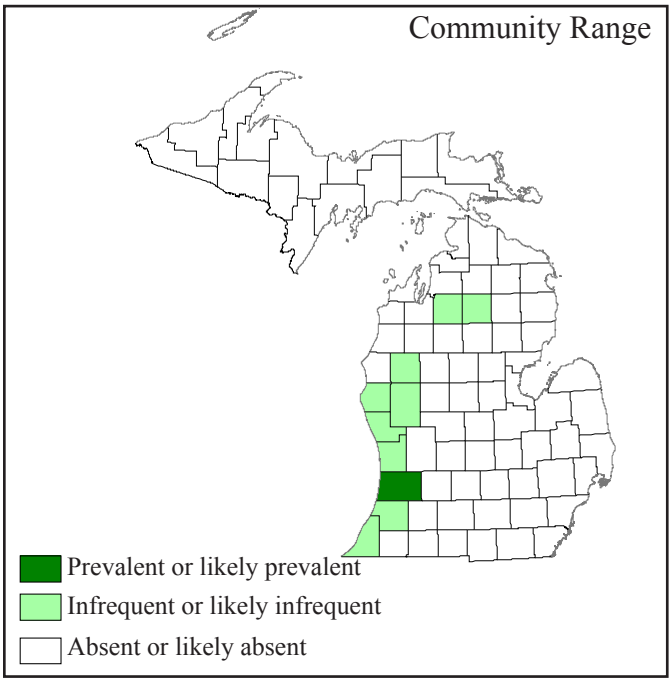
Wet-mesic Sand Prairie — Community Abstract


Photo by Bradford S. Slaughter



Overview: Wet-mesic sand prairie is a native lowland grassland community with species dominance shared by several prairie and wetland grasses, including blue joint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), prairie dropseed (*Sporobolus heterolepis*), Indian grass (*Sorghastrum nutans*), and switch grass (*Panicum virgatum*). The community occurs on loamy sand or sand soils, usually with high organic content, in shallow depressions on glacial outwash and glacial lakeplain, old abandoned glacial lakebeds, stream channels, and river terraces. Sites that support wet-mesic sand prairie have seasonally fluctuating water tables, characterized by moist to inundated conditions in the spring followed by drought conditions in late summer and fall. Thus, the community contains species from a broad range of moisture classes. Areas dominated by native grasses with less than one mature tree per acre are considered prairie (Curtis 1959).

Global and State Rank: G2G3/S2

Range: Wet-mesic sand prairie occurs in IL, IN, MI, WI, and southern Ontario (NatureServe 2009). In Michigan, the community has been documented in both the southern and northern regions of Lower Peninsula in Allegan, Newaygo, Oceana, Crawford and Kalkaska counties. In southern Lower Michigan, wet-mesic sand prairie has been documented on sandy lakeplain and in the northern Lower Peninsula on sandy lakeplain, glacial outwash, stream channels, river terraces, and old glacial lakebeds. Historically, the community likely occurred as small patches within fire prone landscapes on sandy soils with seasonally high water tables and as an ecotone between a variety of non-forested wetland communities and upland savannas such as oak openings, oak barrens, oak-pine barrens, and pine barrens.

Rank Justification: The Michigan Natural Features Inventory database currently includes nine element occurrences of wet-mesic sand prairie, which total 270 acres (109 ha) and range in size from 6 to 115 acres (2.4 to 47 ha). It is difficult to reliably determine the total acreage of wet-mesic sand prairie in Michigan in the 1800s. The acreage of all wet prairie types in Michigan in the 1800s is estimated at approximately 382,000 acres (154,590 ha) (Comer et. al 1995) but this figure likely included a variety of wet prairie types, wet meadows, and fens. Though it is difficult to determine the total historical acreage for wet-mesic sand prairie, it is clear that the community has been significantly reduced from historical levels by the effects of fire suppression, grazing, agricultural, and development (NatureServe 2009).

