



# **Rapid Ecological Assessment for Governor Nelson State Park, Dane County, WI**

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## **A Rapid Ecological Assessment Focusing on Breeding Passerine Birds and High-quality Natural Communities**

Bureau of Parks and Recreation and  
Wisconsin Natural Heritage Inventory Program,  
Bureau of Natural Heritage Conservation  
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\* This appendix contains locational information on rare species and is not for public distribution.

## Purpose and Objectives

This report is intended to be used in conjunction with other sources of information for master planning Governor Nelson State Park (GNSP). This assessment addresses issues specifically related to the conservation of biological diversity for this property.

The primary objectives of this project were to collect biological inventory and to analyze, synthesize and interpret this information for use by the planning team. This effort focused on assessing areas of potential habitat for rare species and identifying natural community management opportunities.

Survey efforts for GNSP were limited to a “rapid assessment” for 1) identifying and evaluating ecologically important areas, 2) documenting passerine bird occurrences, and 3) documenting occurrences of high quality natural communities. This report can serve as the “Biotic Inventory” document used for master planning, although it is a scaled down version in terms of both the time and effort expended when compared to similar projects conducted on much larger properties, such as state forests. The information collected was the result of survey work in 2013. There will, undoubtedly, be gaps in our knowledge of the biota of this property, especially for certain taxa groups; these groups have been identified by the DNR or others as representing either an opportunity or a need for future work.

## Methods

The Wisconsin Natural Heritage Inventory (NHI) program resides in the Wisconsin DNR’s Bureau of Natural Heritage Conservation and is part of an international network of NHI programs. The defining and unifying characteristic of this network is the use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity. This network of data centers was established by The Nature Conservancy and is currently coordinated by NatureServe, an international non-profit organization.

Natural Heritage Inventory programs focus on rare plant and animal species, natural communities, and other natural features, referred to as *elements* of biodiversity. Elements tracked by the Wisconsin NHI Program are listed on the Wisconsin NHI Working List (WNHI 2014), which is the list of Endangered, Threatened and Special Concern plants, animals and natural communities maintained. This list changes over time as the populations of species change (both up and down) and as knowledge about species and natural community status and distribution increases. An explanation of the terms used in the working list can be found in Appendix A. The most recent Working List for the State of Wisconsin is available through the WDNR Bureau of Natural Heritage Conservation ([dnr.wi.gov](http://dnr.wi.gov), keyword “working list”).

The Wisconsin NHI program uses a standard approach for biotic inventory work that supports master planning (Appendix B). Generally, the approach involves data collection and development, data analysis, and presentation of results. Details of standardized NHI methodology can be found on the NatureServe Web site: [www.natureserve.org](http://www.natureserve.org).

Data for this report were compiled using existing NHI data as well as limited surveys during 2013, consisting of natural community and breeding bird surveys. Biotic information from the Environmental Impact Statement (WDNR 1975) and the draft Restoration and Management Plan (Krause 1991) were also included.

## General Background Information

Governor Nelson State Park is a day-use park that covers 422 acres on the north shore of Lake Mendota in central Dane County. The park was established in 1975 with development following in later years. The park is known for its Native American effigy mounds and other archaeological features.

### Previous efforts

Past surveys and inventory efforts highlighting the ecological importance of GNSP include the Land Legacy Report (WDNR 2006a) which was designed to identify Wisconsin's most important conservation and recreation needs for the next 50 years. The legacy area encompassing GNSP, known as the Upper Yahara River and Lakes, was assigned a score of three points on their five-point scale for conservation significance, meaning it possesses "very good ecological qualities, is of adequate size to meet the needs of some the critical components, and/or harbors natural communities or species of state significance." Restoration efforts will typically be important and have a very good chance of success.

## Ecological Context

*This section is largely reproduced from two sources: The Ecological Landscapes of Wisconsin (WDNR 2014) and Wisconsin Wildlife Action Plan (WDNR 2006a).*

The WDNR has mapped the state into areas of similar ecological potential and geography called Ecological Landscapes. The Ecological Landscapes are based on aggregations of smaller ecoregional units (Subsections) from a national system of delineated ecoregions known as the National Hierarchical Framework of Ecological Units (NHFEU) (Cleland et al. 1997). These ecoregional classification systems delineate landscapes of similar ecological pattern and potential for use by resource administrators, planners, and managers.

Governor Nelson State Park is located in the Southeast Glacial Plains Ecological Landscape (Figure 1). The **Southeast Glacial Plains Ecological Landscape** makes up the bulk of the non-coastal land area in southeast Wisconsin. This ecological landscape is situated on glacial till plains and outwash landforms, as well as rolling, ground, and interlobate moraines. Most of this ecological landscape is composed of glacial materials deposited during the Wisconsin Ice Age, but the southwest portion consists of older, pre-Wisconsin till with a more dissected topography. Soils are lime-rich tills overlain in most areas by a silt-loam loess cap. Agricultural and residential interests throughout the landscape have significantly altered the historical vegetation and the hydrology. Most of the rare natural communities that remain are associated with large moraines or in areas where the Niagara Escarpment occurs close to the surface.

Historically, vegetation in the Southeast Glacial Plains consisted of a mix of prairie, oak forests and savanna, and maple-basswood forests. Wet-mesic prairies, southern sedge meadows, emergent marshes, calcareous fens, and tamarack swamps were found in poorly drained, wetter portions of the landscape. End moraines and drumlins supported savannas and forests. Agricultural and urban land use practices have drastically changed the land cover of the Southeast Glacial Plains since Euro-American settlement. The current vegetation is primarily agricultural cropland. Remaining forests occupy only about 10% of the land area and important cover types include oak, maple-basswood, and lowland hardwoods. No large areas of contiguous forest exist today except on the Kettle Interlobate Moraine, which has relatively rugged topography that is often ill-suited for agricultural uses. In the southern Kettle Moraine, much of the historic oak savanna cover has succeeded to dense hardwood forests due to fire suppression. The total land area for the ecological landscape is approximately 4.9 million acres, of which only 10% is classified as timberland.

