United States Department of Agriculture

LOAMY UPLAND DRAINAGEWAY WOODLAND

Provisional Ecological Site Description

An ecological site description (ESD) at the provisional status represents the lowest tier of documentation that is releasable to the public. The ESD contains a grouping of units based on site scale, soils, and ecology within a major land resource area that respond similarly to ecological processes. It has 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state-and-transition model capturing the ecological processes, vegetative states, and plant communities as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. However, little, if any, field level data have been collected. It is expected that the provisional ESD will continue to be refined towards an approved status.

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General Information

Ecological Site Name:

Abiotic: Loamy Upland Drainageway Woodland

Biotic: *Quercus alba – Carya ovata / Carex pensylvanica*

Ecological Site ID: F108DY851IA

Hierarchical Framework Relationships:

Major Land Resource Area (MLRA): Illinois and Iowa Deep Loess and Drift, Western Part (108D)

USFS Subregions: Central Dissected Till Plains Section (251C); Loess Hills (251Cb) and Central Dissected Till and Loess Plain (251Cc) Subsections (Cleland et al, 2007)

Relationship to Other Established Classifications:

NatureServe Classification: Ecological System: North-Central Interior Dry-Mesic Oak Forest and Woodland (4116); Ecological Association: Central Midwest White Oak Mixed Oak Woodland (NatureServe, 2013)

Landfire Biophysical Setting: Central Tallgrass Prairie (4314210) (Landfire, 2009)

MLRA Notes:

The Illinois and Iowa Deep Loess and Drift, Western Part MLRA covers parts of both Iowa and Missouri and is known locally as part of the Southern Iowa Drift Plain. A silty loess deposit of varying thickness (5 to 20 feet) covers a series of glacial advances known collectively as pre-Illinoisan till. This till, deposited more than half a million years ago, was subjected to multiple instances of extreme erosion as well as periods of subdued erosion and intense weathering. The loess is thickest in the western part of the MLRA and generally thins eastward. In some areas, the loess has been removed and the older weathered till, called a "paleosol," entirely exposed. These highly weathered soils, or paleosols, have a high content of clay, which slows the downward movement of water through the profile and causes water to move laterally instead of vertically. Wet areas, or "side-hill seeps," commonly form where these paleosols become exposed along hillsides (Prior, 1991).

The dominant soil orders in this MLRA are Mollisols and Alfisols and, to a lesser extent, Entisols and Inceptisols. Most of the soils are Udolls or Udalfs. Aquolls are on the flatter interfluves. The soils in the area dominantly have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. They generally are very deep, well drained to poorly drained, and silty, loamy, or clayey. These soils on uplands include somewhat poorly drained, nearly level Argiudolls (Macksburg series); moderately well drained, gently sloping to strongly sloping Argiudolls (Sharpsburg series); poorly drained, nearly level Argiaquolls (Winterset series); and well drained strongly, sloping to steep Hapludalfs (Gara, Lindley, Ladoga, and Armstrong series) (USDA-NRCS, 2006).

The western part of the Illinois and Iowa Deep Loess and Drift is a segment of three other MLRAs within the Central Feed Grains and Livestock Region. The other areas are: the West-Central part (108C), the East-Central part (108B) and the Eastern part (108A).

Ecological Site Concept:

Loamy Upland Drainageway Woodlands are within the red areas on the map (Figure 1). These sites formed in local alluvium parent material and can be found in drainageways on uplands. Typically these sites are located down slope from wet upland drainageway prairie ecological sites. Soils are typically Entisols, characterized by thin surface horizons and variable organic matter due flooding, and multiple alluvial deposits. These sites have no rooting restrictions. Plant communities consist of trees, forbs, and grasses.

