# LANDFIRE Biophysical Setting Model

## *Biophysical Setting:* 4914110 Great Lakes Wet-Mesic Lakeplain Prairie

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

## *General Information*

**Contributors** (also see the Comments field) **Date** 10/19/2007


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|---|---|---|---|---|---|
| **Modeler 1** | Brad Slaughter | slaughterb@michigan.gov | **Reviewer** | Jim Drake | jim_drake@natureserve.org |
| **Modeler 2** | | | **Reviewer** | | |
| **Modeler 3** | | | **Reviewer** | | |


**Vegetation Type**
Wetlands/Riparian

**General Model Sources**
☑ Literature
☐ Local Data
☐ Expert Estimate

**Dominant Species**
SCHIZ4
ANGE
PAVI2
SONU2
PYVI
LISP
OLOH
PELA2

**Map Zone**
49

**Model Zone**
☐ Alaska
☐ California
☐ Great Basin
☑ Great Lakes
☐ Hawaii
☐ Northeast
☐ Northern Plains
☐ N-Cent.Rockies
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

### Geographic Range

Lakeplain wet-mesic prairies occur along the glacial lakeplains of the Great Lakes, in southeastern WI, northeastern IL, northern IN, southern MI and northwestern OH, as well as in southern Ontario, Canada. In MZ49, this BpS was concentrated in the lakeplain portion of the Central Corn Belt Plains Level III Ecoregion (54), particularly in the Chicago Lake Plain and Chiwaukee Prairie Region Level IV Ecoregions (Woods et al. 1998, 2006).

### Biophysical Site Description

Lakeplain wet-mesic prairie is most commonly associated with inland portions of Michigan's lakeplains, but is also found along low beach ridges near the present Saginaw Bay shoreline. More specifically, lakeplain wet-mesic prairie occurs on several glacial features of the lakeplain, including level, sandy outwash, sandy lakeplains, and deposits of dune sand on silt or clay glacial lakeplains. The soils are sands, sandy loams, loams, or silty clays with poor to moderate water-retaining capacity. Lakeplain prairies most commonly occur on sand lakeplain with soils of medium to fine-textured sands that are slightly acid to moderately alkaline (pH6-8). The prairies, which experience seasonal flooding and typically include small pockets that remain wet throughout the year, are among the most diverse plant communities in Michigan, with as many as 200 plant species found within a single prairie remnant.

### Vegetation Description

The dominant tallgrass prairie species of this community typically grow 1-2m high. Trees and shrubs are uncommon and bare ground is scarce. Andropogon gerardii (big bluestem), Carex (sedge) spp., Panicum virgatum (switch grass), Schizachyrium scoparius (little bluestem) and Sorghastrum nutans (Indian grass) are the most abundant species. Solidago ohioensis (Ohio goldenrod) is found in both fens and Great Lakes interdunal wetlands as well as this community. Pycnanthemum virginianum (common mountain mint) is common in this community but may also occur in woodlands. In addition to the species listed above, other

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diagnostic species include: Pedicularis lanceolata (swamp-betony), Solidago riddellii (Riddell's goldenrod) and Vernonia (ironweed) spp. Sorghastrum nutans, Liatris spicata (marsh blazing star), Aletris farinosa (colic root) and Coreopsis tripteris (tall coreopsis) are good indicators of functioning lakeplain wet-mesic prairie.

Rare plants associated with lakeplain wet-mesic prairie include: Agalinis gattingeri (Gattinger's gerardia), Agalinis skinneriana (Skinner's gerardia), Angelica venenosa (hairy angelica), Aristida longispica (three-awned grass), Asclepias hirtella (tall green milkweed), A. sullivantii (Sullivant's milkweed), Astragalus neglectus (Cooper's milk-vetch), Baptisia leucophaea (creamy wild indigo), Cacalia plantaginea (prairie Indian-plantain), Carex festucacea (fescue sedge), Conobea multifida (conobea), Cyperus flavescens (yellow nut-grass), Cypripedium candidum (white lady's-slipper), Fimbristylis puberula (chestnut sedge), Hemicarpha micrantha (dwarf-bulrush), Hypericum gentianoides (gentian-leaved St. John's-wort), Juncus biflorus (two-flowered rush), Juncus brachycarpus (short-fruited rush), Lechea minor (least pinweed), Ludwigia alternifolia (seedbox), Lycopodium appressum (appressed bog clubmoss), Panicum leibergii (Leiberg's panic-grass), Platanthera ciliaris (yellow fringed orchid), Platanthera leucophaea (prairie fringed orchid), Polygala cruciata (cross-leaved milkwort), Pycnanthemum verticillatum (whorled mountain-mint), Rotala ramosior (tooth-cup), Scirpus clintonii (Clinton's bulrush), Scleria pauciflora (few-flowered nut-rush), Scleria triglomerata (tall nut-rush), Tradescantia virginiana (Virginia spiderwort) and Triplasis purpurea (sand grass).