The Southeast Glacial Plains has the highest aquatic productivity for plants, insects, invertebrates, and fish of any ecological landscape in the state. The ecological landscape contains several large lakes such as those in the Madison area and in the Lake Winnebago Pool system. Kettle lakes are common on end moraines and in outwash channels. There are a number of significant river systems.

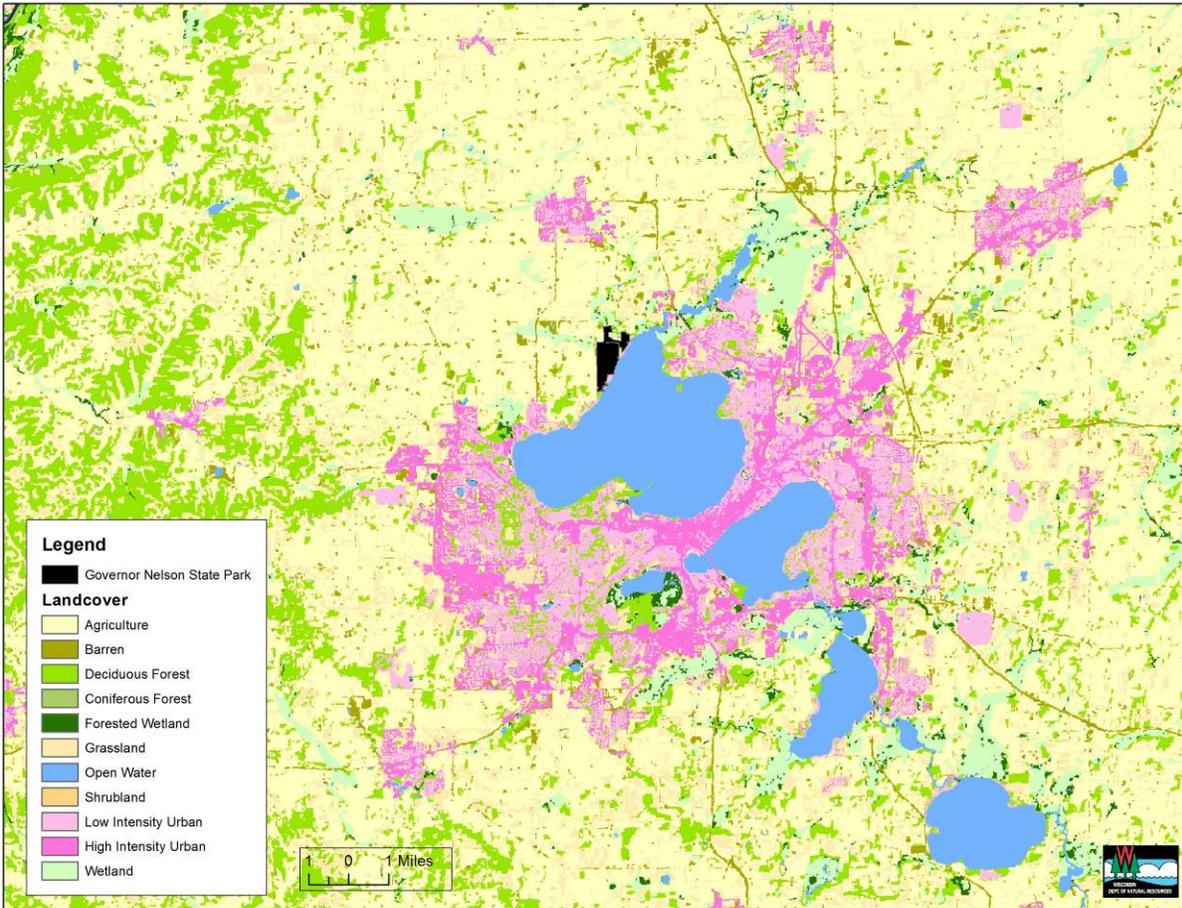
The landscape surrounding GNSP (Figure 2) is dominated by agriculture, the Yahara chain of lakes, and urbanization, including Madison which is Wisconsin's second largest city. GNSP is adjacent to Dorn Creek Fishery Area to the west and DNR-owned statewide habitat areas to the north along Sixmile Creek.



**Figure 1.** Ecological landscapes of Wisconsin. Governor Nelson State Park is represented by the circled black dot.

Governor Nelson State Park is located within two Landtype Associations (LTA) (Figure 3):

- **222Ke07** (Waunakee Moraines). The characteristic landform pattern of this LTA is rolling till plain and irregular drumlins with scattered bedrock knolls, lake plains, and outwash plains. Soils are predominantly well drained silt and loam over calcareous sandy loam till or bedrock. Most of the LTA is in agriculture (76%); grasslands are the next largest at 9%.
- **222Ke08** (Dane-Jefferson Drumlins and Lakes). This LTA is an undulating complex of till plains with drumlins, outwash plains, lake plains and muck deposits common. Soils are predominantly well drained silt and loam over calcareous sandy loam till, loamy lacustrine, or gravelly sandy outwash. Agriculture is the predominant land use (50%) followed by open and forested wetlands (13%), grasslands (10%), water (9%), and upland forests (8%).



