4.4.4 Savanna Group

4.4.4.1 Overview

In the Midwest, savanna is generally used to describe an ecosystem that was historically part of a larger complex bordered by the prairies of the west and the deciduous forests of the east. This complex was a mosaic of plant community types that represented a continuum from prairie to forest. Savannas were the communities in the middle of this continuum. The mosaic was maintained by frequent fires and possibly by ungulates such as deer. Oaks are the dominant canopy trees of savanna (with the exception of Cedar Glade, where eastern red cedar is dominant). Table 4.4.4.1 provides the number of SGCNs estimated to have a high or moderate association with this community group.

Because savannas grade into both prairie and forest, there are no clear dividing lines between savanna and these two communities. In classifying the plant communities of Wisconsin, Curtis (1959) was forced to set limits for what he called savanna. He ultimately defined it as having no less than one tree per acre and no more than a 50% tree canopy. The more wooded part of the historical prairie-forest complex (with 50%-100% tree canopy) is known to us only through the early accounts of explorers and settlers. This community was already so distorted by lack of fire and other disturbances by the mid-1900s that it was not even classified and studied as a separate community by Curtis and his students. Recent research is now starting to shed some light on this plant community. This more heavily wooded portion of the prairie-forest complex is described here as oak woodland. Oak Barrens is another type of savanna that occurs on sandy soils – this type is addressed in the "Barrens Group" subsection.

Oak savanna now shares equal billing with tallgrass prairie as the most threatened plant community in the Midwest and among the most threatened in the world. Intact examples of oak savanna vegetation are now so rare that less than 500 acres are listed in the Natural Heritage Inventory as having a plant assemblage similar to the original oak savanna. This is less than 0.01% of the original 5.5 million acres.

The Savanna Group includes the following three community types:

- Oak Opening
- Oak Woodland
- Cedar Glade

Hereafter, we will use "savanna" to refer to Oak Opening, Oak Woodland, and Cedar Glade," and "oak savanna" to refer to just Oak Opening and Oak Woodland.

Over 500 species of native vascular plants are associated with Wisconsin savannas, many of which are restricted to savanna and prairie community types. In addition to a varied plant community, savannas have a diverse and specialized fauna, especially among herptiles, mammals, and birds.

Descriptions for these community types can be found online.[1]

Table 4.4.4.2 at the end of this Section provides the Natural Community – Ecological Landscape (NC-EL) Opportunity scores for the Savanna Community Group. The key to these scores is provided below.

Key to NC-EL Opportunity Scores

Level of Opportunity	Score	Description
High	3	A major opportunity for sustaining the natural community in the Ecological Landscape exists, either because many significant occurrences of the natural community have been recorded in the landscape or restoration activities in areas of historical occurrence are likely to be successful maintaining the community's composition, structure, and ecological function over a long period of time.
Moderate	2	Although the natural community does not occur extensively or commonly in the Ecological Landscape, one to several significant occurrences do occur and are important in sustaining the community in the state. In some cases, important opportunities may exist because the natural community may be restricted to just one or a few Ecological Landscapes within the state and should be considered for management there because of limited geographic distribution and a lack of better opportunities elsewhere.
Low	1	The natural community occurs in the Ecological Landscape, but better management opportunities appear to exist in other parts of the state.
None	0	The natural community is not known to occur in this Ecological Landscape.

4.4.4.2 Issues and Associated Conservation Actions for the Savanna Communities Group

This Section summarizes issues and conservation actions that are common to all or most of the community types in this group. As much as possible, the source of the threat is described as well as the stresses or effects that occur directly or indirectly as a result of the threat. Stresses are generally thought of as loss, conversion and/or degradation of the natural community.

