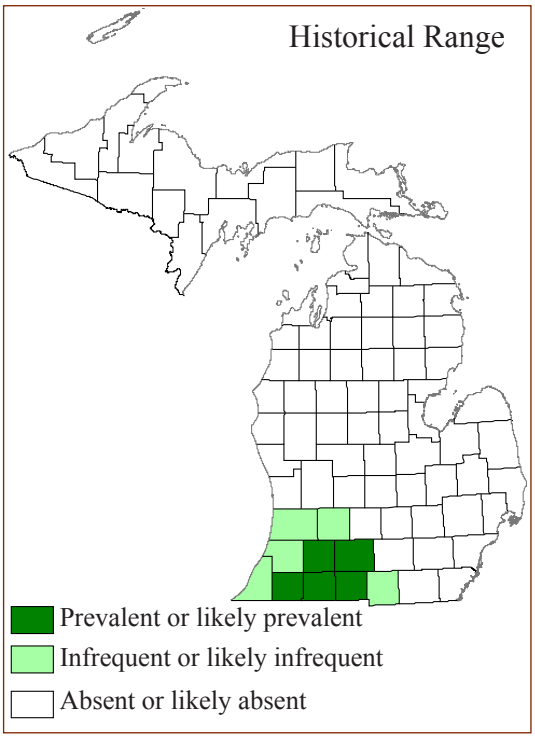
Mesic Prairie — Community Abstract

Photo by MNFI staff



Overview: Mesic prairie is a native grassland community dominated by big bluestem (*Andropogon gerardii*), little bluestem (*Andropogon scoparius*), and Indian grass (*Sorghastrum nutans*) that occurs on loam, sandy loam or silt loam soils on level or slightly undulating glacial outwash. Mesic prairie may also be referred to as black soil, tall grass prairie. Areas dominated by native grasses with less than one mature tree per acre (0.4 ha) are considered prairie (Curtis 1959).

Global and State Rank: G2/S1

Range: Mesic prairie occurs in IA, IL, IN, MI, MN, MO, NE, OH, and WI. (Faber-Langendoen 2001). In Michigan, the community is restricted to the southwestern portion of the Lower Peninsula, corresponding with the "Prairie Peninsula" described by Transeau (1935) (Chapman 1984). Historically, Kalamazoo County had the largest contiguous mesic prairie, Prairie Rhonde, which stretched over 12,600 acres (5,100 ha). Less than one mile west of Prairie Rhonde stood Gourdneck Prairie, another large mesic prairie (>2,100 acres, 850 ha). St. Joseph and Cass County also harbored several large patches of mesic prairies greater than 1,000 acres (400 ha) with several in St. Joseph County over 5,000 acres (2,000 ha). Smaller patches occurred in Branch, Calhoun, Berrien, and Van Buren counties. Lakeplain prairies, which occur on the glacial lakeplains of the southern Lower Peninsula and Saginaw Bay, share many species in common with mesic prairie. However, the soil type and hydrologic processes supporting lakeplain prairie are significantly different from those of the mesic prairies in southwest Lower Michigan (Albert and Kost 1998, Kost et al. 2007). Today, mesic prairie is known to occur in only a few, very small, degraded sites in Kalamazoo and Cass counties.

Rank Justification: In the early to mid 1800s, the southern Lower Peninsula supported approximately 60,500 acres (24,500 ha) of upland prairie, which included pockets of mesic prairie, mesic sand prairie, dry-mesic prairie, dry sand prairie, and hillside prairie (Comer et al. 1995). The Michigan Natural Features Inventory database currently includes three element occurrences of mesic prairie, two are located in Kalamazoo County and the other in Cass County. The acreage of the remaining mesic prairies ranges from 0.6 to 3.7 acres (0.2 to 1.5 ha) and totals 6.2 acres (2.5 ha) in all. By contrast, in the early to mid 1800s grasslands in these two counties, much of which were mesic prairie (Holder et al. 1981, Brewer et al. 1984), totaled nearly 34,000 acres (13,750 ha) (Comer et al. 1995). In the counties believed to support mesic prairie in the 1800s, grasslands once totaled nearly 60,000 acres (24,000 ha) (Comer et al. 1995). It is difficult to reliably determine the total acreage of mesic prairie in Michigan in the 1800s.