**Figure 2.** Land cover from the WISCLAND GIS coverage (WDNR 1993).

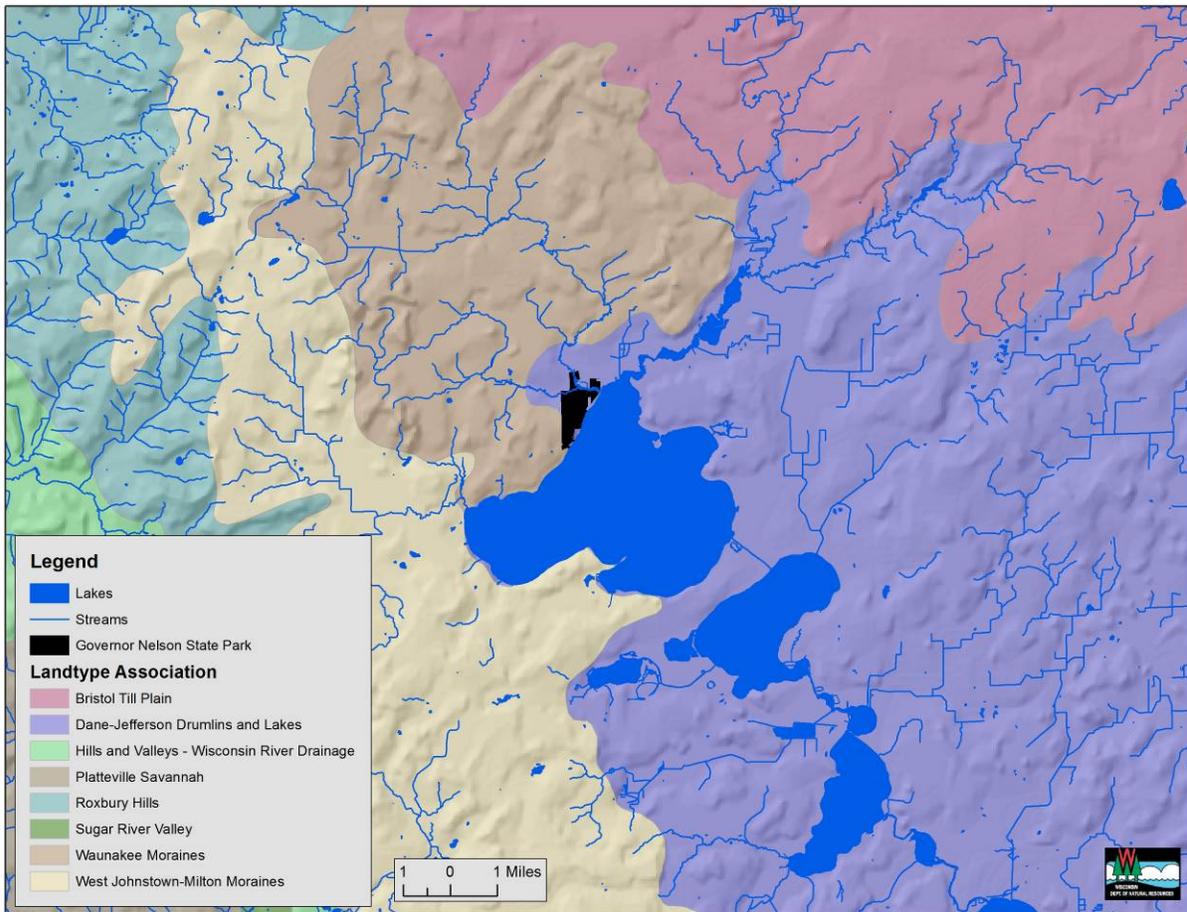
Data from the original Public Land Surveys are often used to infer vegetation cover types for Wisconsin prior to widespread Euro-American settlement. Public Land Surveys for the area comprising the GNSP were conducted between 1832 and 1835. Finley's (1976) Original Vegetation Map described the area that now comprises the GNSP (Figure 4) as dominated by oak-dominated forest with white oak, black oak, and bur oak.

### **Current Vegetation**

Current vegetation of GNSP is characterized by a mosaic of degraded Southern Mesic and Dry-mesic Forest, oak woodlands undergoing restoration, Southern Hardwood Swamp, Southern Sedge Meadow, Shrub Carr, Emergent Marsh, constructed prairies, and old fields. Dominance of the canopies of the mesic and dry-mesic forest is variable and includes red oak, shagbark and bitternut hickory, black cherry, ash, box elder, and hackberry. There are open-grown bur oaks and red cedars embedded within younger, closed canopy forest. The shrub layer has a moderate cover that varies greatly in cover and is often moderate to dense. Dominant shrubs include non-native species (bush honeysuckles, common buckthorn) and native species (gray dogwood) as well as some saplings of canopy species. The oak woodlands are dominated by red and white oak and hickories.

A narrow band of poor quality Southern Hardwood Swamp is near Lake Mendota. Canopy dominants include cottonwood, hackberry, silver maple, green ash, and box elder. Canopy closure is variable,

ranging from closed to less than 50%. Canopy gaps are mostly filling in with willows. Reed canary grass is common in the ground layer.



**Figure 3.** Landtype Associations at Governor Nelson State Park.

The Southern Sedge Meadow is variable in quality, with some areas dominated by native sedges, grasses, and forbs and other areas dominated by reed canary grass, and, in wetter areas, by cattails. There are scattered seepy areas in the sedge meadows; slightly higher areas have elements of Wet-mesic to Mesic Prairie. The sedge meadows are surrounded by and interspersed with Shrub Carr dominated by willow and red-osier dogwood. Scattered green ash trees are present. Common and glossy buckthorn are present and appear to be expanding. A few tamaracks have been planted, some of which are surviving.

There is extensive Emergent Marsh dominated by cattails, sedges, bulrushes, and bur-reeds along with patches of reed canary grass and giant reed along Dorn and Sixmile creeks.

Upland prairie restorations include an array of grasses and forbs. The remaining old fields are dominated by smooth brome and other non-native cool season grasses.