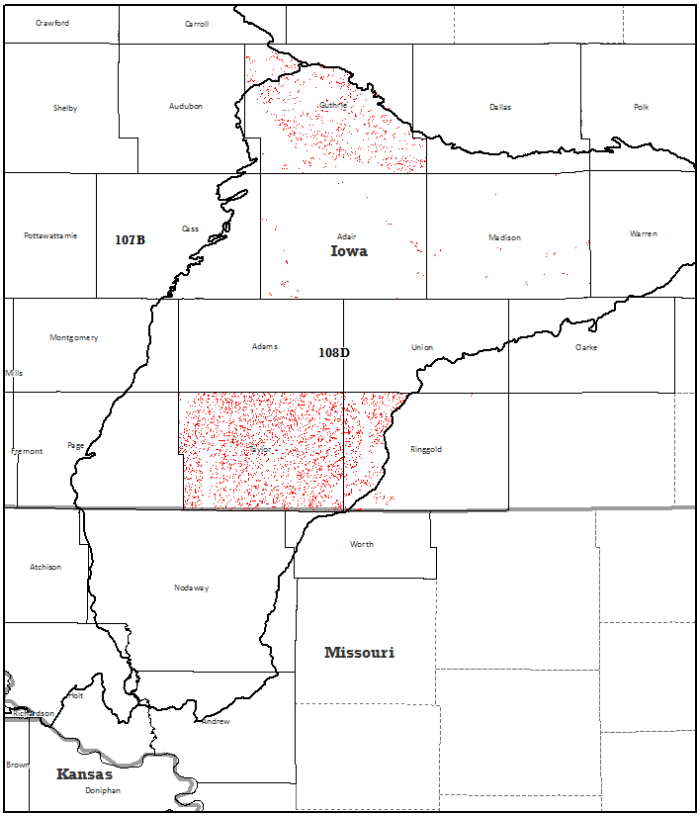


Figure 1. Distribution of Loamy Upland Drainageway Woodlands within MLRA 108D

Physiographic Features

Loamy Upland Drainageway Woodlands are of moderate extent, and can be found on drainageways in uplands throughout MLRA 108D. These sites are within a dissected till plain landscape. Slopes are generally less than 3 percent. These sites typically occur in upland drainageways where soil deposits from upslope wet upland drainageway prairies have accumulated.

Table 1. Physiographic features of Loamy Upland Drainageway Woodlands.
(Data from the National Soil Information System.)

	Minimum	Maximum
Elevation (ft.)	499	1401
Slope (percent)	0	3
Water Table Depth (in.)	48	78
Flooding	none	occasional
Ponding	none	none

Landforms: drainageways
Hillslope Positions: footslopes
Slope Shape: concave across slope and linear up/downslope