Michigan Natural Features Inventory
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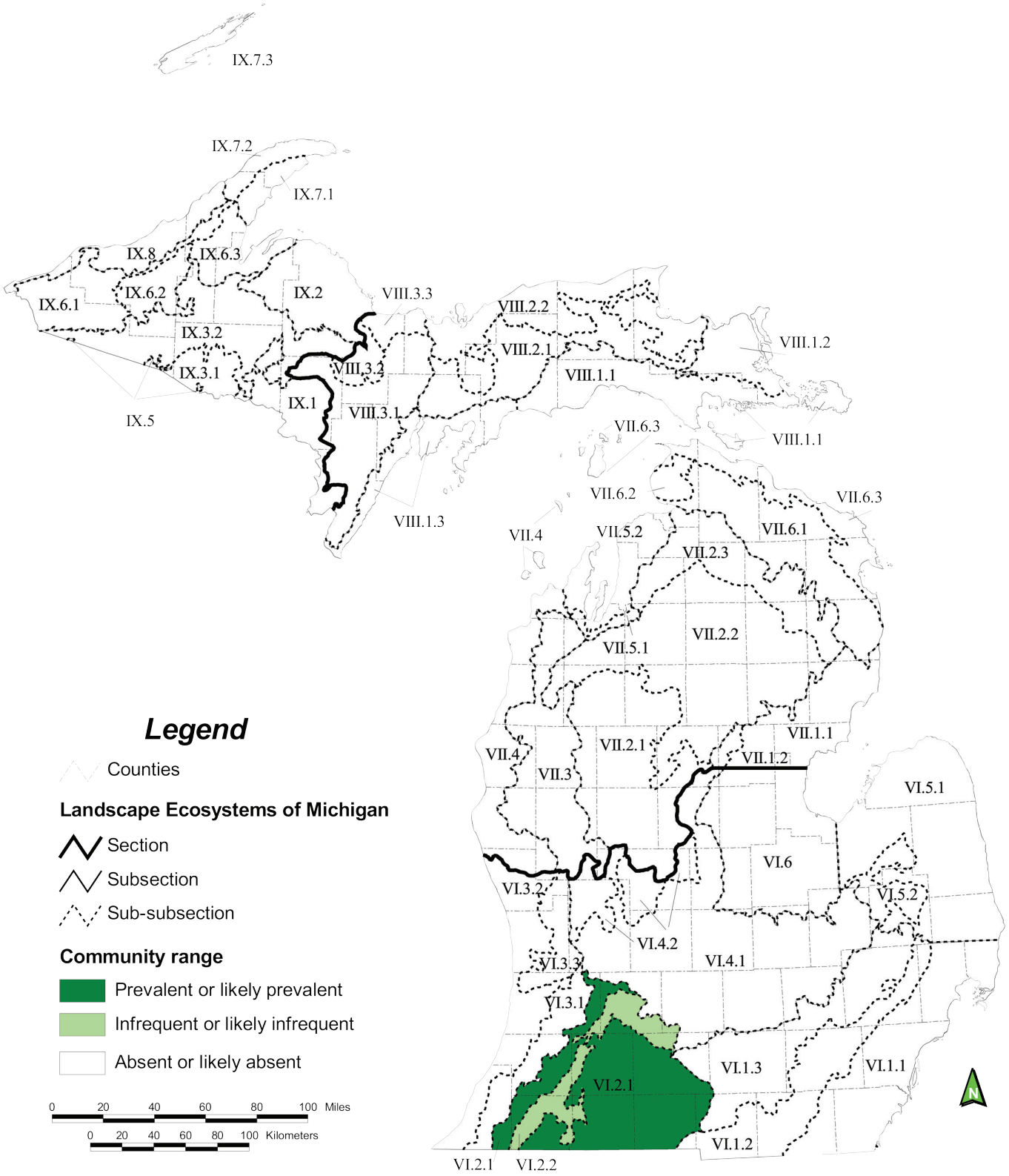

Ecoregional map of Michigan (Albert 1995) depicting historical distribution of mesic prairie (Albert et al. 2008)

However, based on comparisons of the total acreage of all upland prairie element occurrences in southern Lower Michigan today (480 acres, 194 ha) with that found in the early to mid 1800s (provided above), it appears that less than 1% of the original upland prairie remains intact.