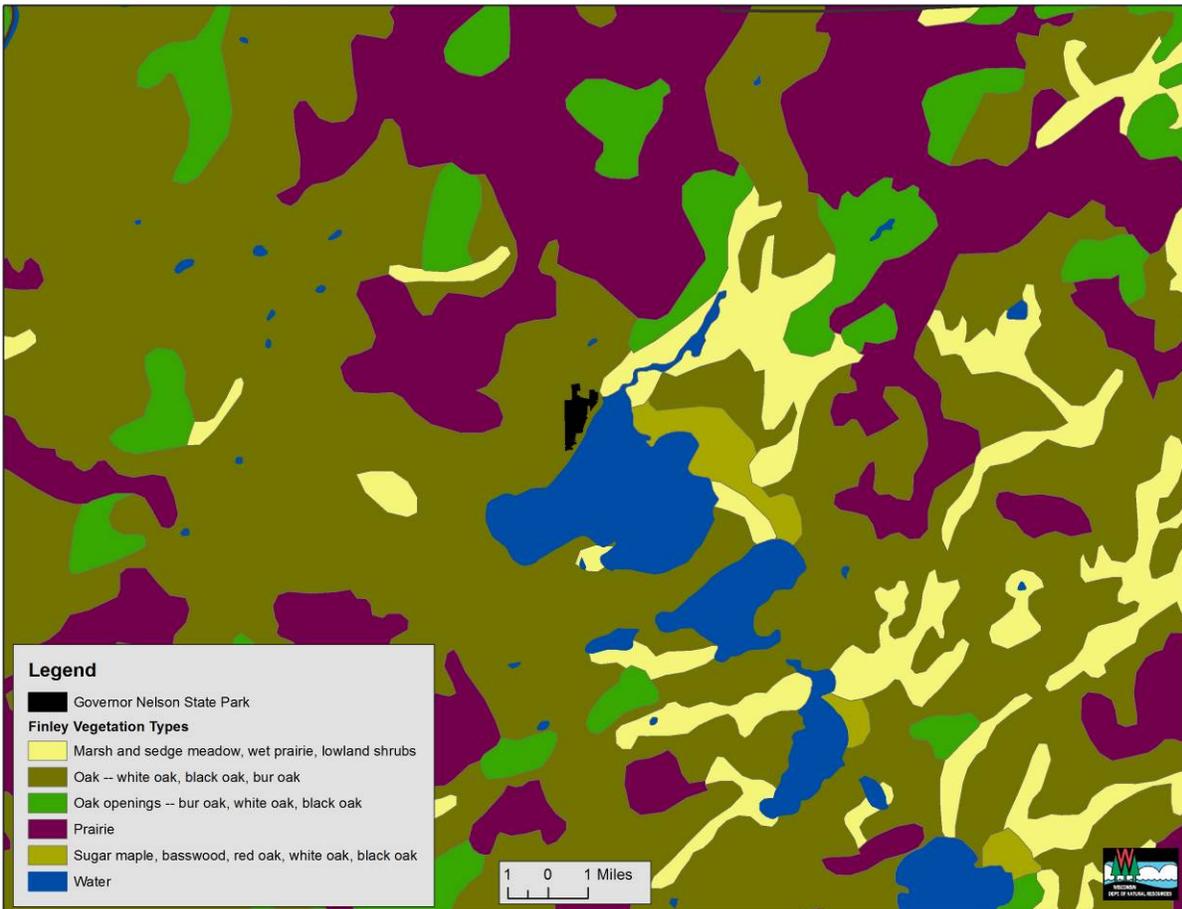
## Water Resources

### *Lake Mendota*

Lake Mendota is a 9,781 acre drainage lake located in Dane County. It has a maximum depth of 83 feet, with a mean depth of 42 feet. The lake bottom is a mixture of sand (29%), gravel (29%), rock (2%), and muck (40%). Fish include musky, panfish, largemouth and smallmouth bass, northern pike, walleye, sturgeon, and catfish ([wi.dnr.gov](http://wi.dnr.gov), keyword “Lake Mendota”). The lake’s water clarity is low. Lake level is controlled by the Tenney Park dam at the Yahara River outlet. Several streams enter Lake Mendota, including the Yahara River and Dorn and Sixmile creeks.

### *Sixmile Creek*

Sixmile Creek is listed as an Exceptional Resource Water which is defined as a surface water providing outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities. Water quality in Sixmile Creek’s 12-mile length is generally good, supporting a limited forage fishery west of STH 113, a diverse forage and warm water sport fishery from STH 113 to Lake Mendota, and abundant spawning areas ([wi.dnr.gov](http://wi.dnr.gov), keyword “Six Mile Creek”).



**Figure 4.** Vegetation prior to widespread Euro-American settlement for Governor Nelson State Park and vicinity. Data are from Finley (1976).

## Rare Species and High Quality Natural Communities of Governor Nelson State Park

Several rare species have been documented at GNSP (Appendix C). Of the ten animal species, one is Threatened, three are Special Concern, and six are on the watch list; nine of the then are Species of Greatest Conservation Need (SGCN). The only rare plant species is listed as Threatened. Other than the Emergent Marsh, the existing condition of the remaining natural communities found on the property does not warrant inclusion in NHI's database of high-quality natural communities. As restoration work continues on the oak woodlands that community type on the park may become of a high enough quality to be mapped in the NHI database. Summary paragraphs describing the rare species and natural community known to occur at GNSP and entered in the NHI database can be found in Appendix C.

## Management Considerations and Opportunities for Biodiversity Conservation for GNSP

### **Migratory Birds – Lake Mendota**

The Madison area, including Lake Mendota, has been recognized as a hotspot by the Wisconsin Society for Ornithology to watch migrating waterfowl and songbirds ([wsobirds.org](http://wsobirds.org), keyword “Lake Mendota”). Maintaining existing undeveloped areas on the Lake Mendota shoreline and other habitat would benefit migratory birds.

### **Grassland Birds**

Grassland bird species are exhibiting one of the most significant declines of any suite of bird species in Wisconsin and across the Midwest (Herkert 1995). The major cause for this decline has been the alteration and loss of breeding habitat (Robbins et al 1996). GNSP presents opportunities for addressing several area sensitive bird species that require large grassland patches to enable good nest success and persistence of viable populations. Estimates show patch size of greater than 100 hectares (247 acres) must be maintained for conservative grassland species (pers. comm. D. Sample). The context of the surrounding landscape should be assessed to determine if larger tracts could be connected to develop and protect larger grassland areas. Currently, the constructed prairie and surrogate grasslands at GNSP support a number of common and rare grassland bird species. Continued restoration efforts, maintaining surrogate grasslands, removing brushy edges and fencerows, and connecting larger grassland areas would all benefit grassland birds.

### **Oak Woodland Restoration**

Historically, the study area was predominantly oak-dominated uplands and a variety of wetlands. Changes in land use practices (e.g., widespread conversion to agriculture, suppression of fire) since the mid-1800s have resulted in changes in habitat types. Areas that were formerly dominated by oak are now a mixture of closed-canopy grown oaks and more fire-sensitive tree species such as hackberry. The presence of several areas with open grown and semi-open grown oaks provides an indication of a formerly more open condition. An oak woodland restoration project began in 2004, and significant progress has been made in the intervening years. The GNSP oak woodland management plan (WDNR 2011) delineated additional areas into which oak woodland management would be expanded beyond the initial restoration zone (Figure 5).

