuce) W,E,N (Prunus pennsylvanica (pin cherry) 21
Prunus serotina (black cherry) W,E,N
Prunus virginiana (choke cherry) W,E,N
Quercus alba (white oak) W,E,N
Quercus borealis (red oak) W,E,N
Quercus macrocarpa (bur oak) 22
Ranunculus abortivus (small-flowered buttercup) W,E,N
Ranunculus fascicularis (early buttercup) 23
Rhus radicans (poison ivy) W,E,N
Rhus typhina (staghorn sumac) 24
Ribes cynobasti (prickly gooseberry) W,E,N
Rosa blanda (meadow rose) 25
Rubus occidentalis (black raspberry) W,E
Sambucus pubens (red-berried elderberry) E
Sanguinaria canadensis (bloodroot) W,E,N
Sanicula gregaria (black snakeroot) 26
Scrophularia lanceolata (figwort) E,N
Smilacina racemosa (false Solomon's seal) W,E,N
Smilax lasioneura (carrion flower) E
Solidago flexicaulis (zig-zag goldenrod) W,E,N
Thalictrum dioicum (early meadow rue) W,E,N
Tilia americana (basswood) W,E,N
Triosteum perfoliatum (tinker's weed) 27
Ulmus rubra (slippery elm) W,E,N
Uvularia grandiflora (bellwort) W,E,N
Verbena urticifolia (white vervain) W,E,N
Veronica sp. (speedwell) 28 **needs verification**

Veronicastrum virginicum (Culver's root) W,E
Viburnum lentago (nannyberry) E
Viburnum rafinesquianum (downy arrowwood) E
Viola papilionacea (common blue violet) W,E,N
Viola pubescens (downy yellow violet) W,E,N
Viola sororia (woolly blue violet) E
Vitis riparia (wild grape) W,E,N
Xanthoxylum americanum (prickly ash) 29

Non-native or "Other" Species

Acer platanoides (Norway maple) E
Alliaria petiolata (garlic mustard) W,E,N
Asparagus officinalis E,N
Catalpa speciosa E
Echinochloa crusgalli (barnyard grass) a
Epipactis helliborine b
Glecoma hederacea (creeping Charlie) E
Homo sapiens (human)
Leonurus cardiaca (motherwort) E
Lonicera tatarica (Tartarian honeysuckle) W,E,N
Morus alba (white mulberry) E
Nepeta cataria (catnip)
Pinus strobus (white pine) E
Prunella vulgaris (heal-all) W,E,N
Rhamnus cathartica (European buckthorn) W,E,N
Rhamnus frangula c
Ribes sativum (garden currant) d
Solanum dulcamara (deadly nightshade) W
Urtica dioica (stinging nettle) e
Viburnum lantana (wayfaring tree) f
Viburnum opulus W,E,N

Appendix E - part 1
Plant Inventory, Eagle Heights Mounds (July 13, 2010)
By Glenda Denniston

Latin name	Common name	Comments
Alliaria petiolata	Garlic mustard	(removed)
Anemone quinquefolia	Wood anemone	
Aquilegia canadensis	Wild columbine	
Arctium minus	Common burdock	
Arisaema triphyllum	Jack-in-the-pulpit	
Aster spp	Aster species	(will ID later)
Carex blanda	Common wood sedge	
Carex pensylvanica	Pennsylvania sedge	
Carex rosea	Curly-styled wood sedge	
Carex spp.	(other woodland sedge species)	(will ID later)
Circaea lutetiana canadensis	Enchanter's nightshade	
Cirsium arvense	Canada thistle	
Eupatorium rugosum	White snakeroot	
Dicentra cucullaria	Dutchman's breeches	(dormant)*
Dodecatheon meadia	Shooting star	(dormant)*
Fragaria virginiana	Wild strawberry	(previously)
Galium sp.	Bedstraw (not aparine)	(will ID later)
Geranium maculatum	Wild geranium	
Geum canadense	White avens	
Hydrophyllum virginianum	Virginia waterleaf	
Impatiens pallida	Yellow jewelweed	
Leonurus cardiaca	Motherwort	(circ. mound)
Nepeta cataria	Catnip	
Osmorhiza longistylis	Smooth sweet cicely	
Oxalis stricta	Yellow wood-sorrel	
Parthenocissus quinquefolia	Virginia creeper	
Phryma leptostachya	American lop-seed	
Podophyllum peltatum	May-apple	
Polygonatum biflorum	Smooth Solomon's seal	
Polygonum virginianum	Jumpseed	
Prunella sp.	Self-heal	(circ. mound)
Prunus virginiana	Choke cherry	
Ranunculus abortivus	Small-flowered buttercup	
Ranunculus hispidus	Bristly buttercup	
Ribes spp	Gooseberry	
Rubus allegheniensis	Common blackberry	
Rubus occidentalis	Black raspberry	
Sambucus racemosa	Red elderberry	
Sanguinaria canadensis	Bloodroot	(formerly)
Sanicula gregaria	Black snakeroot	