The earliest European settlers erroneously assumed that the lack of trees within mesic prairies was a result of poor soils (Curtis 1959). However, following the introduction of the steel moldboard plow, which allowed for cultivation of the thick prairie sod, mesic prairies quickly became favored locations for homesteads because of their productive soils (Curtis 1959). Mesic prairies that were not plowed or grazed soon converted to forest in the absence of the annual fires that once maintained their open character (Curtis 1959).

Mesic prairie has been essentially eliminated from the Michigan landscape. The few, tiny remnants that remain are severely disturbed and their prospects for long-term viability are bleak. The status of mesic prairie in other Midwestern states is similarly dismal.

Landscape and Abiotic Context: In Michigan, mesic prairie occurs exclusively on glacial outwash on nearly level to slightly undulating sites (Chapman 1984, Albert 1995). The vast majority of historical mesic prairies occur on the Battle Creek Outwash Plain Sub-subsection within the Kalamazoo Interlobate Subsection (Albert 1995). This level outwash plain is the northernmost portion of the "Prairie Peninsula" described by Transeau (1935).

Soils supporting mesic prairie are loam or sandy loam and occasionally silt loam with pH ranging form 4.9 to 7.5 (ave. pH 6.2) and water retaining capacity ranging from 37 to 106% (ave. 64%) (Chapman 1984). The soil profile typically contains a B horizon dominated by clay (Chapman 1984). Mesic prairies in Michigan occur on both mollisols and udic alfisols. Mollisols are considered true prairie soils and udic alfisols (e.g., udalfs or Gray-Brown Podzols), which cover much of southern Lower Michigan, are often considered gray to brown forest soils (Chapman 1984).

In the 1800s, mesic prairie in Michigan frequently bordered beech-maple forest or graded into bur oak plains. These communities all occupied level outwash plains and grew on similarly rich soils. Where level outwash plains met end moraines and ground moraines with sandy, drier soils, mesic prairie gave way to dry-mesic prairie and oak openings, or oak woodlands. Today the community is restricted to railroad right-of-ways, cemeteries, and other small remnants, which often border agricultural fields.

Natural Processes: Fire played a critical role in maintaining open conditions in Michigan prairie and oak savanna ecosystems. 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). The rich soils of mesic prairie promoted very high volumes of fine fuels (e.g., grasses), which enabled fire to rapidly spread throughout the community. In general, the probability of a wide-ranging fire increases in level topography like large outwash plains (Chapman 1984). Thus, on the broad, level outwash plains of southwestern Lower Michigan, annual, wind-swept fires once spread easily through the mesic prairies and bur oak plains. Carried by wind, these fires moved across the outwash plains and up slopes of end moraines and ground moraines, carving oak forests into dry-mesic prairies and oak openings.

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 re-census 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 that taller vegetation outcompeted species with small stature, small seeds (e.g., orchids),

and 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, small species and those with small seeds that require open microsites are able to garner enough space and light to remain viable. In the absence of frequent fires, small species are outcompeted by taller and denser types of vegetation. As 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) and thus provides these plants with 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. In addition, the removal of litter by fire creates critical microsites for seed germination and fosters seedling establishment.

The removal of litter by fire also 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 (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 host plants for a variety of insects and 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 soil mixing and aeration include moles, mice, skunks, and badgers (Curtis 1959).

Historically, large herbivores such as bison significantly influenced plant species diversity in Michigan prairie and oak savanna ecosystems. The diet of bison consists of 90 to 95% grasses and sedges (Steuter 1997). As bison selectively forage on grasses and sedges, they reduce the dominance of graminoids and provide a competitive advantage to forb species. The activities of bison, which includes wallowing and trampling, promotes plant species diversity by creating microsites for seed germination and seedling establishment and reducing the dominance of robust perennials (Steuter 1997).