## Disturbance Description

Many factors influence the development and maintenance of prairies on post-glacial lakeplain. Hubbard (1888) speculated that the extensive wet prairies of Wayne and Monroe Counties in Michigan were the result of beaver activity prior to their localized extirpation by the fur trade. His view was based on communications with Native Americans and the prevalence of abandoned beaver dams on the flat lakeplain landscape. Other important factors probably include both soil moisture regimes and periodic wildfires. The combination of 1-3 meters of highly permeable sand over clay sets up a characteristic hydrological regime with spring flooding followed by drought conditions during the growing season. This characteristic water level fluctuation is common to nearly all extant examples of lakeplain prairies in the region, and is possibly the most significant physical process in their establishment and maintenance (Minc 1995, Albert et al. 1996). Such extreme variation in the soil moisture regime prevents woody vegetation from becoming established (Hayes 1964, Roberts et al. 1977). In addition to the dramatic seasonal fluctuations in surface and ground water levels, Great Lakes water level cycles also produce fluctuations in the water table of these prairies. Wet prairies originally occupied the position on the landscape between emergent marsh and adjacent uplands. Based on the original surveyors' notes from the Saginaw Bay shoreline in Michigan, the boundary between prairie and marsh was not static, but moved inland or lakeward across the landscape, depending on the stage of the Great Lakes water-level cycle. Lakeplain prairies isolated from the current Great Lakes shorelines, such as those in the Oak Openings region of Ohio, are not subject to direct flooding by Lake Erie. However, fluctuating hydrology remains a significant factor shaping temporal vegetative composition and structure.

The combination of accumulation of organic material within these wetlands and drought conditions during the growing season made lakeplain prairies prone to wildfires, which limited the encroachment of woody vegetation. However, it remains unclear whether lighting strikes or Native American activities had a more significant role in the maintenance of lakeplain prairie (Hayes 1964, Faber-Langendoen & Maycock 1987). It is clear, however, that Native Americans utilized dune ridges on the lakeplain for settlements and trails (Jones & Knapp 1972, Comer et al. 1995a). One indication of the significance of fire on the lakeplain is the fact that many of the historical oak savannas located along the beach ridges have become closed-canopy oak forests during the last century of fire suppression.

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### Adjacency or Identification Concerns

Historically, these prairies occurred in complex mosaics with lakeplain oak openings, pin oak-swamp white oak sand flatwoods, and elm-ash-maple swamps, all typical of poorly drained lakeplain. At the base of old beach ridges, lakeplain wet-mesic prairie presently occurs as a transition zone between lakeplain wet-prairie and lakeplain mesic prairie (Comer et al. 1995a).

Lakeplain prairies have been lost and degraded via conversion to agriculture, residential and industrial development, alterations of ground water hydrology, and fire suppression. The construction of extensive drainage networks to promote agriculture and residential development has lowered the water table in most of the historical range of lakeplain prairies. That, and the suppression of natural and cultural fires has allowed the community to succeed to shrub and forest communities. Also alteration of natural hydrologic and fire regimes regimes has allowed invasives species to invade lakeplain prairie remants. Significant invasive species found in lakeplain wet-mesic prairies include Phragmites australis, Phalaris arundiancea, Lythrum salicaria. Of nearly 160,000 acres (64,000 ha) of lakeplain prairie in Michigan circa 1800 less than 0.5% remain today (Comer et al. 1995a and b).

### Native Uncharacteristic Conditions

### Scale Description

Patch size characteristics for this community are variable. Circa 1800 patch sizes of lakeplain prairie mosaics (including wet, wet-mesic, and mesic sand prairies) in Michigan varied from <100 acres to over 15,000 acres (40 to 6000 hectares) (Comer et al. 1995b).

### Issues/Problems

### Comments

Copied from model for MZ51 by Becky Schillo. Geographic range modified for MZ62. The text in the General Information Section of this model was copied from the Michigan Natural Features Inventory Abstract for Lakeplain Wet-Mesic Prairie by Dennis Albert and Michael Kost. See References section for complete citation and associated references.

## *Vegetation Classes*

***Class A*** **49 %**

Early Development 1 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model**

**Description**

**Indicator Species and Canopy Position**

TYLA
Low-Mid
CAREX
Lower
SPPE
Low-Mid
CACA4
Low-Mid

**Structure Data (for upper layer lifeform)**

| | *Min* | *Max* |
|---|---|---|
| *Cover* | 11 % | 60 % |
| *Height* | Herb 0m | Herb >1.1m |
| *Tree Size Class* | None | |

- [ ] Upper layer lifeform differs from dominant lifeform.