Issue. Historically, savannas were maintained primarily by frequent fires, either started by lightning strikes or by Native Americans who burned large areas to produce food for game or to aid in hunting and gathering activities. Fire is essential to Wisconsin's savanna communities for a variety of reasons: 1) It limits woody encroachment; 2) It stimulates early and robust growth of native plants; 3) It can deter growth of some non-native invasive and other problematic species; 4) It stimulates flowering and fruit production of native plants; and 5) It increases plant species diversity. Savannas in the absence of regular fire will succeed to woody species and will become less diverse over time. Climate change projections for Wisconsin suggest that the windows of opportunity for prescribed burning may be constrained due to changing conditions (e.g., extreme drought and heat, earlier spring green-up, frequent and intense storms).

[1] http://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=group&Type=Savanna (Search Terms: Savanna Communities Wisconsin DNR)

Invasive and other problematic species can also limit the ability of managers to apply fire by reducing the amount of fuel available to carry fire and by creating a moister ground level microclimate. This is particularly true of brushy species.

Conservation Actions. Depending on your overall objectives, the following conservation actions can address the effects that fire suppression may have on savannas:

- Maintain blocks of related fire-dependent communities that capture a complete gradient from grassland/open wetland to savanna to oak forest.
- Work with Wisconsin's Prescribed Fire Council (prescribedfire.org) to make the use of prescribed fire safe, effective, and more broadly accepted as a management tool.
- Take actions to facilitate rapid mobilization of prescribed burn crews (e.g., prepare units in advance of burn season).
- Maximize impacts of limited burn seasons by burning larger units.
- Evaluating the potential effects to invertebrates should be routinely considered in plans to use fire for restoration or management of this community type. The frequency, intensity and area burned should be planned considering the life history, habitat needs and distribution of fire-sensitive invertebrate species both on the subject property and adjacent habitat. In cases where burning is the preferred community management tool, but invertebrate species impacts are undetermined or potentially significant, the feasibility of creating refugia should be examined as should alternative methods for invasive, shrub and canopy management.
- Quantify and monitor the positive and negative impacts that prescribed burning and other management activities undertaken in grassland, barrens and savanna communities have on SCGN invertebrates to improve management decisions and techniques and improve intended outcomes.

Issue. Non-native invasive plants are prolific reproducers in the absence of their homeland's natural checks and balances, and outcompete native plants by monopolizing light, water and nutrient resources. The most common non-native invasives of savannas include herbs such as garlic mustard (*Alliaria petiolata*) and shrubs such as common buckthorn (*Rhamnus cathartica*) and Eurasian bush honeysuckles (*Lonicera* spp.). Climate change scientists suggest that non-native invasive species may increase in productivity with increasing CO_2, warmer temperatures, earlier springs, and reduced snowpack, and may invade new areas during extreme flood events. Some native woody species are also 'problematic' in savannas, especially in the absence of fire, and can outcompete native vegetation similarly to non-native invasives; climate change may exacerbate this threat as increased CO_2 and nitrogen deposition further stimulate growth of woody species.

Conservation Actions. Depending on your overall objectives, the following conservation actions can address non-native invasives and other problematic species as well as the effects that they have on savannas:

- At the site level, employ an eight-part approach to non-native invasive species: 1) careful planning; 2) prevention; 3) early detection and rapid response; 4) control; 5) slowing the spread; 6) reducing impacts; 7) monitoring; 8) restoration.

- Develop a plan by conducting surveys for invasives and creating maps showing their locations and densities. Set reasonable management objectives based on this information. Consider designating management zones based on degree of infestation and available resources (zero tolerance, acceptable threshold, slow the spread).
- Prevent invasions of non-native plants by limiting human vectors (e.g., install boot brushes at trail heads, clean out seeds from maintenance equipment), minimizing soil disturbance, maintaining healthy and diverse natural communities, conducting periodic inspections of high-risk areas (e.g., trails), and revegetating disturbed sites with native plants.
- Implement an Early Detection-Rapid Response approach by finding new populations of non-native invasives as early as possible when eradication and control are still feasible and less costly.
- Control non-native invasive species and problematic woody species by manual, mechanical, and/or chemical means.
- In areas where eradication and control are not feasible, slow the spread of non-native invasives into adjoining areas by restricting activities during certain seasons, minimizing travel through areas, and inspecting clothing and equipment.
- If eradication, control, and containment methods fail to manage an infestation of non-native invasives, reduce their impact on elements of the natural community by focusing control efforts to allow for specific functions to occur (e.g., tree regeneration), translocating sensitive species, or accommodating unavoidable changes (e.g., if a common buckthorn infestation limits the ability to burn, use mowing and brushing as a surrogate for fire).
- Conduct regular monitoring of sites to detect new invasions and to evaluate the success of pest management plans and control measures.
- Restore sites to confer resistance to infestation by non-native invasives. This may involve restoring system functions (e.g., fire), restoring natural community structure (canopy, mid-story, shrub layer), and ameliorating ground layer species.
- At a landscape or statewide level, enforce and strengthen regulatory mechanisms and voluntary BMPs that address the introduction and spread of non-native invasives.

