

Ecological site F098XA020MI

Wet Sandy Drift Depressions

Last updated: 1/12/2024
Accessed: 05/11/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 098X–Southern Michigan and Northern Indiana Drift Plains

"This area is in the Eastern Lake Section of the Central Lowland Province of the Interior Plains. It is a broad glaciated plain that is deeply mantled by till in the north and outwash to the south. Much of the area is nearly level to gently rolling. Elevation ranges from 183 to 391 m (600 to 1285 ft). Local topographic relief averages 9 m and ranges up to 74 m (30 to 245 ft). Highest relief occurs adjacent to river valleys eroded through moraines. Topography is more subdued south of the Atlantic/Gulf drainage divide near the Michigan/Indiana state line, elevations ranging from 185 to 280 m (605 to 920 ft). Local topographic relief in the south averages 4 m and ranges up to 49 m (10 to 160 ft).

The surface of this area is covered by 30 to 150 m (100 to 500 ft) of glacial drift in most areas. At the northern edge of the area, the drift is more than 100 meters (300 ft) thick. From the Grand River basin northward, most of the drift consists of till from the Saginaw Lobe of the Wisconsin Ice Sheet. From the Kalamazoo River basin southward, there are significant deposits of unconsolidated sand and gravel outwash formed between major lobes of the receding Wisconsin Ice Sheet. The outwash deposits are reworked as sand dunes in the Kankakee River basin.

The bedrock beneath the glacial deposits in this area is deformed in the shape of a basin. The center of this basin is in the north-central part of the area. Pennsylvanian-age sandstone are in the center of the basin, and Mississippian-age sandstone and shale beds form the outer rings of the basin. In a few areas the drift deposits are less than 2 m (6 ft) thick, where glacial outwash channels have eroded to limestone bedrock in Grand Rapids, and where sandstone bedrock cuestas peak in elevation in near Hillsdale, Michigan. A sandstone cliff < 15 m high (<50 ft) occurs along a short stretch of the Grand River in Grand Ledge, Michigan.

Most of the rivers in this area are short because of their proximity to the Great Lakes east and west of the area. The largest watersheds, the St. Joseph River, Grand River, and Kalamazoo River drain into Lake Michigan. The southern extent of the MLRA is drained by the Kankakee River of the Mississippi River watershed."

Classification relationships

Among the USFS ecoregional framework (Cleland et al., 2007), most of MLRA 98 is represented by the Humid Temperate Domain (200), Hot Continental Division (220), Midwest Broadleaf Forest Province (222), South Central Great Lakes Section (222J), subsections 222Jc, 222Jg, 222Jh, and 222Jf. Similar sites within the portion of MLRA 98 that overlap the Prairie Division (250) and Prairie Parkland Province (251) are treated as separate ecological sites. MLRA 98 recently was adjusted to exclude portions of Warm Continental Division (210), Laurentian Mixed Forest Province (212) to the north, and subsections 222Ja and 222Jb to the northwest.

Among the EPA ecoregional framework (Omernik and Griffith, 2014), most of MLRA 98 falls within Eastern Temperate Forests (Level I: 8), Mixed Wood Plains (Level II: 8.1), Southern Michigan/Northern Indiana Drift Plains (Level III: 56), and Level IV: 56b, 56g, and 56h. Similar sites within the portion of MLRA 98 that overlap the Central

USA Plains (Level II: 8.2) and Central Corn Belt Plains (Level III: 54) are treated as separate ecological sites. MLRA 98 recently was adjusted to exclude portions of Northern Forests (Level I: 5), Mixed Wood Shield (Level II: 5.2), Northern Lakes and Forests (Level III: 50) to the north, and level IV: 56d and 56f to the northwest.

Ecological site concept

The central concept of the Wet Drift Depressions is outwash (<70% sands >100 cm deep) that is seasonally saturated (poorly drained and very poorly drained). Site is generally located on lower landscape positions and support rich wetland vegetation.

Associated sites

F098XA017MI	Moist Acidic Drift Flats
F098XA019MI	Moist Sandy Drift Plains

Similar sites

F098XA012MI	Wet Loamy Depressions
R098XB034IN	Kankakee Wet Drift Flats

Table 1. Dominant plant species

Tree	(1) <i>Acer saccharinum</i> (2) <i>Fraxinus pennsylvanica</i>
Shrub	Not specified
Herbaceous	(1) <i>Calamagrostis canadensis</i>

Physiographic features

Site is most commonly found in depressions on outwash plains.