The canopy closure in this stage can range up to 100% but the maximum canopy closure was set at 60% to make this stage exclusive from class B. In this stage there may be standing water at the soil surface for part of the year

Emergent marsh/lakeplain wet-prairie class: This stage is domianted by species such as Calamagrostis canadensis, Spartina pectinata, Juncus balticus, Carex stricta, Carex aquatilis, Carex pellita, Cladium mariscoides, Potentilla fruiticosa and Asclepias incarnata (swamp milkweed). Wetter portions would contain Alisma plantago-aquatica, Carex, Eleocharis, Glyceria borealis, Leersia, Lemna, Nuphar, Nymphaea,

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Polygonum, Pontederia cordata, Sagittaria, Scirpus, Sparganium, Spirodela, Typha, Wolffia and Zizania aquatica.

This stage would occur with fluctuating Great Lakes water levels. When Great Lakes water levels rise, areas of wet-mesic prairie (class B) near the Great Lakes would be inundated and species mix would shift to wet prairie and marsh species (class A). This probability is an estimate and large-scale (interannual) flucations in Great Lakes water levels are stochastic events and occur without regular periodicity. In the absence of disturbance class A would remain as class A.

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***Class B*** **26 %**

Early Development 2 Open

**Upper Layer Lifeform**

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

**Fuel Model**

**Indicator Species and Canopy Position**

SCHIZ4
Low-Mid
SONU2
Low-Mid
PYVI
Lower
LISP
Lower

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 61 % | 100 % |
| *Height* | Herb 0m | Herb 1.0m |
| *Tree Size Class* | None | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Lakeplain wet-mesic prairie class. The stage ranges from 0-100yrs, but lakeplain wet-mesic prairie systems can persist on the landscape for longer than 100yrs as long as fire and hydrologic regimes remian unaltered. This stage is dominated by Schizachyrium scoparium, Sorghastrum nutans, Panicum virgatum, and Andropogon geradii with forbs such as Pycnanthemum virginianum, Solidgao ohioensis, Liatris spicata, Pedicularis lanceolata, Solidago riddellii, Vernonia spp., and Coreopsis tripteris.

The poor to moderately drained soils of the lakeplain supports a moisture regime of spring flooding followed by summer drought. These edaphic factors maintain lakeplain prairie species and limits the encroachment of woody vegetation. In addition to abiotic and edaphic factors, fire also maintains the system in this class. Replacement fire was modeled with a probability of occurring every 7.5yrs (.15). The frequency of fires would have depended in large part on the concentration of Native Americans in the region.

For lakeplain wet-mesic prairies that occur near the Great Lakes, rises in Great Lakes water levels can send the system back to class A, a wet-prairie or marsh. This was modeled as "Optional 2" at a probability of occurring every 40yrs (0.25). Again, this probability is an estimate and large-scale (interannual) flucations in Great Lakes water levels are stochastic events and occur with no regular periodicity.

With time and the absense of fires, trees and shrubs would establish and the system would transition to a lakeplain oak savanna/ oak woodland (class C).

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***Class C*** **25 %**

Late Development 1 Closed

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☑ Tree

**Fuel Model**

**Indicator Species and Canopy Position**

QUBI
Low-Mid
QUPA2
Low-Mid
ULAM
Lower
FRQU
Lower

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | 31 % | 90 % |
| *Height* | Tree 0m | Tree 25m |
| *Tree Size Class* | Large 21-33"DBH | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

Lakeplain oak savanna/oak woodland would include Quercus palustris, Q. bicolor, Ulmus americana, Fraxinus quadrangulata. This stage would result when trees encroach and establish in areas of lakeplain wet-mesic prairie. This would occur when frequent prairie fires are absent. Infrequent replacement fires, modeled at the probability of occurring every 150yrs (.007) would take the system back to the wet-mesic prairie stage represented by class B. It is assumed that an area capable of supporting lakeplain oak savanna/woodland is far enough inland to no longer be affected by changes in Great Lakes water levels.

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***Class D*** **0 %**

[Not Used] [Not Used]

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Indicator Species and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

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***Class E*** **0 %**

[Not Used] [Not Used]

**Upper Layer Lifeform**

☐ Herbaceous
☐ Shrub
☐ Tree

**Fuel Model**

**Indicator Species and Canopy Position**

**Structure Data (for upper layer lifeform)**

| | Min | Max |
|---|---|---|
| *Cover* | % | % |
| *Height* | | |
| *Tree Size Class* | | |

☐ Upper layer lifeform differs from dominant lifeform.