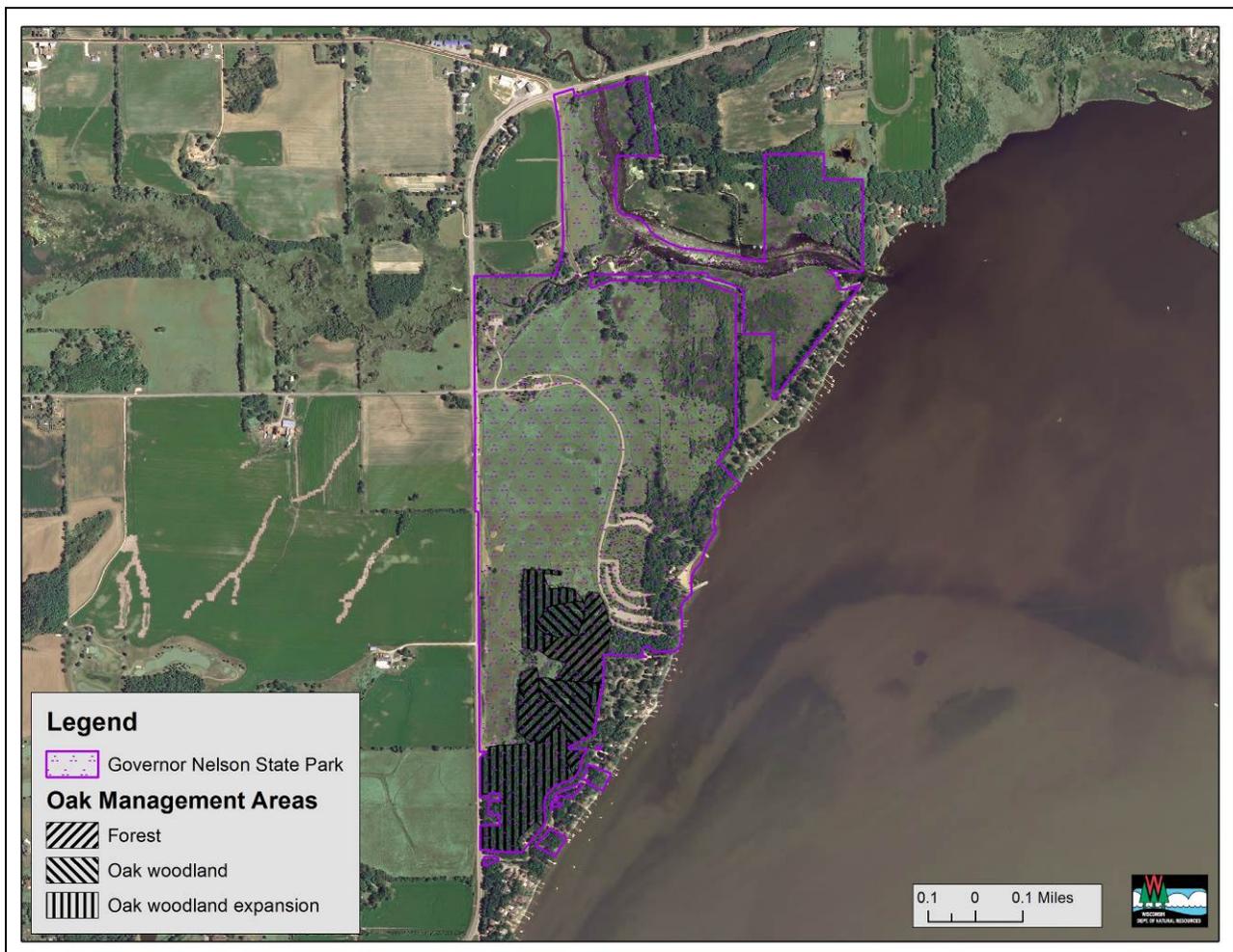
### **Wisconsin Wildlife Action Plan**

All of the vertebrate SGCN known from GNSP, except for one species which was not considered in the first Wisconsin Wildlife Action Plan, along with the natural communities they inhabit represent ecological priorities in the Southeast Glacial Plains Ecological Landscape (WDNR 2006b). The

priorities were developed based on the probability that a species occurs in an ecological landscape, their degree of association with natural communities, and the opportunities in a given ecological landscape for sustaining the natural community (see [dnr.wi.gov](http://dnr.wi.gov), keyword “wildlife action plan” for more information). Appendix D contains a matrix with the vertebrate SGCN and associated ecological opportunities (native communities) for this landscape.

### Wetlands

The mosaic of open and shrubby wetlands provide habitat for a number of different animal species. Based on older aerial photographs and young shoots observed during field work, it appears as if the shrub-carr is expanding. As noted above, the quality of the open sedge meadow is variable, with some areas dominated by native plants and others by non-native species. Prescribed fire and brush clearing could be used to help maintain the open wetlands and reduce the amount of shrub-carr present.



**Figure 5.** Oak woodland management areas at Governor Nelson State Park.

### Invasive Plants

Some invasive plants are well-established at GNSP, including common buckthorn, non-native bush honeysuckles, garlic mustard, and reed canary grass. Other invasive plants that are present and that

represent possible future threats to diversity include Japanese hedge parsley, leafy spurge, and wild parsnip. Numerous other invasive species are present across all habitat types.

## Site-specific Opportunities for Biodiversity Conservation

An outcome of analyzing biotic inventory results can be the delineation of Primary Sites which generally encompass the best examples of 1) both rare and representative natural communities and 2) rare species populations that have been documented. These sites warrant high protection and/or restoration consideration during the development of the new property master plan. This report is meant to be considered along with other information when identifying opportunities for various management designations during the master planning process. Although no Primary Sites were identified at Governor Nelson State Park, opportunities to manage for and enhance biodiversity have been identified above.