Landscape and Abiotic Context: Wet-mesic sand prairie occurs on sandy glacial outwash, lakeplain, and abandoned lakebeds. The community experiences seasonal water table fluctuations, with the wettest

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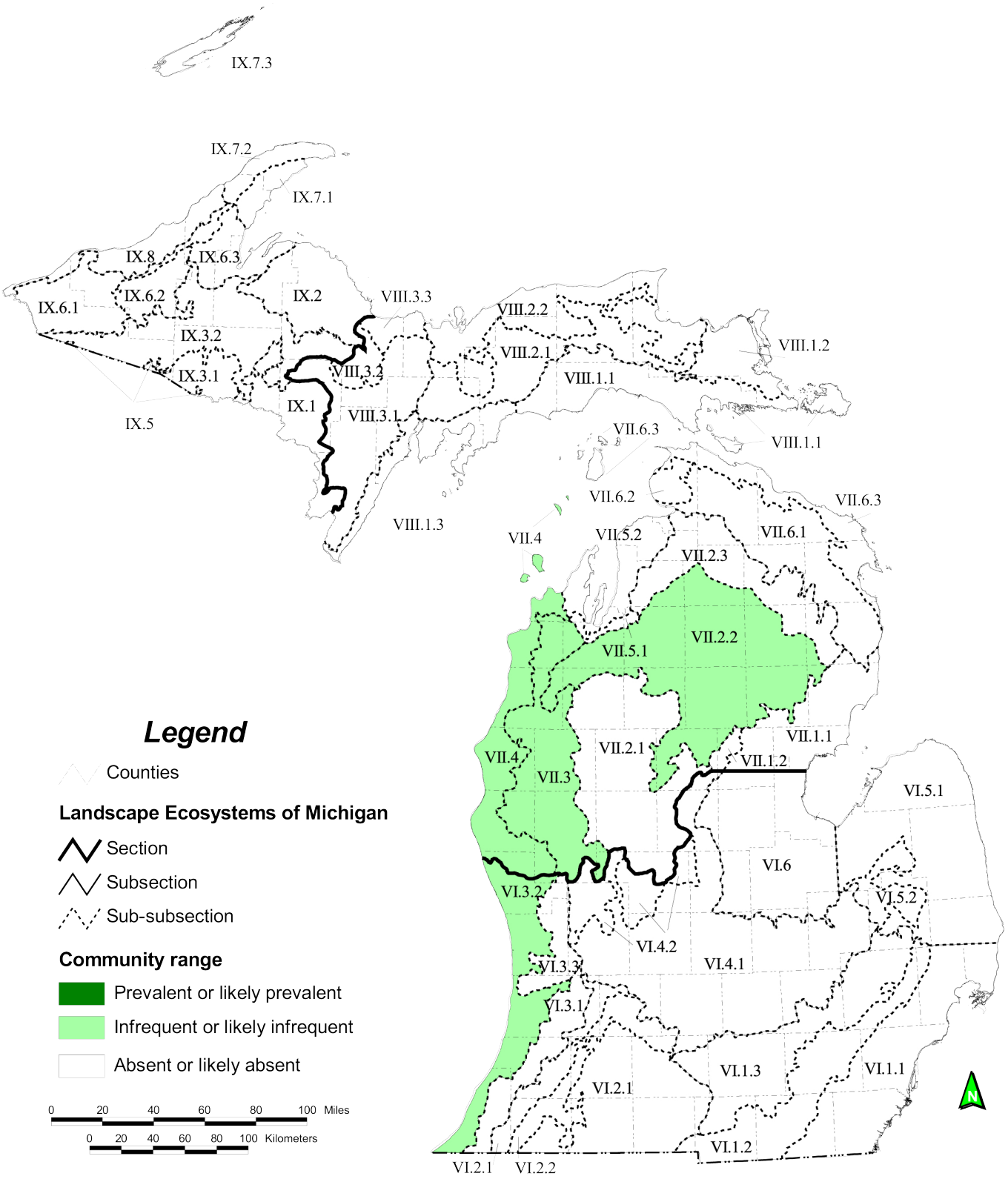

Ecoregional map of Michigan (Albert 1995) depicting distribution of wet-mesic sand prairie (Albert et al. 2008)

conditions occurring in spring and driest periods in late summer and fall. Prolonged spring inundation may occur. Periodicity and duration of seasonal inundation shapes, in part, the vegetative composition characteristic of each site. The close association of wet-mesic sand prairie with other open wetland communities (e.g., coastal plain marsh) suggests a successional relationship whereby the long-term absence of seasonal inundation permits the invasion and establishment of prairie grasses and forbs.

Soils supporting wet-mesic sand prairie range from fine sand to loamy sand or occasionally sandy loam, often with high organic content (e.g., mucky fine sand). The pH is variable, ranging from very strongly acid (4.5-5.0) to mildly or moderately alkaline (7.5-8.0). The wet-mesic condition of the sandy soils is facilitated by a high water table and, in some sites, by a relatively high organic content within the sand matrix, which increases the water holding capacity of soil.