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Outwash plain
Runoff class	Negligible to low
Ponding duration	Brief (2 to 7 days) to very long (more than 30 days)
Ponding frequency	Rare to frequent
Elevation	604–1,276 ft
Water table depth	0–10 in
Aspect	Aspect is not a significant factor

Climatic features

This ecological site experiences a humid continental climate with mild summers and cold winters. Precipitation is moderately well distributed through the year with higher amounts during the growing season than the winter. Temperature extremes are moderated by the Great Lakes compared to other inland continental locations, though not as much as MLRAs directly bordering the Great Lakes. Mean annual extreme minimum temperatures range from -26.6 to -20.8°C (-16 to -5°F), which falls within hardiness zones 5a to 6a. Annual snowfall is enhanced by the Great Lakes, mainly on the western half of the MLRA.

Table 3. Representative climatic features

Frost-free period (characteristic range)	118-135 days
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Freeze-free period (characteristic range)	152-167 days
Precipitation total (characteristic range)	32-38 in
Frost-free period (actual range)	115-146 days
Freeze-free period (actual range)	145-182 days
Precipitation total (actual range)	32-41 in
Frost-free period (average)	127 days
Freeze-free period (average)	160 days
Precipitation total (average)	36 in

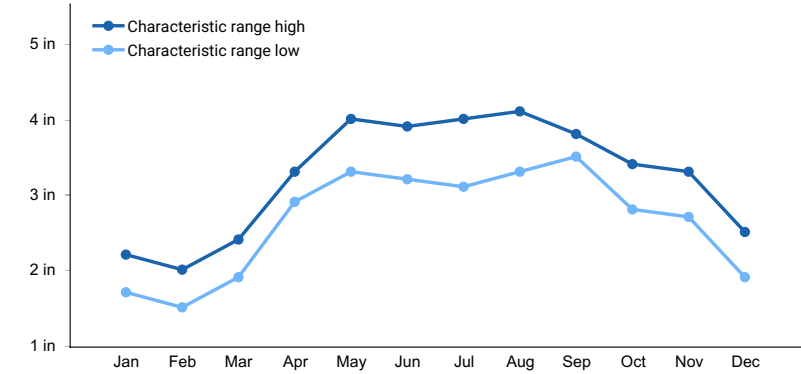


Figure 1. Monthly precipitation range

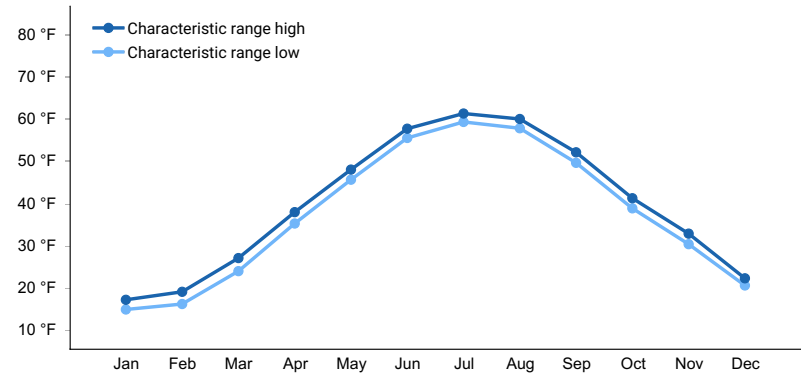


Figure 2. Monthly minimum temperature range