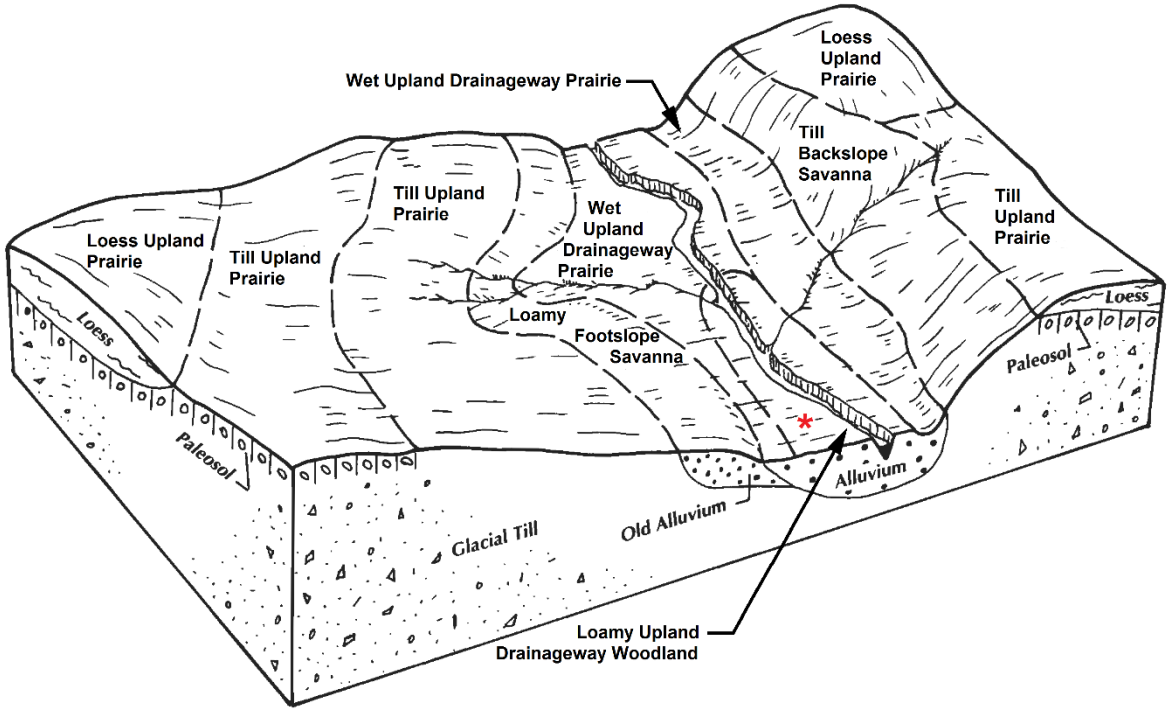


Figure 2. Block diagrams representing typical soil-landform sequences in Glacial Till Side/Footslopes. Red asterisk identifies soil component correlated to Loamy Upland Drainageway Woodland.

Climatic Features

The soil temperature regime of MLRA 108D is classified as “mesic” where the mean annual soil temperature is between 46 and 59°F (Soil Survey Staff, 2014). The average freeze-free period of this ecological site is about 175 days, while the frost-free period is about 148 days (Table 2). Average annual precipitation is 33 inches, which includes rainfall plus the water equivalent from snowfall (Table 3). The average annual low and high temperatures are 38 and 61°F, respectively. Climate data and analyses are derived from 30-year averages gathered from four National Oceanic and Atmospheric Administration (NOAA) weather stations contained within the range of this ecological site (Table 4).

Table 2. Frost-free and freeze-free days.
(Data from NOAA weather stations within the range of this ecological site, using 30-year averages.)

	Average days
Frost-free period (32.5°F or greater, 90% probability)	148
Freeze-free period (Less than 28.5 °F, 90% probability)	175

Table 3. Monthly and annual precipitation and temperature in the range of Loamy Upland Drainageway Woodlands.
(Data from NOAA weather stations within the range of this ecological site, using 30-year averages.)

Monthly Moisture (Inches) and Temperature (°F) Distribution

	----------Precipitation----------			----------Temperature----------	
	Low	**Med**	**High**	**Average Low**	**Average High**
January	0.44	0.75	1.15	11.6	31.6
February	0.59	1.10	1.47	15.8	36.5
March	1.06	2.11	3.35	26.6	49.1
April	1.96	3.26	4.68	37.9	62.4
May	3.32	4.83	6.31	49.4	72.3
June	2.86	4.37	6.50	59.2	81.5
July	2.72	4.46	6.29	63.9	85.4
August	1.92	3.43	5.20	61.5	83.7
September	1.74	2.90	4.84	51.9	76.7
October	1.31	2.38	3.68	39.9	64.3
November	1.17	2.00	2.84	27.7	48.5
December	0.62	1.13	1.84	15.4	34.2
Annual	-	32.72	-	38.4	60.5

Table 4. NOAA climate stations used for data analysis, located within the range of this ecological site.

Climate Station ID	Location (County)	From	To
BEDFORD [USC00130576]	Taylor (IA), 50833	1981	2010
GREENFIELD [USC00133438]	Adair (IA), 50849	1981	2010
GUTHRIE CTR [USC00133509]	Guthrie (IA), 50115	1981	2010
WINTERSET 2NNW [USC00139132]	Madison (IA), 50273	1981	2010

Influencing Water Features

This site is moderately well drained. Permeability is moderate. The soil at this site is in hydrologic group B (Hydrologic Soil Group, 2016). Land capability class is either 2w or 5w (Land Capability Class, 2016). Depth of endosaturation occurs from 4 to greater than 6.5 feet. This ecological site contains first-order streams, which originate from headslope positions at the upper reaches of the units, and are fed from smaller headslopes in the adjacent uplands. The lower reaches of units often contain second-order streams. These streams are ephemeral in most years, with flow in the late fall, winter, and spring months, generally disappearing in the summer, or reduced to isolated pools in the lower reaches. Stream levels typically respond quickly to storm events, especially in watersheds where surface runoff is dominant. Short-duration flooding is common in many areas. Streambeds are typically incised into the surrounding floodplain by as much as 10 feet.