In the 1800s, wet-mesic sand prairie in Michigan occurred as small patches of grassland within and between fire prone communities. The community occupied sandy sites with seasonally high water tables such as those occurring in shallow depressions within outwash plains and glacial lakeplain, and on old glacial lakebeds, abandoned stream channels, and river terraces. Wet-mesic sand prairie also likely occurred as an ecotone between fire-dependent uplands (e.g., oak openings, oak barrens, oak-pine barrens, pine barrens) and other open wetland types (e.g., northern fen, southern wet meadow, northern wet meadow, intermittent wetland, coastal plain marsh, and emergent marsh) (Kost et al. 2007).

Natural Processes: A high water table in the spring followed by drought-like conditions in the late summer and fall creates conditions suitable for a diversity of plant species representing a broad range of moisture tolerances. In addition to seasonal water level fluctuations, longer term changes in the regional water table also influence the community composition.

As in other prairie and savanna communities, fire played a critical role in maintaining open conditions in wet-mesic sand prairie. The frequency and intensity of fire depended on a variety of factors including the type and volume of fuel, topography, presence of natural firebreaks, and density of Native Americans (Chapman 1984). In general, the probability of wide-ranging fire increases in level topography such as large outwash plains (Chapman 1984). Carried by wind, fires moved across the outwash plains, through graminoid-dominated wetlands, and up slopes of end moraines and ground moraines.

While occasional lightning strikes resulted in fires that spread across the landscape, Native Americans were the main sources of ignition. There are many early accounts of Native Americans intentionally setting fires to accomplish specific objectives (see Day 1953, Curtis 1959, Thompson and Smith 1970, Chapman 1984, Denevan 1992, Kay 1995). Native Americans intentionally set fires in the fall to clear briars and brush and make the land more easily passable. Frequent fires kept the land open, increasing both short- and long-range visibility, which facilitated large game hunting and provided a measure of safety from surprise attacks by neighboring tribes. Fire was used to increase productivity of berry crops and agricultural fields. As a habitat management tool, fires were used to maintain high quality forage for deer, elk, woodland caribou, bison and other game species. It was also used as a hunting tool to both drive and encircle game. During warfare, fire was strategically employed to drive away advancing enemies, create cover for escape, and for waging attacks.

In addition to maintaining open conditions, fire plays a critical role in maintaining species diversity. A recensus of 54 prairie remnants in Wisconsin found that 8% to 60% of the original plant species recorded at the sites had been lost over time (32 to 52 years) even though the sites appeared relatively undisturbed (Leach and Givnish 1996). The authors suggest the decline in diversity was a result of taller vegetation outcompeting species with small stature, those with small seeds (e.g., orchids), and those that rely on nitrogen-fixing symbioses, such as members of the legume family (Fabaceae), including lupine (*Lupinus perennis*), wild indigo (*Baptisia* spp.), bush clover (*Lespedeza* spp.), and tick-trefoil (*Desmodium* spp.). Because fire maintains open conditions and burns off accumulated leaf litter, species that require open microsites for seedling establishment and growth are able to garner enough space and light to coexist with taller, denser vegetation. In the absence of frequent fires, small species are outcompeted by taller and denser vegetation. In addition, seedlings with low food reserves, such

as those with small seeds, have difficulty growing through thick litter. The decline in species diversity is especially pronounced in mesic and wet community types where live biomass and leaf liter accumulate rapidly. Because fire volatilizes much of the nitrogen stored in combustible vegetation, frequent burning also favors species that form nitrogen-fixing symbioses (e.g., legumes and rhizobium bacteria) by providing a competitive edge not found in unburned sites (Leach and Givnish 1996).

Fire also helps maintain species diversity by facilitating expression of the soil seed bank and promoting seed germination and establishment. By consuming accumulated and standing leaf litter, fire increases light availability to the soil surface and increases diurnal temperature fluctuations, both of which trigger seed germination. Critical microsites for seed germination and seedling establishment are also created when litter levels are reduced by fire.

Through burning accumulated litter and dead, standing vegetation, fire increases the availability of many important plant nutrients (e.g., N, P, K, Ca and Mg), which are thought to contribute to higher plant biomass, increased flowering and seed production, and greater palatability to herbivores following a burn (Vogl 1964, Daubenmire 1968, Viro 1974, Vogl 1974, Smith and Kadlec 1985, Abrams et al. 1986, Collins and Gibson 1990, Reich et al. 1990, Schmalzer and Hinkle 1992, Timmins 1992, Laubhan 1995, Warners 1997).