Smilacina racemosa	False Solomon's Seal	
Smilax herbacea	Carrion flower	
Solanum dulcamara	Deadly nightshade	(circ. mound)
Solidago canadensis	Common goldenrod	(circ. mound)
Solidago flexicaulis	Zig-zag goldenrod	
Solidago ulmifolia	Elm-leaved goldenrod	
Taraxacum officinale	Common dandelion	(circ. mound)
Thalictrum dioicum	Early meadow-rue	(formerly)
Toxicodendron radicans	Poison-ivy	
Verbena urticifolia	White vervain	(circ. mound)
Viola soraria	Door-yard violet	
Vitis sp.	Wild grape	
Zanthoxylum americanum	Prickly-ash	(previous)

[several different mosses]
[Buckthorn, Shrub honeysuckle, Privet, Green Ash, and other woody saplings taking over]

NOTE:

The Eagle Heights mounds have experienced much soil disturbance over the years. Various individuals and groups have "cared for" the mounds in the past. Lilac, privet, pansies and other garden plants are among the plants that apparently were intentionally introduced by unknown individuals. A group of Boy Scouts is said to have done some weeding and also planting here in the past.

In 2002, Glenda Denniston did a major clearing of the mounds, removing all woody saplings and invasive and weedy herbs. At that time there was no stipulation against pulling plants from mounds. I made every effort, though, to keep soil disturbance to a minimum. I used no herbicides but instead cut some of the larger saplings at the base, returning periodically to cut re-sprouts. No erosion problems were observed following the weeding and cutting, and the violets, shooting stars, various sedges and other native forbs did well in the existing canopy shade after the shrubs were gone.

2004 and 2005 were the last years that I did cleared the mounds. This was because volunteers were told at that time that they could not disturb the earth in any way (I think an exception was made for Garlic mustard, but I don't remember). At any rate, since 2005, the weed problem has been getting progressively worse. I would strongly recommend cutting and treating the woody saplings and pulling the herbaceous weeds.

Photos of mounds in my files:
2002 photos:
0044, 0051: 5-31-02; 0122, 0123 on 6-13-02, during clearing of mounds.
1024: 6-21-02
0958, 0959, 0965: 8-4-02 Mound-clearing (Glenda Denniston)
0189 6-21-02 Clearing of Front linear mound (GD)
1472-1624 Clearing of Back linear mound in 2002 (GD, plus Tom Helgeson on several days)

2004 photos:
3426-3435: 10-4-04 Eagle Heights Woods mounds. Circular mound with Motherwort; Back linear mound: During woody plant removal

2005 photos:
0119 Vegetation on Front linear mound, 5-15-05
0122-0124 Circular mound, 5-15-05 Tom Brock's Field Trip

Appendix E - part 2
Plant Inventory, Eagle Heights Mounds (spring, 2011)
By Glenda Denniston

2 shady linear mounds

LINEAR MOUND #1

Note: vegetation density in little opening 10x the other areas

Undesirable **woody ON** mound
Woodbine
Honeysuckle (few)
Buckthorn

Undesirable **woody ADJACENT TO** mound
Viburnum lantana

Desirable herbaceous plants **ON** mound
Dodecatheon meadia (a patch) shooting star
Arisaema triphyllum (Jack in Pulpit)
Dentaria laciniata (Cutleafed toothwort)
Galium aparine
Dicentra cucularia (dutchmans breeches)
Carex sprengellii
Carex blanda
Carex pennsylvanica group
Carex sf rosea
Polygonum (sp?)(knotweed)
Maianthemum racemosum (False Solomon`s seal)
Polygonatum biflora (Solomon seal)
Ranunculus abortivus (little leaf buttercup)
Sanguinarea canadense (bloodroot)
Osmoriza (sweet cicely)
Circaea (enchanters nightshade)
Oxalis seedlings
Allium (canadense?)
Unknown composites
Geranium maculatum
Anemone quinquefolia (1) (wood anemone)
moss

Desirable herbaceous plants **adjacent to** mound
Podophyllum peltatum (mayapple)
Trillium grandiflora

Desirable woody plants **adjacent to**, if not on mound

Sambucus Canadensis
Native woody saplings, seedlings
Lonicera dioica

LINEAR MOUND #2

Undesirable woody ON mound
Woodbine
Honeysuckle (few)
Buckthorn

Desirable plants ON mound
Mayapple
Dicentra
Impatiens
Geranium
Hydrophyllulm
Polygonum
Viola (purple)
White Avens
Composite (sp) Oct 16 note: we could probably tell which one if we went up there NOW)
Zig zag Solidgo
Parthenocissus
Circae
Veronicastrum virginicum (2)(culvers root)
Sanguinarea
Smilax rotundifolia (common greenbriar)
Smilacina racemosa
Smilacina mayanthemum
Dodecatheon
Agrimony
Thalictrum dioicum
Arisaema triphyllum (jack in pulpit)