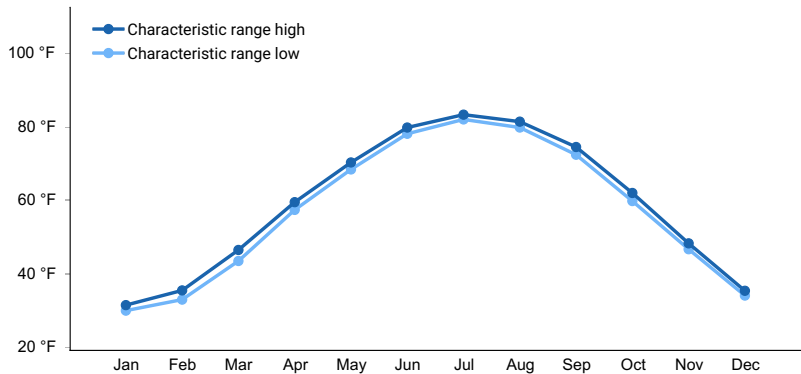


Figure 3. Monthly maximum temperature range

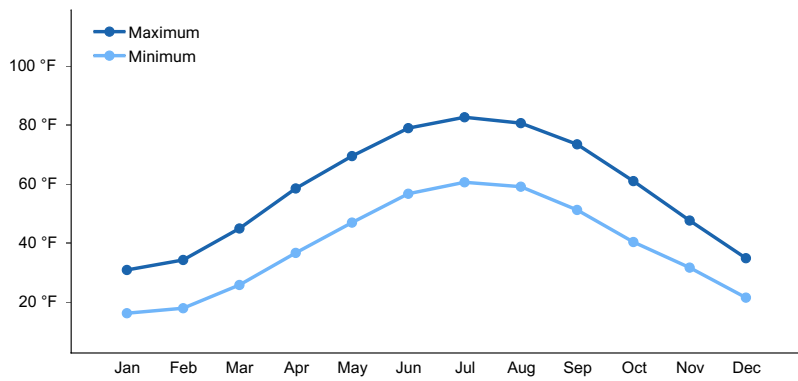


Figure 4. Monthly average minimum and maximum temperature

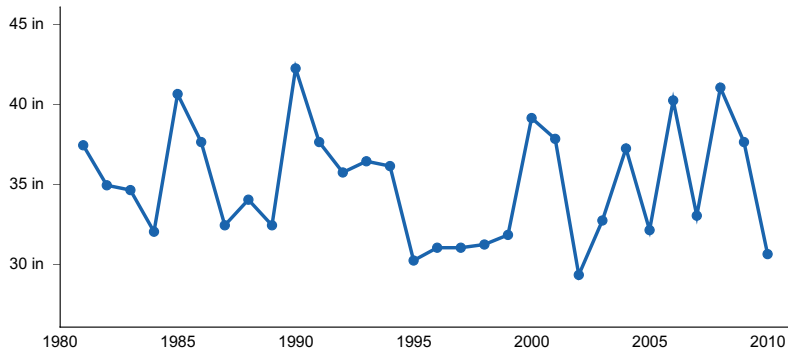


Figure 5. Annual precipitation pattern

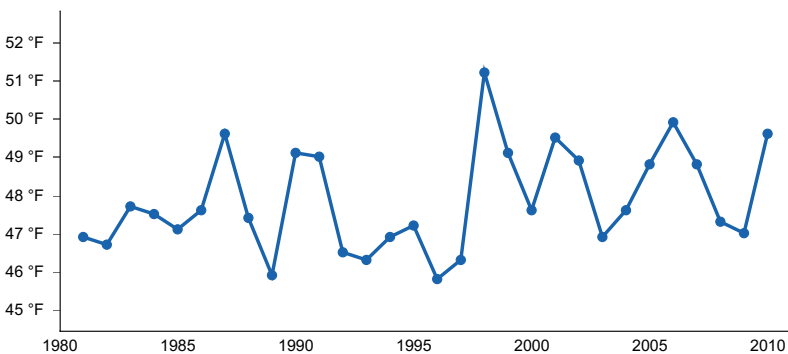


Figure 6. Annual average temperature pattern

Climate stations used

- (1) DOWAGIAC 1 W [USC00202250], Dowagiac, MI
- (2) GREENVILLE 2 NNE [USC00203429], Greenville, MI
- (3) SAINT JOHNS [USC00207280], Saint Johns, MI
- (4) THREE RIVERS [USC00208184], Three Rivers, MI
- (5) BATTLE CREEK KELLOGG AP [USW00014815], Battle Creek, MI
- (6) LAPORTE [USC00124837], La Porte, IN
- (7) VALPARAISO WTR WKS [USC00128999], Valparaiso, IN
- (8) CHARLOTTE [USC00201476], Roscommon, MI
- (9) FLINT 7 W [USC00202851], Flushing, MI
- (10) HASTINGS [USC00203661], Hastings, MI
- (11) FLINT BISHOP INTL AP [USW00014826], Flint, MI
- (12) COLDWATER ST SCHOOL [USC00201675], Coldwater, MI
- (13) EAST LANSING 4 S [USC00202395], Holt, MI
- (14) GULL LK BIOLOGICAL STN [USC00203504], Augusta, MI
- (15) HILLSDALE [USC00203823], Hillsdale, MI
- (16) GRAND RAPIDS [USW00094860], Grand Rapids, MI

- (17) PRAIRIE HEIGHTS [USC00127102], LaGrange, IN
- (18) ALMA [USC00200146], Alma, MI
- (19) HOWELL WWTP [USC00203947], Howell, MI
- (20) IONIA 2SSW [USC00204078], Ionia, MI
- (21) OWOSSO WWTP [USC00206300], Owosso, MI
- (22) JACKSON REYNOLDS FLD [USW00014833], Jackson, MI
- (23) LANSING CAPITAL CITY AP [USW00014836], Lansing, MI

Influencing water features

Ground water table is within 0 - 25 cm.