While this discussion has focused on plants it is important to note that these species serve as hosts for a variety of insects, and that the structure of open grasslands is critical to a wide variety of animal species, many of which are considered rare or declining today (see Other Noteworthy Species section).

Ants, particularly the genus *Formica*, play an important role in mixing and aerating prairie soils (Curtis 1959, Trager 1998). Large ant mounds, which may measure half a meter in height and over one meter wide and number 40 to 50 per acre are especially conspicuous following a prairie fire (Curtis 1959). Because of their abundance and frequent habit of abandoning old mounds and building new ones, ants overturn large portions of prairies in a relatively short time (Curtis 1959). Other important species contributing to the mixture and aeration of prairie soil include moles, voles, mice, skunks, ground hogs, ground squirrels, and badgers (Curtis 1959).

Vegetation Description: Wet-mesic sand prairie supports a moderately dense growth of graminoids 1-2 m tall (NatureServe 2009). The community is typically dominated by one or more of the following prairie grasses: blue joint grass, cordgrass, big bluestem, little bluestem, prairie dropseed, Indian grass, and switch grass. Sedges (*Carex* spp.), rushes (*Juncus* spp.), and bulrushes (*Scirpus* spp.) are locally common. Pennsylvania sedge (*Carex pensylvanica*) may occur where drought-like conditions in late summer and fall are a common occurrence. (Table 1).

Table 1. Plant species commonly occurring in Wet-mesic Sand Prairie.

Scientific name	Common name	Coefficient of wetness (*W*)
Grasses, Sedges, and Rushes		
Andropogon gerardii	big bluestem	1
Andropogon scoparius	little bluestem grass	3
Aristida purpurascens	three awned grass	5
Calamagrostis canadensis	blue joint grass	-5
Carex pensylvanica	Pensylvania sedge	5
Eragrostis spectabilis	purple love grass	5
Juncus balticus	rush	-5
Juncus biflorus	two flowered rush	-3
Juncus greenei	Greene's rush	0
Juncus vaseyi	Vasey's rush	-3
Panicum virgatum	switch grass	-1
Rhynchospora capitellata	beak rush	-5
Sorghastrum nutans	Indian grass	2
Spartina pectinata	cordgrass	-4
Sporobolus heterolepis	prairie dropseed	4
Forbs		
Aster dumosus	bushy aster	-1
Comandra umbellata	bastard toadflax	3
Euthamia remota	Lakes flat topped goldenrod	-3
Liatris spicata	marsh blazing star	0
Lycopus americanus	common water horehound	-5
Pycnanthemum virginianum	common mountain mint	-4
Solidago rugosa	rough goldenrod	-1
Spiranthes cernua	nodding ladies' tresses	-2
Stachys hyssopifolia	hyssop hedge nettle	-4
Veronicastrum virginicum	culver's root	0
Trees and Shrubs		
Cornus foemina	gray dogwood	-2
Hypericum kalmianum	Kalm's St. John's wort	-2

Scientific name	Common name	Coefficient of wetness (*W*)
Pinus banksiana	jack pine	3
Pinus strobus	white pine	3
Populus tremuloides	quaking aspen	0
Prunus pumila	sand cherry	5
Quercus alba	white oak	3
Quercus velutina	black oak	5
Rosa carolina	pasture rose	4
Rubus flagellaris	northern dewberry	4
Rubus hispidus	swamp dewberry	-3
Salix humilis	prairie willow	3
Spiraea alba	meadowsweet	-4

Evident from the list above is that the community is comprised of species with a wide range of wetland coefficients (e.g., moisture tolerances), indicating that large fluctuations in local and regional water tables strongly influence community composition. Wet-mesic sand prairie is characterized by species of wetland affinity, with >50% of plant species assigned wetland coefficients (*W*) (Herman et al. 2001) between -1 and -5. Wet-mesic sand prairie and mesic sand prairie, an upland prairie type dominated by species with *W* values between +1 and +5, may intergrade with or occur as distinctive zones within a larger prairie, savanna, or wetland complex (Kost et al. 2007).