CONICAL MOUND

Undesirable woody ON mound
Woodbine
Honeysuckle (few)
Buckthorn

Undesirable woody ADJACENT TO mound
Parthenocissus (woodbine)
Raspberry
Rhamnus (Buckthorn)
Honeysuckle
Privet

All trees
Ribes (currant)

Undesirable herbaceous ADJACENT TO mound
Burdock
Garlic mustard
Motherwort
dandelion

Desirable plants ON mound
Polygonum
Hydrophyllum virginiana
Solidago ulmifolia
Geum (Avens)
Impatiens pallid
Geranium maculatum
Arisaema triphyllum

Desirable plants adjacent to, if not on mound
Podophyllum
Solomon seal
Poison ivy
Uvularia
Smilacina

Appendix E - Part 3
Spring 2012 Inventory of vegetation in areas cut in fall 2011

HERBACEOUS PLANTS

Survey Date: June 12, 2012

Latin name		**Common name**	**Location**	**Location**
genus	**species**		**B-C South**	**B South**
			Plant counts	**Plant counts**
Arisaema	triphyllum	Jack-in-the-pulpit	57	38
Asteraceae	unknown spp	single heart-shaped leaf	1	
Circaea	lutetiana	enchanter's nightshade	45	4
Geranium	maculatum	wild geranium		18
Geum	canadense	white avens	11	3
Hydrophyllum	virginianum	Virginia waterleaf	6	
Impatiens	pallida	yellow impatiens	5	
Lactuca	sp.	Prickly lettuce	1	
Maianthemum	racemosum	False Solomon`s seal		3
Sanguinarea	canadense	bloodroot	23	
Taraxacum	officinale	dandelion	1	
Thalictrum	dioicum	early meadow-rue		2
Percent of ground with moss:			1%	
Percent of plot covered by litter or bare ground:			70%	60%

Plants are counted by root origin, not by number of stems.

Additional notes about plots below, right:

B-C South

West 1/3 of plot has more live ground cover than the rest. East 2/3 of plot has ash at some places in soil, and cinders in some places.

This plot is fairly shady: 70-80% canopy

B South

Dead tree B-6 has fallen, leaving a small tip-up hole a few feet SE of the S tail of the mound.

It has fallen across the cut plot, obscuring some of it.

This plot is sunny in spots: 50- 70% canopy

This plot is less than half the size of B-C South.

The narrow cut corridor E to the path was not included in the survey.