Mesic prairies are thought to result from the catastrophic destruction of mesic southern forest (beech-sugar maple forest or sugar maple-basswood forest) by fire (Curtis 1959, Grimm 1984). Evidence for its origin from mesic forest is based on soil type, landscape position, vegetation, and observation (Curtis 1959, Chapman 1984, Caton 1870 in Curtis 1959). In southern Michigan both mesic prairie and mesic southern forest frequently occurred on the same types of rich forest soils and both occupy level to gently rolling terrain (Curtis 1959, Chapman 1984). A variety of mesic forest plants occur within mesic prairies and are thought to represent relict populations from a previously forested environment rather than having colonized the open prairie from nearby forests (Curtis 1959, Chapman 1984). In addition, mesic prairie typically lacks oak grubs, which were very abundant in bur oak plains, oak openings, and dry-mesic prairie and were tolerant of the annual fires that swept through these communities. Thus, while dry-mesic prairie and oak openings are strongly related to the demise of an oak forest canopy by annual fires, the lack of oak grubs in mesic prairie may indicate its origin from a different type of forest, one that occurs on rich, mesic soils and lacks abundant oak trees. Lastly, Curtis provides detailed accounts of windswept prairie fires moving through adjacent hardwood forests and resulting in complete destruction of the forest canopy and conversion of these former forests to prairies (see Curtis 1959, pp. 303-304).

Vegetation Description: Unfortunately, no detailed ecological study of mesic prairie was completed in Michigan before the nearly total demise of the community. What information is available comes from written descriptions of the community by early European settlers and from studies of small prairie remnants.

In 1881, while recalling Prairie Rhonde and Gourdneck Prairie, both in southwest Kalamazoo County, Brown eulogizes "Early in March the rank growth of last year's grass, dried by the sun and wind, was set on fire and the whole prairie burned over, leaving it bare and black as midnight. Then in a few days came the beautiful flowers, covering the whole prairie with one uniform kind of color; first the blue violet [*Viola pedatifida*]; then purple phlox [*Phlox pilosa*], and this succeeded by some other color. In July and August a tall yellow flower, the name of which I do not know [*Silphium* spp. or *Ratibida pinnata*?], mixed profusely with the tall grass, gave yellow as the predominating color" (Brown 1981 in Chapman 1984).

Another early account (Taylor 1855), eloquently describes Grand Prairie near Kalamazoo in 1855: "Beneath, about, and beyond me, as far as the eye could reach, was spread out, in undulating elegance, an emerald carpet of nature's choicest fabric, inlaid profusely with flowers of every imaginable variety of name and tint – gorgeous and fascinating as the most brilliant hues of the rainbow" (Taylor 1855 in Chapman 1984).

Several early accounts of Michigan mesic prairies attest to their open, treeless character. Wheeting and Bergquist write in 1923, "the rich black, open prairies which required no clearing were undoubtedly the choice of the first settlers. The Sturgis prairie and the White Pigeon prairie [both in St. Joseph County] show evidence of having been the homes of these pioneers" (Wheeting and Bergquist 1923 in Chapman 1984). Brown describes Prairie Rhonde as he found it in 1831 as "…covered with a pretty rank growth of grass, then dry and sere, no tree except the Big Island grove and one or two other small groves'' (Brown 1981 in Chapman 1984).

The transition from the open bur oak plains to prairie was apparently clearly demarcated based on Coffinberry's 1880 account of the area around Nottawa-Sippi Prairie in St. Joseph County. "On the one hand stretched bur-oak plains, spread with a verdant carpet, variegated with dazzling wild flowers, without an obstacle to intercept the view for miles, save somber trunks of low oaks, sparsely spreading their shadows across the lawn; on the other hand arose the undulations of the white oak openings, with picturesque outlines of swells and slopes gracefully sweeping and sharply defined in the distance. Then, there lay the majestic prairie, grand in expansive solitude, its fringe of timber, as seen in the distance, resembling a diligently trained and well-trimmed garden parterre" (Coffinberry 1880 in Chapman 1984).