Wet-mesic sand prairie in depressions on sandy lakeplain in western Lower Michigan (Allegan, Muskegon, and Newaygo Counties) is often associated with coastal plain marsh, and may contain several plant species disjunct from the main portions of their ranges on the Atlantic and/or Gulf coastal plain (see Kost and Penskar 2000).

Other Noteworthy Species:
Rare plant species associated with wet-mesic sand prairie are listed below along with their status, which is indicated by the following abbreviations: X, extirpated from state; E, State Endangered; T, State Threatened; SC, State Species of Special Concern; LT, Federally Threatened. LE, Federally Endangered.

Scientific Name	Common Name	Status
Asclepias hirtella	tall green milkweed	T
Cirsium hillii	Hill's thistle	SC
Eleocharis tricostata	three-ribbed spike-rush	T
Gentiana puberulenta	downy gentian	E
Juncus brachycarpus	short-fruited rush	T
Juncus scirpoides	Scirpus-like rush	T
Juncus vaseyi	Vasey's rush	T
Lactuca floridana	woodland lettuce	T
Oxalis violacea	violet wood-sorrel	X
Polygala cruciata	cross-leaved milkwort	SC
Pycnanthemum verticillatum	whorled mountain-mint	SC
Rhexia mariana var. *mariana*	Maryland meadow beauty	T
Rhexia virginica	meadow beauty	SC
Rhynchospora macrostachya	tall beak-rush	SC
Scleria pauciflora	few-flowered nut-rush	E
Scleria reticularis	netted nut-rush	T
Scleria triglomerata	tall nut-rush	SC
Sisyrinchium atlanticum	Atlantic blue-eyed-grass	T
Sisyrinchium strictum	blue-eyed-grass	SC
Solidago houghtonii	Houghton's goldenrod	T, LT
Sporobolus heterolepis	prairie dropseed	SC
Strophostyles helvula	trailing wild bean	SC
Trichophorum clintonii	Clinton's bulrush	SC
Viola novae-angliae	New England violet	T

Rare animal species associated with wet-mesic sand prairie include the following:

Grassland birds: Henslow's sparrow (*Ammodramus henslowii*) (E), grasshopper sparrow (*Ammodramus savannarum*) (SC), short-eared owl (*Asio flammeus*) (E), long-eared owl (*Asio otus*) (T), lark sparrow (*Chondestes grammacus*) (X), northern harrier (*Circus cyaneus*) (SC), migrant loggerhead shrike (*Lanius ludovicianus migrans*) (E), dickcissel (*Spiza americana*) (SC), western meadowlark (*Sturnella neglecta*) (SC), and barn owl (*Tyto alba*) (E).

Insects: dusted skipper (*Atrytonopsis hianna*) (SC), Gorgone checkerspot (*Chlosyne gorgone carlota*) (SC), American burying beetle (*Nicrophorus americanus*) (X, LE), blazing star borer (*Papaipema beeriana*) (SC), Culver's root borer (*Papaipema sciata*) (SC), Silphium borer moth (*Papaipema silphii*) (T), tawny crescent (*Phyciodes batesii*) (SC), red-legged spittlebug (*Prosapia ignipectus*) (SC), Sprague's pygarctia (*Pygarctia spraguei*) (SC), grizzled skipper (*Pyrgus wyandot*) (SC), phlox moth (*Schinia indiana*) (E), Spartina moth (*Spartiniphaga inops*) (SC), and regal fritillary (*Speyeria idalia*) (E).

Mammals: prairie vole (*Microtus ochrogaster*) (E).

Reptiles: spotted turtle (*Clemmys guttata*) (T), Kirtland's snake (*Clonophis kirtlandii*) (E), Blanding's turtle (*Emydoidea blandingii*) (SC), eastern massasauga

(*Sistrurus c. catenatus*) (SC and Federal Candidate Species), and eastern box turtle (*Terrapene c. carolina*) (SC).

Conservation and Management: Efforts should be made to identify, protect, and manage remnants of wet-mesic sand prairie. Several studies to identify prairie remnants in Michigan have been undertaken and most remnants are very small and/or occur as narrow strips adjacent to railroads (Hauser 1953, Scharrer 1972, Thompson 1970, 1975, and 1983, Chapman 1984, Comer et al. 1995). The small size and poor landscape context of most prairie remnants makes large-scale restoration of existing prairies nearly impossible.