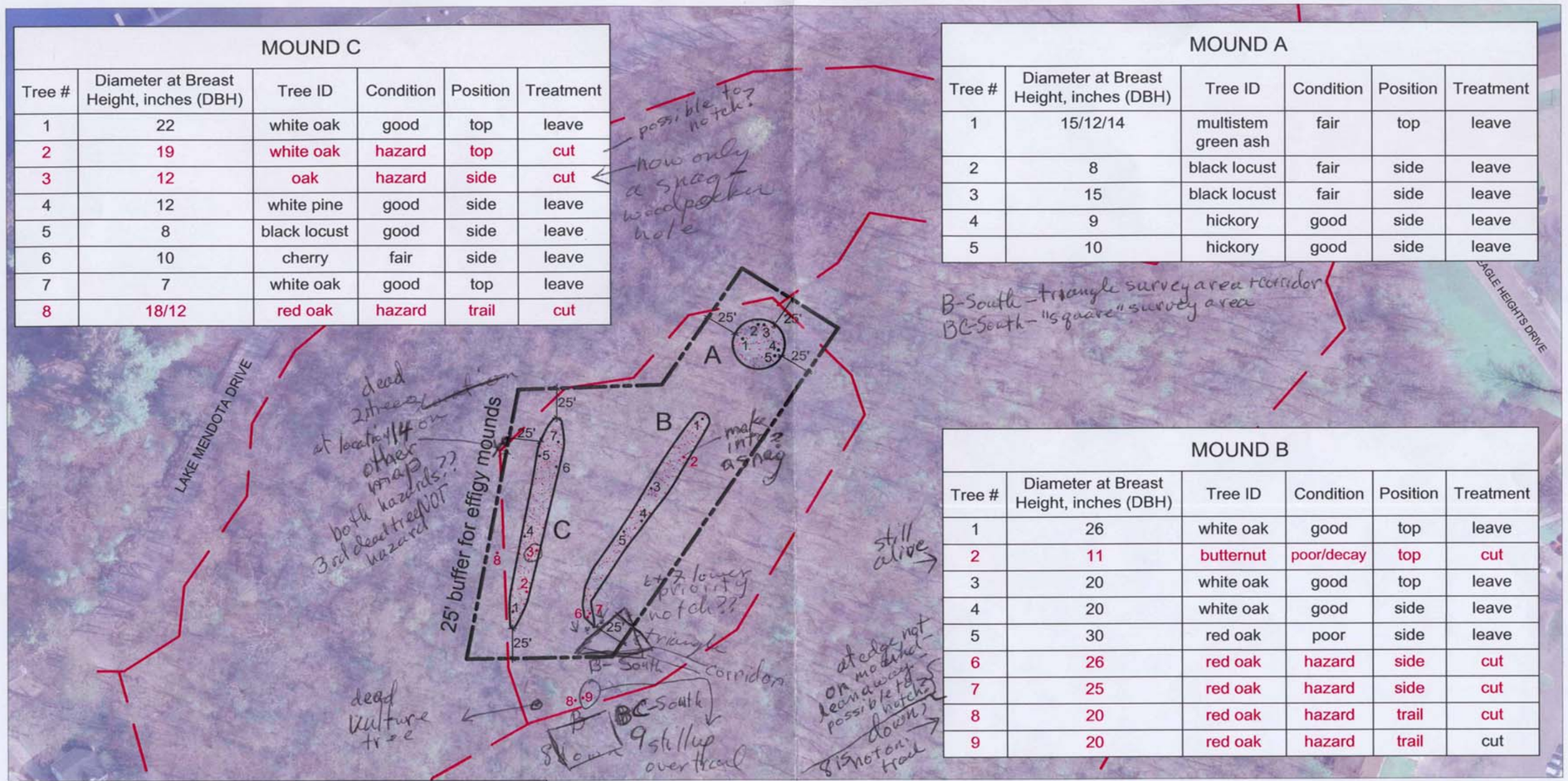
WOODY PLANTS

Survey Date: June 12, 2012

Shrub/vine seedlings/sprouts				
Latin name		**Common name**	**Location**	**Location**
genus	**species**		**B-C South**	**B South**
			Plant counts	**Plant counts/estimates**
Cornus	rugosa	gray dogwood	3	15
Lonicera	dioica	native vine honeysuckle	2	
Parthenocissus	quinquefolia	Woodbine	38	21
Prunus	virginiana	Choke cherry	8	
Rhamnus	cathartica	Buckthorn	108	~35
	resprouts only		12	
Smilax	herbacea	carrion flower	1	
Viburnum	acerifolium	maple-leaved viburnum	58	2

Tree seedlings

Latin name		**Common name**	**Location**	**Location**
genus	**species**		**B-C South**	**B South**
			Plant counts	**Plant counts**
Carya	ovata	shagbark hickory	1	
Celtis	occidentalis	hackberry	6	
Fraxinus	sp.	ash (prob. Green)	1	9
Prunus	serotina	black cherry	2	



MOUND C

Tree #	Diameter at Breast Height, inches (DBH)	Tree ID	Condition	Position	Treatment
1	22	white oak	good	top	leave
2	19	white oak	hazard	top	cut
3	12	oak	hazard	side	cut
4	12	white pine	good	side	leave
5	8	black locust	good	side	leave
6	10	cherry	fair	side	leave
7	7	white oak	good	top	leave
8	18/12	red oak	hazard	trail	cut

MOUND A

Tree #	Diameter at Breast Height, inches (DBH)	Tree ID	Condition	Position	Treatment
1	15/12/14	multistem green ash	fair	top	leave
2	8	black locust	fair	side	leave
3	15	black locust	fair	side	leave
4	9	hickory	good	side	leave
5	10	hickory	good	side	leave

MOUND B

Tree #	Diameter at Breast Height, inches (DBH)	Tree ID	Condition	Position	Treatment
1	26	white oak	good	top	leave
2	11	butternut	poor/decay	top	cut
3	20	white oak	good	top	leave
4	20	white oak	good	side	leave
5	30	red oak	poor	side	leave
6	26	red oak	hazard	side	cut
7	25	red oak	hazard	side	cut
8	20	red oak	hazard	trail	cut
9	20	red oak	hazard	trail	cut

Notes

Site boundaries established by Jenkins survey (2004)
Mound outlines based on site visit by A. Rosebrough (2004)