Chapman (1984) completed a study of 66 prairie and savanna remnants in southern Lower Michigan, four of which he classified as mesic prairie. In addition, Curtis (1959) and Curtis and Green (1949) collected detailed information on 45 mesic prairie stands in Wisconsin and much of their data may be applicable to Michigan's mesic prairies.

Mesic prairie supports a dense to moderately dense growth of medium to tall vegetation (Chapman 1984). The community is dominated by big bluestem, little bluestem, and Indian grass, which can occur in varying degrees of dominance (Chapman 1984). In addition to the three grasses mentioned above, Curtis (1959) lists three additional grass species as dominant in mesic prairie in Wisconsin, porcupine grass (*Stipa spartea*), prairie dropseed (*Sporobolus heterolepis*), and Leigberg's panic grass (*Panicum leibergii*). While all three are native to southwestern Michigan, it is important to note that both prairie dropseed and Leiberg's panic grass are now rare in Michigan and listed as State Threatened. Switch grass (*Panicum virgatum*) is mentioned within the text by Curtis (1959) but does not appear within his list of prevalent species for the community and the species occurs sparsely (< 5% frequency) in only one site studied by Chapman (1984).

The following table of mesic prairie plants was compiled from Chapman's (1984) study of four mesic prairie sites and includes native species occurring in at least 50% of the sites he studied.

SCIENTIFIC NAME	COMMON NAME
Grasses and sedges	
Andropogon gerardii	big bluestem
Andropogon scoparius	little bluestem grass
Carex bicknellii	sedge
Panicum oligosanthes	panic grass
Sorghastrum nutans	Indian grass
Spartina pectinata	prairie cordgrass
Forbs	
Anemone cylindrica	thimbleweed
Antennaria parlinii	smooth pussytoes
Apocynum androsaemifolium	spreading dogbane
Asclepias syriaca	common milkweed
Asclepias tuberosa	butterfly weed
Aster laevis	smooth aster
Aster oolentangiensis	sky-blue aster
Cacalia atriplicifolia	pale Indian plantain
Comandra umbellata	bastard toadflax

Forbs

Coreopsis palmata	prairie coreopsis
Coreopsis tripteris	tall coreopsis
Desmodium illinoense	prairie tick-trefoil
Dioscorea villosa	wild yam
Erigeron annuus	annual fleabane
Erigeron strigosus	daisy fleabane
Eryngium yuccifolium	rattlesnake master
Euphorbia corollata	flowering spurge
Euthamia graminifolia	grass-leaved goldenrod
Fragaria virginiana	wild strawberry
Frasera caroliniensis	American columbo
Galium boreale	northern bedstraw
Galium pilosum	hairy bedstraw
Gentiana flavida (E)	yellowish gentian
Geranium maculatum	wild geranium
Helianthemum canadense	common rockrose
Helianthus divaricatus	woodland sunflower
Helianthus occidentalis	western sunflower
Helianthus strumosus	pale-leaved sunflower
Heuchera americana	alum root
Kuhnia eupatorioides(SC)	false boneset
Lactuca canadensis	tall lettuce
Lespedeza capitata	round-headed bush clover
Lespedeza hirta	hairy bush clover
Lithospermum canescens	hoary puccoon
Luzula multiflora	common wood rush
Monarda fistulosa	wild bergamot
Phlox pilosa	prairie phlox
Potentilla simplex	old field cinquefoil
Ranunculus fascicularis	early buttercup
Ratibida pinnata	yellow coneflower
Rudbeckia hirta	black-eyed susan
Silphium integrifolium (T)	rosin weed
Silphium terebinthinaceum	prairie dock
Smilacina racemosa	false spikenard
Solidago altissima	tall goldenrod
Solidago nemoralis	old field goldenrod
Solidago rigida	stiff goldenrod
Solidago speciosa	showy goldenrod
Taenidia integerrima	yellow pimpernel
Thalictrum dasycarpum	purple meadow rue
Tradescantia ohiensis	common spiderwort
Verbena stricta	hoary vervain
Veronicastrum virginicum	Culver's root
Vicia americana	American vetch
Viola sororia	common blue violet
Zizia aurea	golden alexanders