## Future Needs

This project was designed to provide a rapid assessment of the biodiversity values for GNSP. Although the report is adequate for master planning purposes, additional efforts could help to inform future adaptive management efforts, along with providing useful information regarding the natural communities and rare species at GNSP.

- Invasives monitoring and control should be continued and expanded, as able. State parks and many other public lands throughout Wisconsin are facing major management problems because of serious infestations of highly invasive species such as garlic mustard, common and glossy buckthorn, and non-native bush honeysuckles. Some of these species are easily dispersed by humans and vehicles; others are spread by birds, mammals, insects, water, or wind.
- One rare herptile species has been documented at the park, and there is potential habitat for other rare species. Surveys for reptiles and amphibians are recommended to help determine the diversity and abundance of herptiles at the park.
- With the proximity of Lake Mendota and the diversity of habitats present, GNSP has good potential for use by bats. Surveys are recommended to help elucidate bat usage of the park.
- Additional rare plant surveys could be conducted at the park focusing on different times of the year to take advantage of phenological events.
- Casual observations would suggest a fairly diverse invertebrate fauna. Targeted groups (e.g., dragonflies, butterflies) could be surveyed to provide more data that could help inform management decisions.

## Glossary

**Area Sensitive** – species that respond negatively to decreasing habitat patch size. Area-sensitive species exhibit an increase in either population density or probability of occurrence with increasing size of a habitat patch.

**Ecological Landscape** - landscape units developed by the WDNR to provide an ecological framework to support natural resource management decisions. The boundaries of Wisconsin's sixteen Ecological Landscapes correspond to ecoregional boundaries from the National Hierarchical Framework of Ecological Units, but sometimes combine subsections to produce a more manageable number of units.

**Ecological Priority** – the natural communities (habitats) in each Ecological Landscape that are most important to the Species of Greatest Conservation Need, as identified in the Wisconsin Wildlife Action Plan (WDNR 2006b). Three sources of data were used to derive this information: 1) the probability that a species will occur in a given landscape, 2) the degree to which a species is associated with a particular natural community, and 3) the degree to which there are opportunities for sustaining a given natural community in any given Ecological Landscape. See [dnr.wi.gov](http://dnr.wi.gov), keyword “wildlife action plan” for more information.

**Element** –the basic building blocks of the Natural Heritage Inventory. They include natural communities, rare plants, rare animals, and other selected features such as colonial bird rookeries and mussel beds. In short, an element is any biological or ecological entity upon which we wish to gather information for conservation purposes.

**Landtype Association (LTA)** - a level in the National Hierarchical Framework of Ecological Units (see next entry) representing an area of 10,000 – 300,000 acres. Similarities of landform, soil, and vegetation are the key factors in delineating LTAs.

**National Hierarchical Framework of Ecological Unit** - a land unit classification system developed by the U.S. Forest Service and many collaborators. As described by Avers et al (1994): “The NHFEU can provide a basis for assessing resource conditions at multiple scales. Broadly defined ecological units can be used for general planning assessments of resource capability. Intermediate scale units can be used to identify areas with similar disturbance regimes. Narrowly defined land units can be used to assess specific site conditions including: distributions of terrestrial and aquatic biota; forest growth, succession, and health; and various physical conditions.”

**Natural community** – an assemblage of plants and animals, in a particular place at a particular time, interacting with one another, the abiotic environment around them, and subject to primarily natural disturbance regimes. Those assemblages that are repeated across a landscape in an observable pattern constitute a community type. No two assemblages, however, are exactly alike.

**Representative** - native plant species that would be expected to occur in native plant communities influenced primarily by natural disturbance regimes in a given landscape - e.g., see Curtis (1959).

**SGCN (or “Species of Greatest Conservation Need”)** – native wildlife species with low or declining populations that are most at risk of no longer being a viable part of Wisconsin's fauna (from the “Wisconsin Wildlife Action Plan,” WDNR 2006b).

**Surrogate grasslands** - these are the main habitats (e.g. CRP, old field, pasture) now available for birds that require grasslands, especially large grasslands, for portions or all of their life cycles. These communities are similar in structure (but not species composition) to the native prairies and open (i.e.,

recently burned) barrens that were formerly more abundant in Wisconsin. The dominant plants in “surrogate” grasslands are typically exotic “cool season” grasses. See Sample and Mossman (1997) for more information.

**Watch list** – consists of species that have experienced, or are believed to have experienced, a statewide or range-wide decline, but are not currently tracked in the Natural Heritage Inventory (NHI) database. The watch list includes newly discovered species for which origin and rarity need to be determined, certain animals designated as Species of Greatest Conservation Need (SGCN) in the Wisconsin Wildlife Action Plan, and species that were tracked in the past but proved more abundant, widespread, or less vulnerable than previously thought. Although watch list species are not actively tracked by NHI, occurrences documented during surveys are often stored by NHI, as these species could be tracked in the future if there is further evidence of their decline.

## Species List

The following is a list of species referred to by common name in the report text.

<b>Common Name</b>	<b>Scientific Name</b>
<b>Animals</b>	
catfish	<i>Ictalurus punctatus</i>
lake sturgeon	<i>Acipenser fulvescens</i>
largemouth bass	<i>Micropterus salmoides</i>
muskellunge	<i>Esox masquinongy</i>
northern pike	<i>Esox lucius</i>
smallmouth bass	<i>Micropterus dolomieu</i>
walleye	<i>Sander vitreus</i>
<b>Plants</b>	
ash	<i>Fraxinus</i> spp
bitternut hickory	<i>Carya cordiformis</i>
black cherry	<i>Prunus serotina</i>
box elder	<i>Acer negundo</i>
bulrush	<i>Scirpus</i> spp
bur oak	<i>Quercus macrocarpa</i>
bur-reed	<i>Sparganium</i> spp
bush honeysuckle	<i>Lonicera</i> spp
cattail	<i>Typha</i> spp
common buckthorn	<i>Rhamnus cathartica</i>
eastern cottonwood	<i>Populus deltoides</i>
garlic mustard	<i>Alliaria petiolata</i>
giant reed	<i>Phalaris arundinacea</i>
glossy buckthorn	<i>Rhamnus frangula</i>
gray dogwood	<i>Cornus racemosa</i>
green ash	<i>Fraxinus pennsylvanica</i>
hackberry	<i>Celtis occidentalis</i>
Japanese hedge-parsley	<i>Torilis japonica</i>
red cedar	<i>Juniperus virginiana</i>
red oak	<i>Quercus rubra</i>
red-osier dogwood	<i>Cornus stolonifera</i>
reed canary grass	<i>Phalaris arundinacea</i>
sedges	<i>Carex</i> spp
shagbark hickory	<i>Carya ovata</i>
silver maple	<i>Acer saccharinum</i>
smooth brome	<i>Bromus inermis</i>
wild parsnip	<i>Pastinaca sativa</i>
willows	<i>Salix</i> spp