Legend

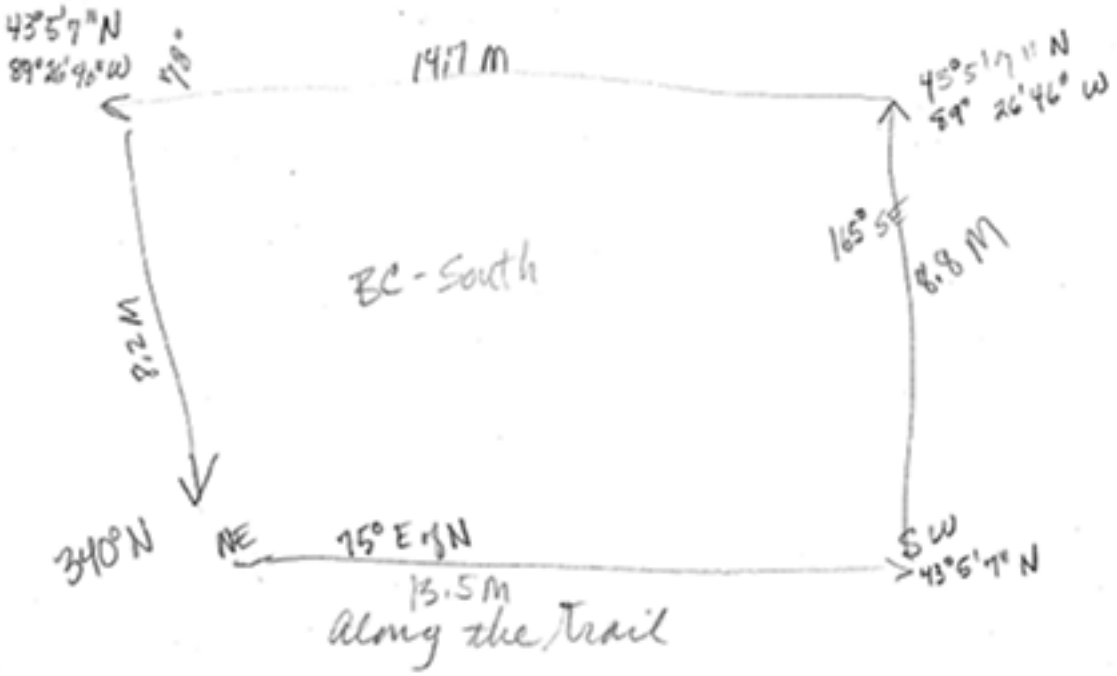
- Boundary of catalogued mound site
- Extant mound feature
- Existing unpaved path

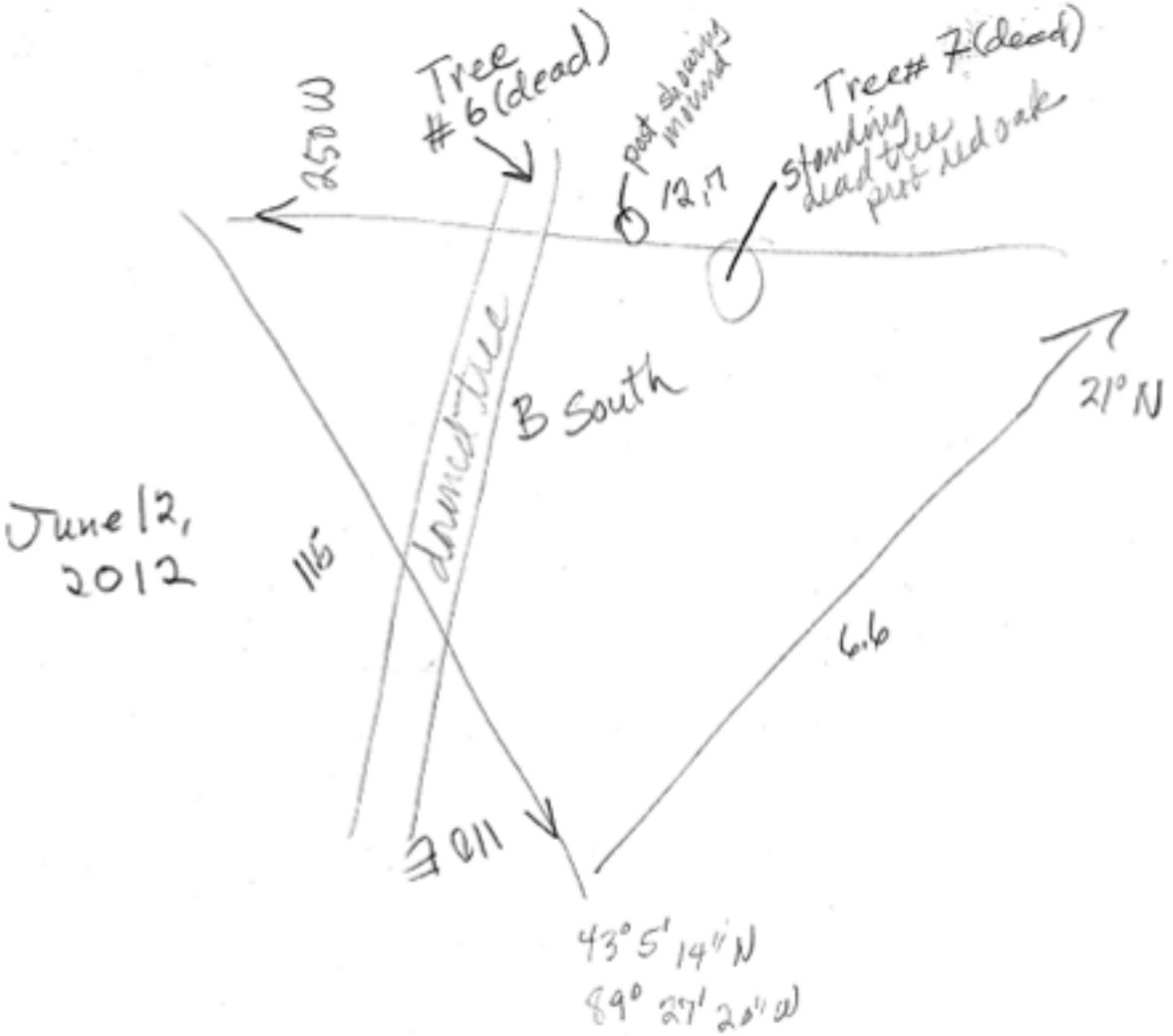
0 10' 40' 80'