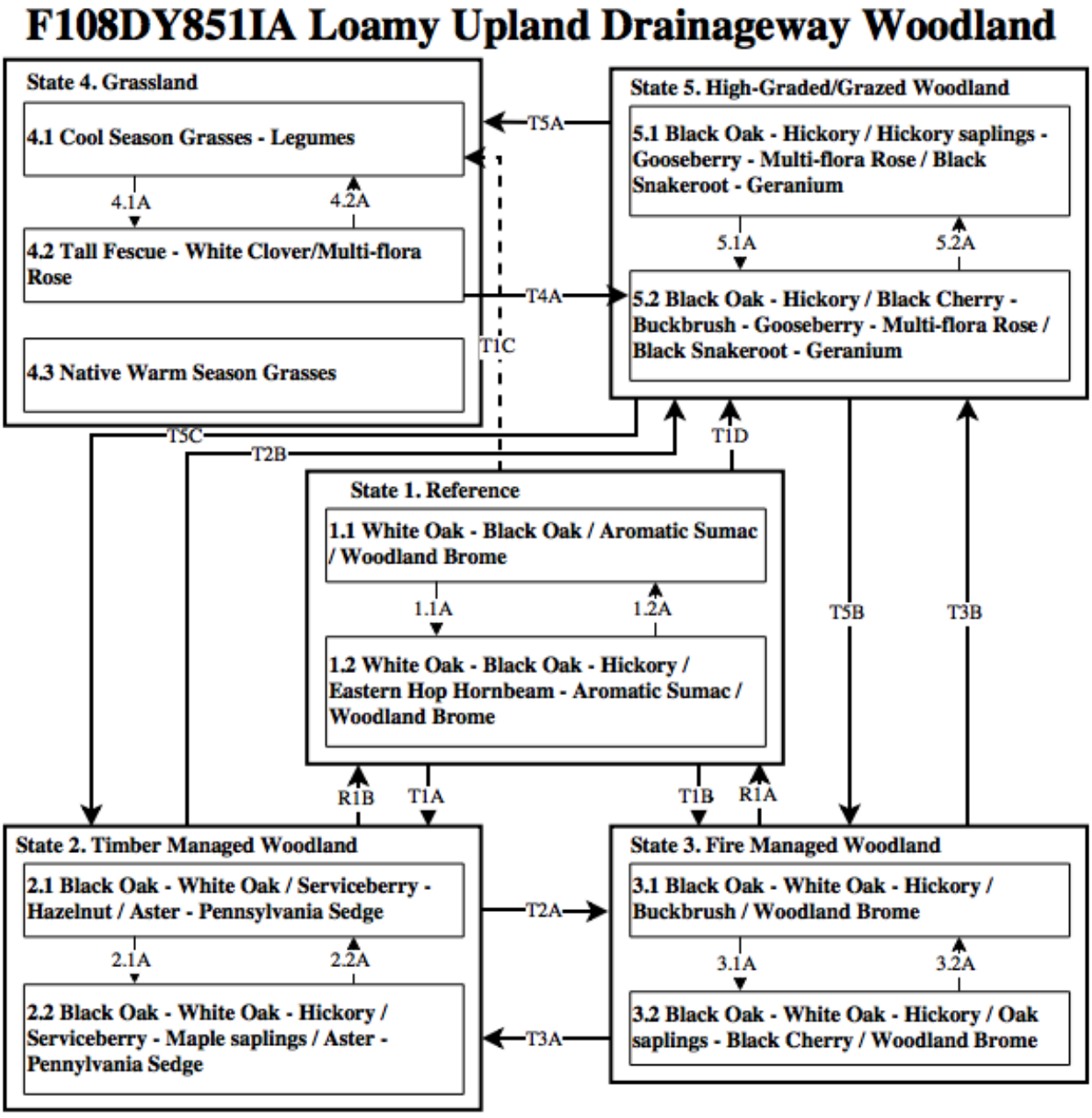
Representative Soil Features

These soils have no major rooting restriction. The soils were formed under woodland vegetation, and have thin surface horizons. The soils have silt loam surface horizons (Table 5). Subsoils are silt loam or silty clay loam. Soil series associated with this site include Nodaway.