Managing wet-mesic sand prairie requires prescribed burning to protect and enhance plant species diversity and prevent encroachment of trees and tall shrubs, which outcompete light demanding prairie plants. In prairie remnants where fire has been excluded for long periods (i.e., decades), local extinctions of plant species are common (Leach and Givnish 1996).

In addition to prescribed fire, brush cutting accompanied by herbicide application to cut stumps is an important component of prairie restoration. While fires frequently kill woody seedlings, long established trees and tall shrubs such as black cherry (*Prunus serotina*) and dogwoods (*Cornus* spp.) typically resprout and can reach former levels of dominance within two to three years. Applying herbicide to the cut stumps will prevent resprouting.

To reduce the impacts of management on fire-intolerant species it will be important to consider a rotating schedule of prescribed burning in which adjacent management units are burned in alternate years. This is especially important when planning burns in remnant prairies. Insect species that are restricted to these habitats have already experienced severe losses in the amount of available habitat due to forest succession brought on by years of fire suppression. By burning adjacent management units in alternate years, insect species from unburned units may be able to recolonize burned areas (Panzer et al. 1995). Avian species diversity is also thought to be enhanced by managing large areas of grassland as a mosaic of burned and unburned patches (Herkert et al. 1993).
Prairie ants (*Formica* spp.) are an extremely important component of grassland communities and research indicates they respond with population increases to restoration activities, especially prescribed fire (Trager 1998). Prescribed burning precipitates changes in the dominance of ant species from carpenter and woodland ants (*Camponotus* spp. and *Aphaenogaster* spp.) to prairie ants because it reduces woody vegetation and detritus used by the arboreal and litter- and twig-nesting species in favor of species restricted to grassland habitats (Trager 1998). Restorations involving prairie plantings near old fields or remnant prairies are typically colonized by several species of prairie ants within a few years.

Controlling invasive species is a critical step in restoring and managing wet-mesic sand prairie. By outcompeting native species, invasives alter vegetation structure, reduce species diversity, and upset delicately balanced ecological processes such as trophic relationships, interspecific competition, nutrient cycling, soil erosion, hydrologic balance, and solar insolation (Bratton 1982, Harty 1986). Invasive species that threaten the diversity and community structure of wet-mesic sand prairie include glossy buckthorn (*Rhamnus frangula*), common buckthorn (*Rhamnus cathartica*), autumn olive (*Elaeagnus umbellata*), Eurasian honeysuckles (*Lonicera morrowii*, *L. japonica*, *L. maackii*, *L. sempervirens*, *L. tatarica*, *L.* x*bella*, and *L. xylosteum*), multiflora rose (*Rosa multiflora*), reed (*Phragmites australis*), reed canary grass (*Phalaris arundinacea*), narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha* x*glauca*), and purple loosestrife (*Lythrum salicaria*).

In addition to reestablishing ecological processes such as fire, significantly degraded restoration sites will require the reintroduction of appropriate native species and genotypes. Plants can be reintroduced through both seeding and seedling transplants. Small, isolated prairie remnants may harbor plant populations that have suffered from reduced gene flow. Restoration efforts at isolated prairie remnants should consider introducing seeds collected from nearby stocks to augment and maintain genetic diversity of remnant plant populations. The Michigan Native Plant Producers Association may be a helpful resource for locating sources of prairie plants with Michigan genotypes (http://www.mnppa.org/).

Several helpful guides are available for restoring prairies and starting prairie plants from seed (Nuzzo 1976, Packard and Mutel 1997). See Packard and Mutel (1997) for a comprehensive treatment of the subject and additional references.

Restoration and management of grasslands such as wet-mesic sand prairie are critically important to grassland birds, which have suffered precipitous population declines due to habitat loss and changing agricultural practices (e.g., early mowing of hay fields). Detailed habitat management guidelines for grassland birds have been developed by Herkert et al. (1993) and Sample and Mossman (1997). Listed below are several of the recommendations suggested by Herkert et al. (1993) (see publication for complete list of management guidelines).