THE UNIVERSITY WISCONSIN MADISON

Project: **Hazard Tree Removal Plan for Eagle Heights Mound Group 47 DA-130**		Designed By: DFE	Date: 10-31-2011
		Drawn By: RJR/JLB	Scale: 1' = 80'-0"
Drawing Title: Site Plan		O.S.M.:	
Building No.: N/A		Revision: Date:	Sheet: L-1
File: L:\ACAD\PLANNING\Archaeological Sites\Native Am Mounds_sites\Eagle Heights\EH Mounds Tree Removal.dwg			
FACILITIES PLANNING AND MANAGEMENT Campus Planning & Landscape Architecture	610 Walnut Street 930 WARF Madison, Wisconsin 53726		1 of 1

June 12, 2012


43°5'7"N
89°26'46"W
79°
14.7 M
45°5'7" N
89° 26'46" W
165° SE
8.8 M
BC - South
8.2 M
340°N
NE
75° E of N
SW
43°5'7" N
13.5 M
Along the Trail


Tree
#6 (dead)
post showing mound
Tree# 7 (dead)
standing dead tree
prob red oak
250 W
12.7
B South
21° N
June 12,
2012
116
6.6
43°5'14" N
89° 27' 20" W

Appendix F

Planning & Implementation subcommittee recommendations for potential herbaceous seeding on the Eagle Heights Mounds.

Herbaceous plants

Latin name genus	species	Common name
Agrimonia	gryposepala	common agrimony
Allium	canadense?	wild onion
Anemone	quinquefolia	wood anemone
Carex	blanda	common wood sedge
Carex	pennsylvanica g	Pennsylvania sedge
Carex	sf rosea	curly-styled wood sedge
Carex	sprengellii	sedge
Carex	spp.	sedge
Circaea	lutetiana	enchanter's nightshade
Dentaria	laciniata	Cutleafed toothwort
Dicentra	cucullaria	Dutchman's breeches
Dodecatheon	meadia	shooting star
Fragaria	virginiana	wild strawberry
Galium	aparine	bedstraw/cleavers
Galium	sp.	bedstraw
Geranium	maculatum	wild geranium
Geum	canadense	white avens
Hydrophyllum	virginianum	Virginia waterleaf
Maianthemum	racemosum	False Solomon`s seal
Maianthemum	stellatum	False Solomon`s seal
moss		several spp
Polygonatum	biflorum	Solomon's seal
Ranunculus	abortivus	little leaf buttercup
Ranunculus	hispidus	bristly buttercup
Sanguinarea	canadense	bloodroot
Viola	sororia	dooryard violet
Viola	sp.	purple violet

Appendix G

Hazard tree removals at Eagle Heights mound group

Prepared by D. Einstein
Historic and Cultural Resources Manager/Campus Planning and Landscape Architecture
Nov. 1, 2011 (v. 2 DRAFT)

Justification: Eight dead trees located in the Lakeshore Nature Preserve's Eagle Heights Woods pose a hazard to the integrity of the Indian burial mounds and the safety of visitors using the adjacent trail. Arborists designate "hazard trees" using the follow definition: "A *tree* is considered *hazardous* if it has defects that may cause a failure resulting in property damage, personal injury or death." Ellen Agnew, certified arborist and grounds department supervisor, has determined that these trees meet this hazard definition.

The trees have been dead for several years and are decaying. Large branches have recently fallen across the mounds, and additional limbs will certainly drop in the future. It is likely that these trees may also topple and cause "tip-ups" (exposed root masses with associated pits and disturbed soil).

The *"UW-Madison Indian Burial Sites Management Policy*" (approved May 26, 2011, by the Campus Planning Committee) states that burial sites will be managed to "preserve the structural integrity of mounds." Furthermore, the university as property stewards for this site is required under the state burial sites preservation law (Wis. Stat. 157.70) to protect the mounds from disturbance—such as might occur from falling limbs and "tip-ups."

