LANDFIRE Biophysical Setting Model

Biophysical Setting: 5114110 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** 4/10/2007

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Vegetation Type
Wetlands/Riparian

General Model Sources
☐ Literature
☐ Local Data
☐ Expert Estimate

Dominant Species
SCHIZ4
ANGE
PAVI2
SONU2
PYVI
LISP
OLOH
PELA2

Map Zone
51

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 MI, lakeplain wet-mesic prairies are found in three regions: the southeast counties along Lake Erie, the Detroit River and Lake St. Clair; the Saginaw Bay Shoreline; and in Berrien and Allegan counties in the southwest. These corespond with subsections 222Ua, 222Ue and 222Jb.

Biophysical Site Description

Lakeplain wet-mesic prairie is most commonly associated with inland portions of MI'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 MI's lakeplain. Hubbard (1888) speculated that the extensive wet prairies of Wayne and Monroe counties 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 1-3m 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 Michigan's lakeplain prairies, and is possibly the most significant physical process in their establishment and maintenance (Albert et al. 1996, Minc 1995). Such extreme variation in the soil moisture regime prevents woody vegetation from becoming established (Roberts et al. 1977, Hayes 1964). 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, 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.

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 (Faber-Langendoen and Maycock 1987, Hayes 1964). It is clear, however, that Native Americans utilized dune ridges on the lakeplain for settlements and trails (Comer et al. 1995a, Jones & Knapp 1972). As elsewhere in the state, it is quite likely that fires periodically resulted from this use, spreading to adjacent savanna and grassland. 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.

Adjacency or Identification Concerns

Historically, these prairies occurred in complex mosaics with lakeplain oak openings, pin oak-swamp white

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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 have allowed the community to succeed to shrub and forest communities. Also alteration of natural hydrologic and fire regimes has allowed invasives species to invade lakeplain prairie remnants. Significant invasive species found in lakeplain wet-mesic prairies include Phragmites australis, Phalaris arundiancea, Lythrum salicaria. Of nearly 160,000ac (64,000ha) of lakeplain prairie in MI circa 1800 <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 MI varied from <100ac to over 15,000ac (40-6000ha) (Comer et al. 1995b).

Issues/Problems

Modified VDDT model because model wasn't working right in LANDSUM (everything came out in C). Made classes self-perpetuating and used alternative succession to move between classes (M.H. Weber-MiFSL, 12/31/07).

Comments

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 **43 %**

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model

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 stage B. In this stage there may be standing water at the soil surface for part of the year.

Description

Emergent marsh/lakeplain wet-prairie class: This stage is dominated by species such Calamagrostis canadensis, Spartina pectinata, Juncus balticus, Carex stricta, Carex aquatilis, Carex pellita (sedge), Cladium mariscoides, Potentilla fruiticosa and Asclepias incarnata (swamp milkweed), and wetter portions would contain Alisma

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plantago-aquatica, Carex, Eleocharis, Glyceria borealis, Leersia, Lemna, Nuphar, Nymphaea, 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 speceis (class A). Conversely, when Great Lakes water levels decline, modeled as "optional 1" with a probability of occurring every 40yrs (0.025), class A would shift to class B. This probability is an estimate and large-scale (interannual) fluctuations in Great Lakes water levels are stochastic events and occur without regular periodicity. In the absence of disturbance the class A would remain as class A.

Class B **43 %**

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 10.0m
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 remain unaltered. This stage is dominated by Schizachyrium scoparius, 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 maintians the system in this class. Replacement fire was modeled with a probability of occurring every 7.5yrs (0.15). 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) fluctuations in Great Lakes water levels are stochastic events and occur with no regular periodicity.

With time and the absence 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 14 %

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 Querucs palustris, Q. bicolor, Ulmus americana and 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 (0.007) 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.

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

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

**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	15.29			0.0654	100
Mixed					
Surface					
All Fires	15			0.06542	

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

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