Soil features

Soils are poorly drained to very poorly drained loams and sands with moderate pH. They are commonly classified as Typic Endoaquolls, Typic Argiaquolls, and Mollic Psammaquents, and commonly mapped as Sebewa, Gilford, and Granby series.

Table 4. Representative soil features

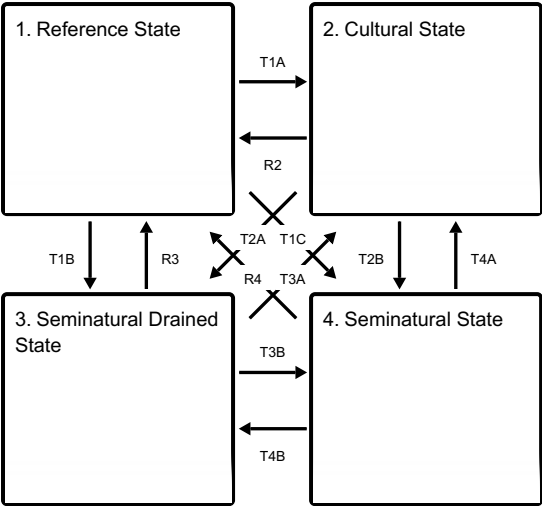
Parent material	(1) Glaciofluvial deposits
Surface texture	(1) Sand
Drainage class	Very poorly drained to poorly drained
Permeability class	Moderately rapid to rapid
Soil depth	79 in
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%
Available water capacity (0-39.4in)	1.57–3.94 in
Soil reaction (1:1 water) (0-19.7in)	5.5–7
Subsurface fragment volume <=3" (0-59.1in)	0–5%
Subsurface fragment volume >3" (0-59.1in)	0–1%

Ecological dynamics

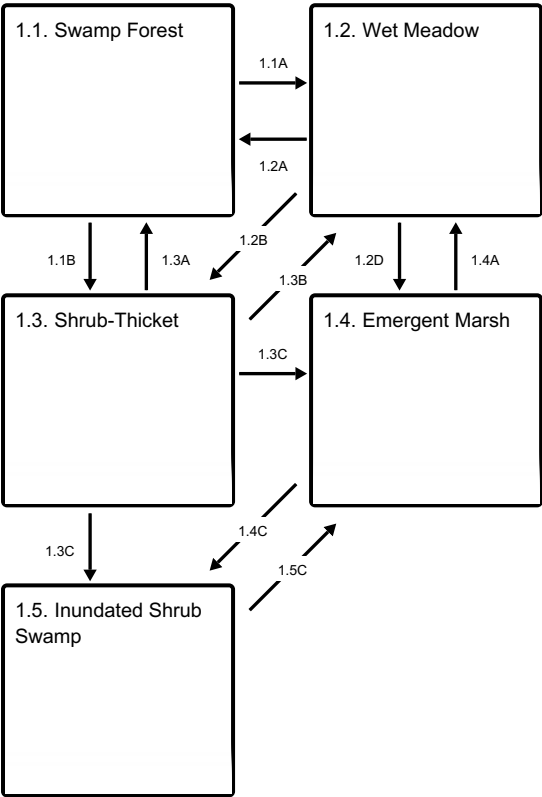
Fire was infrequent, allowing succession to fire sensitive species. Windthrow is a frequent disturbance due to shallow rooting in wet soils. Wet anoxic soils favor facultative and obligate wetland species. The moderate nutrient status and seasonal ponding water table supports green ash and red maple, and moderate diversity of other swamp species, and sedge meadows and marshes. The reference community is dominated by silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*), with open areas containing grasses like Canada blue-joint (*Calamagrostis canadensis*).