Tree locations: Five dead oaks on the mounds and three dead oaks near the adjacent walking trail have been identified as hazard trees. See attached map for specific locations.

Removal strategy: The optimal removal strategy would involve the use of a "bucket truck" in order to access and cut limbs to be lowered to the ground in a controlled descent. Constrained road access makes it impossible to bring a bucket truck to the site.

Due to the advanced decay state of the trees it would not be safe to use a tree climber to work up in the tree, to cut and lower limbs. The only safe option would be to drop the entire tree by cutting the main trunk at ground level. Dropping a large tree, with massive limbs attached, poses several challenges: the tree may "hang-up" in adjacent trees and the force of the tree hitting the ground may cause soil disturbance.

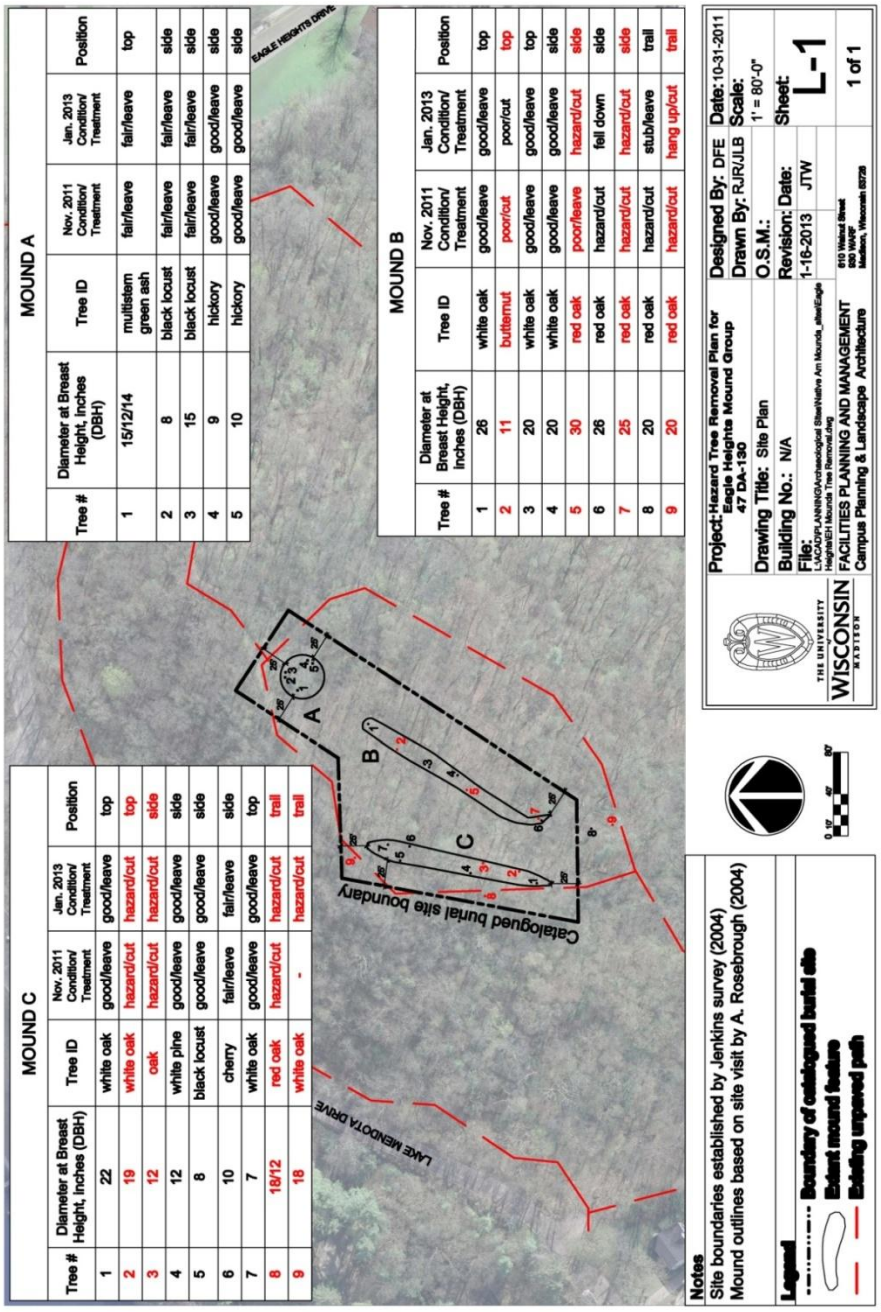
To avoid "hang-ups" the arborist may be required to remove additional trees in the fall zone. To avoid soil disturbance the trees will need to be felled ONLY under conditions where the ground is solidly frozen. It is likely that only small sized buckthorn and honeysuckle shrubs will need to be removed to safely remove the hazard trees. It is possible however, that a few additional small trees may be cut in the course of hazard tree removal. All efforts will be made to avoid removal of native trees in the drop zone.