**Description**

## *Disturbances*

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**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

**Fire Regime Group**:** II

**Historical Fire Size (acres)**

Avg 0
Min 0
Max 0

**Sources of Fire Regime Data**

- ☐ Literature
- ☐ Local Data
- ☑ Expert Estimate

| Fire Intervals | Avg FI | Min FI | Max FI | Probability | Percent of All Fires |
|---|---|---|---|---|---|
| *Replacement* | 23.93 | | | 0.04179 | 100 |
| *Mixed* | | | | | |
| *Surface* | | | | | |
| *All Fires* | 24 | | | 0.04181 | |

***Fire Intervals (FI):***

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

**Additional Disturbances Modeled**

- ☐ Insects/Disease
- ☐ Native Grazing
- ☐ Other (optional 1) Decline in Great Lakes Water Levels
- ☐ Wind/Weather/Stress
- ☐ Competition
- ☑ Other (optional 2) Rise in Great Lakes Water Levels

## References


Albert, D.A. and M.A. Kost 1998. Natural community abstract for lakeplain wet-mesic prairie. Michigan Natural Features Inventory, Lansing, MI. 5 pp.

Anderson, D. 1981. Ohio plant community classification and survey. Ohio Department of Natural Resources Division of Natural Areas and Preserves Natural Heritage Program, Columbus, Ohio.

Brewer, L.C. and J.L. Vankat. 2004. Description of vegetation of the Oak Openings of northwestern Ohio at the time of Euro-American settlement. Ohio Journal of Science 104: 76-85.

NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe, Arlington, VA. 14 December 2007 http: // www.natureserve.org/explorer.

Omernik, J.M., S.S. Chapman, R.A. Lillie, and R.T. Dumke. 2000. Ecoregions of Wisconsin. Transactions of the Wisconsin Academy of Science, Arts and Letters 88(2000): 77-103.

White, J. and M.H. Madany. 1978. Classification of natural communities in Illinois. Appendix 30 in: Illinois Natural Areas Inventory- Technical report by The Department of Landscape Architecture, University of Illinois at Urbana-Champaign & The Natural Land Institute, Rockford, IL.

Woods, A.J., J.M. Omernik, C.S. Brockman, T.D. Gerber, W.D. Hosteter and S.H. Azevedo. 1998. Ecoregions of Indiana and Ohio (2-sided color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, scale 1: 500,000.

Woods, A.J., J.M. Omernik, C.L. Pederson, and B.C. Moran. 2006. Ecoregions of Illinois (2-sided color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, scale 1: 500,000.

References Cited in Michigan Natural Features Inventory Abstract:


**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

Albert, D.A. 1995. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: a working map and classification. North Central Forest Experiment Station. Forest Service - U.S. Department of Agriculture.

Albert, D.A., D.L. Cuthrell, D.A. Hyde, J.T. Legge, M.R. Penskar, and M.L. Rabe. 1996. Sampling and management of lakeplain prairies in southern Lower Michigan. Michigan Natural Features Inventory. 93 pp.

Comer, P.J., D.A. Albert, H.A. Wells, B.L. Hart, J.B. Raab, D.L. Price, D.M. Kashian, R.A. Corner, and D.W. Schuen. 1995a. Michigan's presettlement vegetation, as interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing, MI. 76 pp.

Comer, J.P., W.A. MacKinnon, M.L. Rabe, D.L. Cuthrell, M.R. Penskar, and D.A. Albert. 1995b. A survey of lakeplain prairie in Michigan. Michigan Natural Features Inventory, Lansing, MI. 232 pp.

Faber-Langendoen, D. and P.F. Maycock. 1987. Composition and soil-environment analysis of prairies on Walpole Island, southwestern Ontario. Canadian Journal of Botany 65: 2410-2419.

Jones, C.L. and R.O. Kapp. 1972. Relationship of Bay County Michigan presettlement forest patterns to Indian cultures. The Michigan Academician, pp. 17-28.

Hayes, B.N. 1964. An ecological study of wet prairie on Harsons Island, Michigan. The Michigan Botanist 3: 71-82.

Hubbard, B. 1888. Memorials of a half-century in Michigan and the Lake Region. G. P. Putnam's Sons. Pp. 360-367.

Minc, L.D. 1995. Seasonal hydrology and species relationships in Lower Michigan's lakeplain prairies. An analysis and report submitted to Michigan Natural Features Inventory. 89 pp.

Roberts, T.M., T. Robson, and P.J. Catling. 1977. Factors maintaining a disjunct community of Liatris spicata and other prairie species in Ontario, Canada. Canadian Journal of Botany 55: 593-605.

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