1. Avoid fragmentation of existing grasslands.
2. Grassland restorations aimed at supporting populations of the most area-sensitive grassland birds should be at least 125 acres and preferably more than 250 acres in size. Area sensitive species requiring large patches of grassland (>100 acres) include northern harrier (SC), bobolink (*Dolichonyx oryzivorus*), savannah sparrow (*Passerculus sandwichensis*), Henslow's sparrow (SC), short-eared owl (E), and barn owl (E) (Herkert et al. 1993, Sample and Mossman 1997). Patches of grassland less than 50 acres will benefit the least area-sensitive grassland birds such as northern bobwhite (*Colinus virginianus*), red-winged black bird (*Agelaius phoeniceus*), American goldfinch (*Carduelis tristis*), Vesper sparrow (*Pooecetes gramineus*), field sparrow (*Spizella pusilla*), song sparrow (*Melospiza melodia*), dickcissel (SC), and common yellowthroat (*Geothlypis trichas*) (Herkert et al. 1993).
3. Maximize interior grassland habitat by establishing circular (best) or square grassland plantings and avoiding long, narrow plantings, which increase edge habitat.
4. Where grassland habitats border forests, strive to create a feathered edge by allowing prescribed fires to burn through adjacent forests as opposed to installing firebreaks along the forest edge. Grasslands with feathered edges experience lower rates of nest predation than those with sharply contrasting edges (Ratti and Reese 1988).

Research Needs: Remaining remnants of wet-mesic sand prairie need to be identified, protected, and managed. Studies designed to compare plant species composition and abiotic factors (soils, landscape position, etc.) among prairie types in Michigan are needed to improve community classification. In particular, further research is needed to elucidate differences between wet-mesic sand prairie and mesic sand prairie. Studies aimed at understanding the effects of small, isolated populations on plant species genetic diversity will provide important information on managing prairie remnants. Research on the utilization of restored and remnant prairies by grassland birds and insects will provide useful information for understanding how wet-mesic sand prairies contribute to biodiversity. Studies on methods of prairie establishment and management, including controlling invasive species, will benefit both ongoing and new efforts to restore wet-mesic sand prairie. Conservation and management efforts will benefit from further study of how species composition is influenced by fire frequency, intensity, and periodicity.

Similar Communities: Mesic sand prairie, wet-mesic prairie, wet prairie, lakeplain wet-mesic prairie, lakeplain wet prairie, and coastal plain marsh.

Other classifications:
Michigan Natural Features Inventory circa 1800s Vegetation (MNFI): Grassland

Michigan Department of Natural Resources (MDNR): **G**

The Nature Conservancy U.S. National Vegetation Classification and International Classification of Ecological Communities (Faber-Langendoen 2001, NatureServe 2009):
CODE; ALLIANCE; ASSOCIATION; COMMON NAME:

V.A.5.N.a; *Andropogon gerardii – (Calamagrostis canadensis, Panicum virgatum)* Herbaceous Alliance; *Andropogon gerardii – Calamagrostis canadensis* Sand Herbaceous Vegetation; Central Wet-Mesic Sand Tallgrass Prairie

V.A.5.N.j; *Spartina pectinata* Temporarily Flooded Herbaceous Alliance; *Spartina pectinata – Carex* spp. – *Calamagrostis canadensis* Sand Herbaceous Vegetation; Central Cordgrass Wet Sand Prairie

V.A.5.N.a; *Andropogon gerardii – (Calamagrostis canadensis, Panicum virgatum)* Herbaceous Alliance; *Andropogon gerardii – Calamagrostis canadensis – Pycnanthemum virginianum – Oligoneuron ohioense* Herbaceous Vegetation; Lakeplain Wet-Mesic Prairie

V.A.5.N.a; *Andropogon gerardii – (Calamagrostis canadensis, Panicum virgatum)* Herbaceous Alliance; *Andropogon gerardii – Panicum virgatum – Helianthus grosseserratus* Herbaceous Vegetation; Central Wet-Mesic Tallgrass Prairie

V.A.5.N.a; *Andropogon gerardii – (Sorghastrum nutans)* Herbaceous Alliance; V.A.5.N.a; *Andropogon gerardii – Sorghastrum nutans – Schizachyrium scoparium – Aletris farinosa* Herbaceous Vegetation; Mesic Sand Tallgrass Prairie

Related Abstracts: mesic sand prairie, lakeplain wet-mesic prairie, lakeplain wet prairie, coastal plain marsh, Culver's root borer, dusted skipper, eastern box turtle, eastern massasauga, spotted turtle, Blanding's turtle, Henslow's sparrow, migrant loggerhead shrike, northern harrier, short-eared owl, blazing star borer, Culver's root borer, Silphium borer, red-legged spittlebug, grizzled skipper, prairie dropseed, Houghton's goldenrod, tall green milkweed, Hill's thistle, short-fruited rush, meadow-beauty, few-flowered nut-rush,.

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