State and transition model

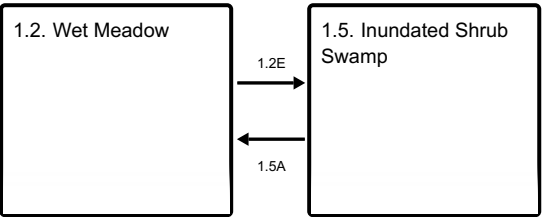
Ecosystem states



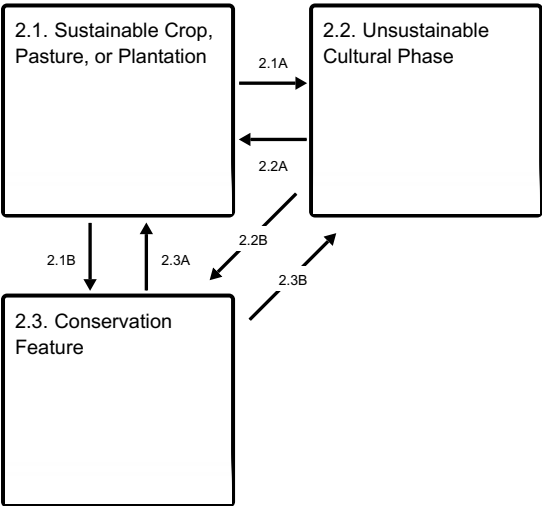
State 1 submodel, plant communities



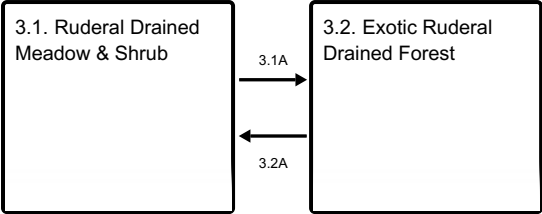
Communities 2 and 5 (additional pathways)



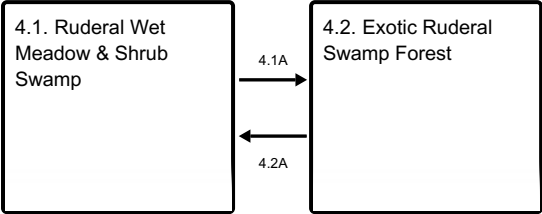
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 1
Reference State

The Reference State consists of a mosaic of swamp forest, shrub swamp, wet meadows, and marshes.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- bluejoint (*Calamagrostis canadensis*), grass

Community 1.1
Swamp Forest

Community 1.2
Wet Meadow

Community 1.3
Shrub-Thicket

Community 1.4
Emergent Marsh

Community 1.5
Inundated Shrub Swamp

Pathway 1.1A
Community 1.1 to 1.2

Temporary prolonged inundation.

Pathway 1.1B
Community 1.1 to 1.3

Clearcut/Blowdown.

Conservation practices

Early Successional Habitat Development/Management
Forest Stand Improvement

Pathway 1.2A
Community 1.2 to 1.1

Succession.

Conservation practices

Tree/Shrub Site Preparation
Tree/Shrub Establishment

Pathway 1.2B
Community 1.2 to 1.3

Succession.

Conservation practices

Tree/Shrub Site Preparation
Tree/Shrub Establishment

Pathway 1.2D
Community 1.2 to 1.4

Permanent inundation.

Pathway 1.2E
Community 1.2 to 1.5

Shrub establishment; permanent inundation.

Conservation practices

Tree/Shrub Establishment

Pathway 1.3A
Community 1.3 to 1.1

Succession.

Conservation practices

Tree/Shrub Site Preparation
Tree/Shrub Establishment

Pathway 1.3B
Community 1.3 to 1.2

Temporary prolonged inundation.

Pathway 1.3C
Community 1.3 to 1.4

Permanent inundation.

Pathway 1.3C

Community 1.3 to 1.5

Permanent inundation.

Pathway 1.4A

Community 1.4 to 1.2

Drop water table.

Pathway 1.4C

Community 1.4 to 1.5

Temporary drop water table; shrub establishment.

Pathway 1.5A

Community 1.5 to 1.2

Drop water table; shrub mortality.

Conservation practices

Brush Management

Pathway 1.5C

Community 1.5 to 1.4

Temporary drought; shrub mortality.

State 2

Cultural State

[Alternative States to be developed; refer to component communities.]

Community 2.1

Sustainable Crop, Pasture, or Plantation

Community 2.2

Unsustainable Cultural Phase

Community 2.3

Conservation Feature

Can be a grassed waterway, conservation reserve, a small patch pollinator garden, or other land taken out of its primary cultural production to mitigate or reduce impacts of adjacent land use, and is not by itself a permanent restoration of a complete native biological community and associated ecosystem services.