Ferns and Fern Allies

Equisetum laevigatum	smooth scouring rush
Pteridium aquilinum	bracken fern

Shrubs

Ceanothus americanus	New Jersey tea
Cornus foemina	gray dogwood
Corylus americana	hazelnut
Rhus glabra	smooth sumac
Rhus typhina	staghorn sumac
Rosa carolina	pasture rose
Rubus hispidus	swamp dewberry
Salix humilis	prairie willow

Michigan Indicator Species: Chapman (1984) lists the following native species as indicators of mesic prairie: pale Indian plantain (*Cacalia atriplicifolia*), sedge (*Carex bicknellii*), prairie coreopsis (*Coreopsis palmata*), American columbo (*Frasera caroliniensis*), yellowish gentian (*Gentiana flavida*), wild geranium (*Geranium maculatum*), pale-leaved sunflower (*Helianthus strumosus*), false boneset (*Kuhnia eupatoriodes*), bur oak (*Quercus macrocarpa*), smooth sumac (*Rhus glabra*), yellow pimpernel (*Taenidia integerrima*), hoary vervain (*Verbena stricta*), American vetch (*Vicia americana*), prairie violet (*Viola pedatifida*) and common blue violet (*Viola sororia*). Species more common in wet-mesic or lowland sites but which can serve as indicators of mesic prairie when found in upland sites include the following: wild yam (*Dioscorea villosa*), daisy fleabane (*Erigeron annuus*), rattlesnake master (*Eryngium yuccifolium*), swamp dewberry (*Rubus hispidus*), rosin weed (*Silphium integrifolium*), prairie dock (*S. terebinthinaceum*), tall goldenrod (*Solidago altissima*), prairie cord grass (*Spartina pectinata*), tall meadow rue (*Thalictrum dasycarpum*), and golden alexanders (*Zizia aurea*) (Chapman 1984). It is noteworthy that none of the indicators listed by Curtis (1959) for mesic prairie in Wisconsin are considered mesic prairie indicators in Michigan by Chapman (1984).

Other Noteworthy Species: Rare plant species associated with mesic 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.

Scientific Name	Common Name	Status
Amorpha canescens	lead-plant	SC
Baptisia lactea	white false indigo	SC
Baptisia leucophaea	cream wild indigo	E
Coreopsis palmata	prairie coreopsis	T
Dichanthelium leibergii	Leigberg's panic grass	T
Dodecatheon meadia	shooting-star	E
Echinacea purpurea	purple confeflower	X
Eryngium yuccifolium	rattlesnake-master	T
Gentiana flavida	white gentian	E
Polygala incarnata	pink milkwort	X
Silphium integrifolium	rosinweed	T
Silphium laciniatum	compass-plant	T
Sisyrinchium strictum	blue-eyed-grass	SC
Spiranthes ovalis	lesser ladies'-tresses	T
Sporobolus heterolepis	prairie dropseed	SC
Viola pedatifida	prairie birdfoot violet	T

Rare animal species associated with mesic 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), 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: blazing star borer (*Papaipema beeriana*) (SC), Culver's root borer (*Papaipema sciata*) (SC), Silphium borer (*Papaipema silphii*) (T), leadplant flower moth (*Schinia lucens*) (E), red-legged spittlebug (*Prosapia ignipectus*) (SC), Sprague's pygarctia (*Pygarctia spraguei*) (SC), and Spartina moth (*Spartiniphaga inops*) (SC).

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

Reptiles: eastern massasauga (*Sistrurus c. catenatus*) (SC and Federal Candidate Species), gray ratsnake (*Pantherophis spiloides*) (SC), Kirtland's snake (*Clonophis kirtlandii*) (T), and eastern box turtle (*Terrapene c. carolina*) (SC). Spotted turtle (*Clemmys guttata*) (T) and Blanding's turtle (*Emydoidea blandingii*) (SC) may nest in mesic prairie when it occurs adjacent to wetlands.