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## Appendix A

### Wisconsin Natural Heritage Working List Explanation

The Wisconsin Natural Heritage Working List contains species known or suspected to be rare in the state and natural communities native to Wisconsin. It includes species legally designated as "Endangered" or "Threatened" as well as species in the advisory "Special Concern" category. Most of the species and natural communities on the list are actively tracked and we encourage data submissions on these species. This list is meant to be dynamic - it is updated as often as new information regarding the biological status of species becomes available. See the Endangered Resources Program web site for the most recent Natural Heritage Inventory Working List (<http://dnr.wi.gov/org/land/er/wlist/>).

#### Key

**Scientific Name:** Scientific name used by the Wisconsin Natural Heritage Inventory Program.

**Common Name:** Standard, contrived, or agreed upon common names.

**Global Rank:** Global element rank. See the rank definitions below.

**State Rank:** State element rank. See the rank definitions below.

**US Status:** Federal protection status in Wisconsin, designated by the Office of Endangered Species, U.S. Fish and Wildlife Service through the U.S. Endangered Species Act. LE = listed endangered; LT = listed threatened; XN = non-essential experimental population(s); LT,PD = listed threatened, proposed for de-listing; C = candidate for future listing.

**WI Status:** Protection category designated by the Wisconsin DNR. END = endangered; THR = threatened; SC = Special Concern.

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are SC/P = fully protected; SC/N = no laws regulating use, possession, or harvesting; SC/H = take regulated by establishment of open closed seasons; SC/FL = federally protected as endangered or threatened, but not so designated by WDNR; SC/M = fully protected by federal and state laws under the Migratory Bird Act.

Special Concern species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

## **Global & State Element Rank Definitions**

### **Global Element Ranks:**

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single state or physiographic region) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.

G4 = Apparently globally secure, though it may be quite rare in parts of its range, especially at the periphery.

G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.

GH = Of historical occurrence throughout its range, i.e., formerly part of the established biota, with the expectation that it may be rediscovered.

GU = Possibly in peril range-wide, but their status is uncertain. More information is needed.

GX = Believed to be extinct throughout its range (e.g. Passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? = Not ranked.

Species with a questionable taxonomic assignment are given a "Q" after the global rank.

Subspecies and varieties are given subranks composed of the letter "T" plus a number or letter. The definition of the second character of the subrank parallels that of the full global rank. (Examples: a rare subspecies of a rare species is ranked G1T1; a rare subspecies of a common species is ranked G5T1.)

### **State Element Ranks**

S1 = Critically imperiled in Wisconsin because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation from the state.

S2 = Imperiled in Wisconsin because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.

S3 = Rare or uncommon in Wisconsin (21 to 100 occurrences).

S4 = Apparently secure in Wisconsin, with many occurrences.

S5 = Demonstrably secure in Wisconsin and essentially ineradicable under present conditions.

SA = Accidental (occurring only once or a few times) or casual (occurring more regularly although not every year); a few of these species (typically long-distance migrants such as some birds and butterflies) may have even bred on one or more of the occasions when they were recorded.

SE = An exotic established in the state; may be native elsewhere in North America.

SH = Of historical occurrence in Wisconsin, perhaps having not been verified in the past 20 years, and suspected to be still extant. Naturally, an element would become SH without such a 20-year delay if the only known occurrence were destroyed or if it had been extensively and unsuccessfully looked for.

SN = Regularly occurring, usually migratory and typically non-breeding species for which no significant or effective habitat conservation measures can be taken in Wisconsin. This category includes migratory birds and bats that pass through twice a year or, may remain in the winter (or, in a few cases, the summer) along with certain lepidoptera which regularly migrate to Wisconsin where they reproduce, but then completely die out every year with no return migration. Species in this category are so widely and unreliably distributed during migration or in winter that no small set of sites could be set aside with the hope of significantly furthering their conservation.

SZ = Not of significant conservation concern in Wisconsin, invariably because there are no definable occurrences in the state, although the taxon is native and appears regularly in the state. An SZ rank will generally be used for long-distance migrants whose occurrence during their migrations are too irregular (in terms of repeated visitation to the same locations), transitory, and dispersed to be reliably identified, mapped, and protected. Typically, the SZ rank applies to a non-breeding population.

SR = Reported from Wisconsin, but without persuasive documentation which would provide a basis for either accepting or rejecting the report. Some of these are very recent discoveries for which the program hasn't yet received first-hand information; others are old, obscure reports that are hard to dismiss because the habitat is now destroyed.

SRF = Reported falsely (in error) from Wisconsin but this error is persisting in the literature.

SU = Possibly in peril in the state, but their status is uncertain. More information is needed.

SX = Apparently extirpated from the state.

### **State Ranking of Long-Distance Migrant Animals:**

Ranking long distance aerial migrant animals presents special problems relating to the fact that their non-breeding status (rank) may be quite different from their breeding status, if any, in Wisconsin. In other words, the conservation needs of these taxa may vary between seasons. In order to present a less ambiguous picture of a migrant's status, it is necessary to specify whether the rank refers to the breeding (B) or non-breeding (N) status of the taxon in question. (e.g. S2B,S5N).