Pathway 2.1A

Community 2.1 to 2.2

Revert to unsustainable cultural practices.

Pathway 2.1B

Community 2.1 to 2.3

Establish conservation feature.

Conservation practices

Conservation Cover
Grassed Waterway

Pathway 2.2A
Community 2.2 to 2.1

Implement sustainable cultural practices.

Conservation practices

Conservation Crop Rotation
Cover Crop
Nutrient Management
Integrated Pest Management (IPM)

Pathway 2.2B
Community 2.2 to 2.3

Establish conservation feature.

Conservation practices

Conservation Cover
Grassed Waterway

Pathway 2.3A
Community 2.3 to 2.1

Implement sustainable cultural practices.

Conservation practices

Conservation Crop Rotation
Cover Crop
Nutrient Management
Integrated Pest Management (IPM)

Pathway 2.3B
Community 2.3 to 2.2

Revert to unsustainable cultural practices.

State 3
Seminatural Drained State

[Alternative States to be developed; refer to component communities.]

Community 3.1
Ruderal Drained Meadow & Shrub

Community 3.2
Exotic Ruderal Drained Forest

Pathway 3.1A
Community 3.1 to 3.2

Succession

Pathway 3.2A
Community 3.2 to 3.1

Blowdown/clearcut.

Conservation practices

Early Successional Habitat Development/Management
Forest Stand Improvement

State 4
Seminatural State

[Alternative States to be developed; refer to component communities.]

Community 4.1
Ruderal Wet Meadow & Shrub Swamp

Community 4.2
Exotic Ruderal Swamp Forest

Pathway 4.1A
Community 4.1 to 4.2

Succession.

Pathway 4.2A
Community 4.2 to 4.1

Blowdown/clearcut.

Conservation practices

Early Successional Habitat Development/Management
Forest Stand Improvement

Transition T1A
State 1 to 2

Drain; clear vegetation; cultivate domesticated species.

Transition T1B
State 1 to 3

Drain; clear vegetation, invasive species introduced.

Transition T1C
State 1 to 4

Clear vegetation, invasive species introduced.

Restoration pathway R2

State 2 to 1

Restore hydrology; remove domesticated species; restore native species.

Conservation practices

Brush Management
Restoration and Management of Rare and Declining Habitats
Wetland Wildlife Habitat Management
Wetland Restoration
Herbaceous Weed Control

Transition T2A

State 2 to 3

Abandon, succession.

Transition T2B

State 2 to 4

Restore hydrology; abandon; succession.

Conservation practices

Wetland Restoration

Restoration pathway R3

State 3 to 1

Restore hydrology; control invasive species; restore native species

Conservation practices

Brush Management
Restoration and Management of Rare and Declining Habitats
Wetland Wildlife Habitat Management
Wetland Restoration
Herbaceous Weed Control

Transition T3A

State 3 to 2

Clear vegetation; cultivate domesticated species.

Transition T3B

State 3 to 4

Restore hydrology.

Conservation practices

Wetland Restoration

Restoration pathway R4

State 4 to 1

Control invasive species; restore native species.

Conservation practices

Brush Management
Restoration and Management of Rare and Declining Habitats
Wetland Wildlife Habitat Management
Herbaceous Weed Control

Transition T4A

State 4 to 2

Drain; clear vegetation; cultivate domesticated species.

Transition T4B

State 4 to 3

Drain.

Additional community tables

Inventory data references

Site Development and Testing Plan

Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

Other references

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U.S. Department of the Interior, Geological Survey, 2011. LANDFIRE: LANDFIRE 1.1.0 Existing Vegetation Type layer. <http://landfire.cr.usgs.gov/viewer/>

Contributors

Greg Schmidt

Approval

Nels Barrett, 1/12/2024

Acknowledgments

Matt Bromley and Andy Henriksen reviewed the narratives. Matt Bromley reviewed associated soil map units.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/11/2025
Approved by	Nels Barrett
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills:

2. Presence of water flow patterns:

3. Number and height of erosional pedestals or terracettes:

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**
-
5. **Number of gullies and erosion associated with gullies:**
-
6. **Extent of wind scoured, blowouts and/or depositional areas:**
-
7. **Amount of litter movement (describe size and distance expected to travel):**
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**
-
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant:
- Sub-dominant:
- Other:
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
-
14. **Average percent litter cover (%) and depth (in):**
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

-
16. **Potential invasive (including noxious) species (native and non-native).** List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:
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17. **Perennial plant reproductive capability:**
-