Issue. Ecological simplification is a legacy of past fire suppression, grazing, and non-native invasive plants; only a small number of hardy and common plants can survive grazing as well as intense competition from invading woody and non-native species. As a result, most of Wisconsin's savannas lack the species and structural diversity needed to support a flourishing community of plant and wildlife species. In addition, ecological simplification renders savannas more vulnerable to pests and diseases and less resilient to drought, wind storms, climate change, and other environmental stresses. Restoration of oak savanna diversity continues to pose challenges to managers and researchers. The actual sources and appropriate actions for some issues remain in question (e.g., limitations to oak regeneration and Pennsylvania sedge domination). Managers and researchers also struggle with developing the best methods for restoring the ground layer in highly degraded oak savannas. Research to address ecological simplification in savannas is thus a high priority.

Conservation Actions: Depending on your overall objectives, the following conservation actions can address ecological simplification as well as the effects that it has on savannas:

- Restore savanna structure and function by applying techniques such as timber management, brushing, prescribed fire, herbicide application, and ground layer enhancement.
- Conduct research on oak regeneration methods in different regions, landscape settings, and on various soil types to ensure persistence of oak in oak-dominated natural communities.
- Conduct research on restoration of oak savanna ecosystems, especially in terms of techniques that promote oak regeneration and establishment of ground layer species, and that limit overabundance of brush.
- Research methods to restore native herbaceous ground layer species in forests, savannas, and barrens currently dominated by Pennsylvania sedge.
- Maintain and restore savanna and related habitats by rotating management spatially and temporally and using a variety of management techniques, including (where appropriate) timber harvest, prescribed fire, mowing, grazing, and herbicide application to minimize negative impacts from any particular management technique.

Issue. Cropping, development, and transportation projects can result in fragmentation of savannas. This fragmentation can sever connections that are important to both plants and animals, can limit opportunities for exchange of genetic material among plants, can render sites more susceptible to invasion by non-native invasive plants, and can inhibit the application of prescribed fire at a landscape scale.

Conservation Actions. Depending on your overall objectives, the following conservation actions can be considered to address habitat fragmentation as well as the effects that it has on savannas:

- Fragmentation can be minimized by preserving larger blocks of habitat and/or by buffering them with compatible cover types that together create a matrix of related community types.
- Maintain blocks of related fire-dependent communities that capture a complete gradient from grassland/open wetland to savanna to oak forest.
- Buffer the effects of anthropogenic land uses by maintaining compatible cover types in lands immediately surrounding savannas. The best buffer types include oak-dominated forest, shrublands, and grasslands.