## **Appendix B.**

# **Natural Heritage Inventory Overview and General Methodology**

The Ice Age National Scientific Reserve at Cross Plains Rapid Ecological Assessment was conducted by the Wisconsin Natural Heritage Inventory (NHI) program, which is part of an international network of NHI programs. The defining characteristic of this network, and the feature that unites the programs, is the use of a standard methodology for collecting, processing, and managing data on the occurrences of natural biological diversity. This network of data centers is coordinated by NatureServe, an international non-profit organization.

Natural Heritage Inventory programs focus on rare species, natural communities, and other rare elements of nature. When NHI programs are established, one of the first tasks facing the staff is to consolidate existing information on the status and location of rare elements. Before proceeding, the NHI program must determine what elements warrant “tracking” and which are more common. Similar to most states, Wisconsin biologists had a general idea of which species in the better-studied taxonomic groups (e.g., mammals, birds, and vascular plants) were rare or declining. For less-studied groups such as macroinvertebrates, the process of assembling the list of species to track and gathering the data were quite dynamic. Initially, NHI staff cast a wide net, collecting data on many species from existing sources (e.g., scientific literature, field guides, books, maps, and museum collections) as well as from direct contact with experts throughout the state. As more data were gathered, it was clear that some species were more common than originally thought and the NHI program stopped collecting data on them. Thus, the list of which elements are tracked, the NHI Working List, changes over time as species’ populations change (both up and down) and as our knowledge about their status and distribution increases. This evolution continues today, with the NHI Working List typically going through several revisions a year. The most current Wisconsin Natural Heritage Working List for the State of Wisconsin is available through the NHI office and on the Endangered Resources Program Web pages ([dnr.wi.gov/org/land/er/wlist/](http://dnr.wi.gov/org/land/er/wlist/)).

In general, there are two approaches to surveying biodiversity: (1) those focused on locating occurrences of particular elements, and (2) those focused on assessing the components of a particular area. The latter approach employs a “top down” analysis that begins with an assessment of the natural communities and aquatic features present, their relative quality and condition, the surrounding landscape pattern, and current land use and results in the identification of future species-oriented surveys. This approach, commonly referred to as “coarse filter-fine filter,” concentrates inventory efforts on those sites most likely to contain target species. It also allows sites to be placed in a larger, landscape context for more broad applications of ecosystem management principles.

The NHI methodology for organizing and storing data is actually a system of three inter-related data storage techniques: structured manual information files, topographic map files, and a computer database that integrates the various files. The computer component, known as Biotics, is a sophisticated relational database management application with both tabular and spatial components.

## **Methods of Inventory**

The following is a description of standard NHI methods for conducting inventories. Any step may be modified, dropped, or repeated as appropriate to the project.

**File Compilation:** Involves obtaining existing records of natural communities, rare plants and animals, and aquatic features for the study area and surrounding lands and waters from Biotics. Other databases with potentially useful information may also be queried, such as: forest stand/compartment reconnaissance, which is available for many public agency owned lands; the DNR Surface Water Resources series for summaries of the physical, chemical, and biological characteristics of lakes and streams (statewide, by county); the Milwaukee Public Museum's statewide Herp Atlas; museum/herbarium collections for various target taxa; soil surveys; and the fish distribution database (by watershed, WDNR-Research).

Additional data sources are sought out as warranted by the location and character of the site, and the purpose of the project. Manual files maintained within the Bureau of Endangered Resources contain information on a variety of subjects relevant to the inventory of natural features and are frequently useful.

**Literature Review:** Field biologists involved with a given project consult basic references on the natural history and ecology of the region within which the study area is situated. This can both broaden and sharpen the focus of the investigator.

**Target Elements:** Lists of target elements including natural communities, rare plants and animals, and aquatic features are developed for the study area. Field inventory is then scheduled for the times when these elements are most identifiable or active. Inventory methods follow accepted scientific standards for each taxon.

**Map Compilation:** USGS 7.5 minute topographic quadrangles serve as the base maps for field survey and often yield useful clues regarding access, extent of area to be surveyed, developments, and the presence and location of special features.

WDNR wetland maps consist of aerial photographs upon which all wetlands down to a scale of 2 or 5 acres have been delineated. Each wetland polygon is classified based on characteristics of vegetation, soils, and water depth.

Ecoregion maps are useful for comprehensive projects covering large geographic areas such as counties, national and state forests, and major watersheds. These maps integrate basic ecological information on climate, landforms, geology, soils, and vegetation. As these maps evolve, they should become increasingly useful, even for relatively small, localized projects.

Geographic Information Systems (GIS) are increasing our ability to integrate spatial information on lands and waters of the state and are becoming a basic resource tool for the efficient and comprehensive planning of surveys and the analysis of their results.

**Aerial photographs:** These provide information on a study area not available from maps, paper files, or computer printouts. Examination of both current and historical photos, taken over a period of decades, can be especially useful in revealing changes in the environment over time.

**Original Land Survey Records:** The surveyors who laid out the rectilinear Town-Range-Section grid across the state in the mid-nineteenth century recorded trees by species and size at all section corners and along section lines. These notes also record general impressions of vegetation, soil fertility, and topography, and note aquatic features, wetlands, and recent disturbances such as windthrow and fire. As these surveys typically occurred prior to extensive settlement of the state by Europeans, they constitute a valuable record of conditions prior to extensive modification of the landscape by European technologies and settlement patterns.

**Interviews:** Interviews with scientists, naturalists, land managers or others knowledgeable about the area to be surveyed often yield information not available in other formats.

**Analysis of Compiled Information:** The compiled information is analyzed to identify inventory priorities, determine needed expertise, and develop budgets.

**Meetings:** Planning and coordination meetings are held with all participants to provide an overview of the project, share information, identify special equipment needs, coordinate schedules, and assign landowner contact responsibilities. Team development may be a part of this step.

**Aerial Reconnaissance:** Fly-overs are desirable for large sites, and for small sites where contextual issues are especially important. When possible, this should be done both before and after ground level work. Flights are scheduled for those times when significant features of the study area are most easily identified and differentiated. They are also useful for observing the general lay of the land, vegetation patterns and patch sizes, aquatic features, infrastructure, and disturbances within and around the site.