Wood Clean-up: Trees trunks will be cut at ground level. Major limbs will be cut such that the main trunk rests on the ground. Major limbs that do not pose a safety hazard will remain attached to the main trunk. Woody material within five feet of the edge of the mound will be removed and scattered in adjacent areas.

Removal crew: Arborists from the Physical Plant grounds crew will fell the trees and buck limbs necessary to getting the main trunk to lie on the ground. Preserve staff and their contractors will be

responsible for removing small diameter shrubs/trees to establish a safe tree "drop zone." The Historic and Cultural Landscape Resources manager will work with all parties to assure that the burial mound site is appropriately protected.

Site restoration: In order to prevent soil erosion on the mound as result of the tree removals, Preserve staff may need to re-seed the area with appropriate ground cover plants or install bio-degradable erosion control mulch or mats.



Appendix H
Oak Woodland and Red Oak-Mixed Forest Descriptions

The southern oak forest/oak woodland community is widespread in southern Wisconsin. Differences between oak forest and oak woodland are primarily the density of oak trees and the resulting canopy closure but also include the type of oaks and other tree species present. Differences are the result of soil type—moisture and available nutrients, the slope of the land and its orientation to the mid-day sun (aspect), and fire history, current use as a management tool, and frequency.

Oak woodlands are fire shaped communities. This forest type has been in decline since fire suppression started at the time of settlement. Oaks make up 60-90 percent of the canopy. Indicator tree species are black, white, bur, and red oak and black cherry. The tree canopy is 30-90 percent closed. Because the tree canopy is somewhat open some of the trees have an "open-grown" form, although this form is less pronounced than an open-grown savanna tree because there isn't enough sunlight to support fully developed lower branches. The oak trunks in an oak woodland are taller than those that grow in oak savanna and the majority of the branches are in the upper half of the tree where they receive more sunlight. The branches frequently take on a twisted, open, spreading appearance. Shrubs are common in oak woodlands however frequent fire (historically) prevented them from becoming tall or dense. Wildflowers and grasses create a dense groundlayer. Spring blooming species are less common here than in more mesic forests in favor of summer or fall blooming species. Relatives of open prairie species such as *Helianthus strumosus* (pale-leaved woodland sunflower), *Aster lateriflorus* (calico aster), *Aster shortii* (Short's aster), *Asclepias exaltata* (poke milkweed), and *Elymus villosus* (silky wild rye) are abundant. Oak woodlands also have some species normally associated with moist prairies such as *Veronicastrum virginicum* (Culver's root) and *Dodecatheon meadia* (shooting star) which can tolerate light shade.

Red oak-mixed forests develop where deeper more nutrient rich soils favor a mix of oaks and moist-soil tree species. Red and white oak dominate, along with red maple and shagbark hickory on drier sites and sugar maple and basswood on moister sites. This forest type expanded greatly with fire suppression after settlement which allowed red oak seedlings and saplings to reach maturity. American elm, white ash, and sugar maple also benefitted from fire suppression. However infrequent burning and grazing kept these forests from being completely dominated by sugar maple and other shade tolerant species. Occasional fire is essential in this community to allow for oak regeneration and to prevent it from becoming a sugar maple dominated community. The tree canopy is 70-100 percent closed, although there are often gaps caused by disease, wind, and tree mortality. Oak trees that develop in the shade of a forest have a form referred to as "forest-grown" in which there are few if any lower branches because there isn't enough light to support their growth. Because young trees grow upward towards the sun, their trunks are relatively tall and slender. Southern oak forests have abundant shrubs and oak saplings in the midstory. Characteristic species in southern red oak-mixed forests include *Aster sagittifolius* (arrow-leaved aster), *Sanguinaria canadensis* (bloodroot), *Elymus hystrix* (bottlebrush grass), *Carex pensylvanica* (Pennsylvania sedge), *Thalictrum dioicum* (early meadow rue), *Cornus racemosa* (gray dogwood), *Podophyllum peltatum* (Mayapple), *Arisaema triphyllum* (jack in the pulpit), *Solidago ulmifolia* (elm-leaved

goldenrod), *Geranium maculatum* (wild geranium), *Maianthemum racemosum* (false solomon's seal), and *Viburnum rafinesquianum* (downy arrow-wood).
The division between the oak woodland and oak forest is purely arbitrary. Oak woodland will dominate well-drained sites, on south and west slopes of hills, or on thin soils on hilltops and ridges. They frequently adjoin oak savanna on the dry side and red oak forest or sugar maple-basswood forest on the protected (from fire) side with transitional areas between all.

Taken from:
The Tallgrass Restoration Handbook, Eds. Stephen Packard and Cornelia Mutel, 1997.
Wisconsin's Natural Communities, Randy Hoffman, 2002.
Vegetation of Wisconsin, John Curtis, 1959.