Conservation and Management: Efforts should be made to identify, protect, and manage remnants of mesic 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 (Scharrer 1972, Thompson 1970, 1975, and 1983, Chapman 1984). The small size and poor landscape context of most remnant mesic prairies make large-scale restoration of existing prairies nearly impossible. Prairie plantings located in areas of former mesic prairie, especially on the Battle Creek Outwash Plain (Albert 1995), are particularly needed.

Managing mesic prairie requires frequent burning, from annual to every two to three years. Longer burn intervals will result in tree and tall shrub encroachment. Prescribed burning is required 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 (e.g., decades), local extinctions of plant species are common (Leach and Givnish 1996).

In addition to prescribed fire, brush cutting accompanied by stump application of herbicide is an important component of prairie restoration. While fires frequently kill woody seedlings, long established trees and tall shrubs like black cherry (*Prunus serotina*) and dogwoods (*Cornus* spp.) typically resprout and can reach former levels of dominance within two to three years. Herbicide application to 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 open grasslands such as mesic prairie. 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 as a mosaic of burned and unburned patches (Herkert et al. 1993).

Prairie ants (*Formica*) are an extremely important component of grassland communities and research indicates that 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* and *Aphaenogaster*) 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 (Trager 1990).

Controlling invasive species is a critical step in restoring and managing mesic 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). At present some of the most aggressive invasive species that threaten biodiversity of grassland communities include reed canary grass (*Phalaris arundinacea*), white and yellow sweet clover (*Melilotus alba* and *M. officinalis*), spotted knapweed (*Centaurea maculosa*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), Eurasian honeysuckles (*Lonicera maackii*, *L. morrowii*, *L. tatarica*, *L.* x *bella*.), and black locust (*Robinia pseudoacacia*).

In addition to reestablishing ecological processes such as fire, most restoration sites will require the reintroduction of appropriate native species and genotypes. Plants can be reintroduced both through seeding or 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 Michigan genotypes (http://www.nohlc.org/MNPPA.htm).

Several helpful guides are available for restoring prairies and starting prairie plants from seed (Packard and Mutel 1997, Nuzzo 1976, Schulenberg 1972). See Packard and Mutel (1997) for a comprehensive treatment of the subject and additional references

Restoration and management of grasslands such as mesic 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), grasshopper sparrow (SC), eastern meadowlark (*Sturnella magna*), western meadowlark, sedge wren (*Cistothorus platensis*), sharp-tailed grouse (*Pedioecetes phasianellus*), upland sandpiper (*Bartramia longicauda*), 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 mesic prairie need to be identified, protected, and managed. Further research on the historical plant species composition of mesic prairie in Michigan would be useful for developing seed mixes for restoration. Genetic studies of the effects of small, isolated populations on plant species genetic diversity will provide information

on managing remnants of mesic prairie. Research on the utilization of restored and remnant prairies by grassland birds and insects will provide useful information for understanding how mesic 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 mesic prairie. Conservation and management efforts will benefit from further study of how species composition is influenced by fire frequency, intensity, and periodicity.

Similar Communities: Dry-mesic prairie, bur oak plains, oak openings, mesic sand prairie, and wet-mesic prairie

Other Classifications:
Michigan Natural Features Inventory Circa 1800s Vegetation (MNFI): Grassland

The Nature Conservancy U.S. National Vegetation Classification and International Classification of Ecological Communities (Faber-Langendoen 2001, NatureServe 2004):
CODE; ALLIANCE; ASSOCIATION; COMMON NAME

V.A.5.N.a; *Andropogon gerardii* – (*Sorghastrum nutan*s) Herbaceous Alliance; *Andropogon gerardii* – *Sorghastrum nutans* – (*Sporobolus heterolepis*) – *Liatris* spp. – *Ratibida pinnata* Herbaceous Vegetation; Big Bluestem – Yellow Indiangrass – (Prairie Dropseed) – Blazingstar Species – Grey-head Prairie Coneflower Herbaceous Vegetation

Related Abstracts: bur oak plains, oak openings, oak barrens, dry-mesic prairie, Culver's root borer, eastern box turtle, eastern massasauga, Henslow's sparrow, migrant loggerhead shrike, northern harrier, red-legged spittlebug, and prairie dropseed.

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