Issue. Projections for vulnerability of savanna communities to climate change range from moderately low to moderately high (Climate Change Vulnerability Assessment Workshops 2014). Savannas may have natural resistance to climate change due to the fact that associated plant species are strongly adapted to extreme heat and drought. Resilience is also conferred by typically high diversity of species and species guilds (annuals, perennials, forbs, grasses, etc.). The vulnerability of savannas to climate change primarily stems from the exacerbation of threats that are already significant, especially non-native invasive species and woody invasion/mesophication. Lower winter snow depths may also render some savanna plants susceptible to frost and

drought damage. The threat of tree pests and diseases may increase as trees become stressed with extreme heat, drought, and frost damage. Furthermore, prescribed burning opportunities may change due to extreme drought and heat, earlier spring green-up, and frequent and intense storms. The exact nature of these potential changes is currently unclear: windows of opportunity for burning may become narrower or they may shift to different seasons, conditions may result in cooler and less effective burns, opportunities may actually increase with warmer drier conditions, or conditions may become more volatile and trigger more regulatory constraints. These changes may vary depending on site conditions, landscape variables, and ecoregion. Managers may wish to adopt a proactive approach that offers them the most flexibility in the face of changing and unpredictable conditions.

Differences in projected vulnerabilities among the three savanna types stem in part from the relative fates of the dominant tree species. Suitable habitat for bur oak, black oak and shagbark hickory is projected to remain the same or increase with climate change; habitat for white oak may remain the same with "low change" but decrease with "high change." Overall, this bodes well for the dominant trees of Oak Opening. In contrast, under a "high change" scenario, two other species that are important to Oak Woodland, red oak and black cherry, may incur large decreases in suitable habitat. Suitable habitat for eastern red cedar is projected to see large increases with climate change, a favorable factor relating to Cedar Glade communities.

While Wisconsin's savannas have characteristics that may confer resistance to climate change, and while they may benefit from some changes such as increased temperatures and drought, potential negatives may outweigh these positives; the uncertainty relating to the future of prescribed fire may represent the fulcrum in this balancing act. An additional and significant consideration is the fact that Wisconsin's remnant savannas are already highly degraded and in need of consistent intensive management (especially prescribed fire).

Conservation Actions. Depending on your overall objectives, the following conservation actions can address climate change and the effects that it has on savanna communities:

- Promote drought- and frost-tolerant species and plant morphologies through regular prescribed burning (mainly pertains to Oak Opening and Oak Woodland; the fire regime of Cedar Glade remains poorly understood).
- Take actions to facilitate rapid mobilization of prescribed burn crews (e.g., prepare units in advance of burn season).
- Maximize impacts of limited burn seasons by burning larger units.
- At the site level, employ an eight-part approach to non-native invasive species: 1) careful planning; 2) prevention; 3) early detection and rapid response; 4) control; 5) slowing the spread; 6) reducing impacts; 7) monitoring; 8) restoration.
- See other conservation actions under the following issue sections above:
    - Fire suppression
    - Non-native and native invasive and problematic plants

Estimated Vulnerability of Savanna Communities to Climate Change under Low and High Change Scenarios

Community type	Vulnerability under Low degree of climate change	Vulnerability under High degree of climate change
Oak Opening	Moderately low	Moderately low
Oak Woodland	Moderate	Moderately high
Cedar Glade	Moderately low	Moderate

Source: WDNR Climate Change Vulnerability Assessment Workshops 2014.

Table 4.4.4.1 Number of Species of Greatest Conservation Need Highly or Moderately Associated with Savanna Communities

SGCN Species Group	Savanna Community Group
Birds	13
Fish	
Herps	12
Mammals	6
Insects - Aquatic	1
Insects - Terrestrial	21
Invertebrates - Crustacea	
Invertebrates - Mussels	
Invertebrates - Terrestrial Snails	
Total SGCN (High/Moderate Association)	**53**

Table 4.4.4.2 Natural Community – Ecological Landscape Opportunity Scores for the Savanna Community Group

Community	Central Lake Michigan Coastal	Central Sand Hills	Central Sand Plains	Forest Transition	North Central Forest	Northeast Sands	Northern Highland	Northern Lake Michigan Coastal	Northwest Lowlands	Northwest Sands	Southeast Glacial Plains	Southern Lake Michigan Coastal	Southwest Savanna	Superior Coastal Plain	Western Coulee and Ridges	Western Prairie
Cedar Glade	L	L	L					L			L		L		M	M
Oak Opening		L									H	M	H		H	M
Oak Woodland		L	L								H	L	H		H	M