Table 5. Representative soil features of Loamy Upland Drainageway Woodland.
(Data from the National Soil Information System.)

	Minimum	Maximum
Surface Fragments less than 3" (percent cover)	0	0
Surface Fragments greater than 3" (percent cover)	0	0
Subsurface Fragments less than 3" (percent volume)	0	0
Subsurface Fragments greater than 3" (percent volume)	0	0
Drainage Class	Moderately Well	Moderately Well
Permeability Class (most limiting layer)	Moderate	Moderate
Soil Depth	80	80+
Soil Reaction/pH (1:1 water)	6.0	6.5
Available Water Capacity (inches in 60")	8.4	8.4
Calcium carbonate equivalent	0	0
Parent Material – Kind: local alluvium		
Surface Texture: silt loam		
Surface Texture Modifier: none		
Subsurface Group: fine-silty		
Soil Series: Nodaway		

States and Community Phases



Code	Process	Code	Process
T1A	Fire Suppression; forest timber management	1.1A	No disturbance (10+ years)
T1B	Perscribed burning; forest stand improvement	1.2A	Disturbance (fire, wind, ice) < 10 years
T1C, T5A	Clearing; pasture planting; grassland management	2.1A	No activity; idle
T1D, T2B, T3B	High-grading harvesting; uncontrolled grazing	2.2A	Forest timber management
T2A	Prescribed fire; thinning	3.1A	No activity; idle; fire suppression
T3A	Fire suppression; forest timber management	3.2A	Prescribed fire; selective thinning
T4A	Long-term succession; no grazing	4.1A	Over grazing; no management
T5B	Forest stand improvement; no grazing; prescribed burning	4.2A	Brush management; grassland seeding; grassland management
T5C	Forest stand improvement; no grazing; thinning	5.1A	No activity; idle
R1A	Extended rotations; selective thinning	5.2A	High-grading; uncontrolled grazing
R1B	Prescribed fire; extended rotations; selective thinning		

Figure 3. State-and-transition diagram for Loamy Upland Drainageway Woodland provisional ecological site.

Ecological Dynamics

Reference plant community is categorized as a dry/mesic oak woodland and includes trees, grasses, and forbs. Species composition typically includes *Quercus alba*, *Carya ovata*, *Andropogon gerardii* and *Carex pensylvanica*.

Fire, windstorms, ice storms and grazing, are all disturbances influencing the dynamics at this site. Disturbances at these sites likely occurred every 10 years. The most common fires were surface fires which were fast moving and moderate to high intensity. Native Americans contributed to the majority of ignitions, though a limited amount of lightning strike ignitions were also responsible. Wind and ice storm damage contributed to increased canopy openings and light penetration. Grazing, from elk and bison was minimal (Mutel, 2008).

STATE 1 – REFERENCE STATE

This state is a mesic oak woodland. As such, this has a reference plant community which includes trees, grasses and forbs.

Community Phase 1.1 White Oak – Black Oak / Aromatic Sumac / Woodland Brome -- Species composition of this phase includes *Quercus alba*, *Carya ovata*, *Carya tomentosa*, *Carya ovalis*, *Quercus rubra*, *Quercus velutina*, *Andropogon gerardii*, *Elymus virginicus*, *Elymus hystrix*, *Festuca subverticillata*, *Carex pensylvanica*, *Amphicarpaea bracteata*, *Asclepias purpurascens*, *Helianthus strumosus*, *Penstemon digitalis*, *Sanicula Canadensis*, *Sanicula odorata*, *Solidago ulmifolia*, and *Veronicastrum virginicum*. Canopy cover is between 21 and 60 percent. Periods of no disturbance greater than 10 years will cause a shift to phase 1.2 (Figure 3). If disturbance frequency becomes more often than every 10 years, phase 1.2 will shift back to this phase.

Community Phase 1.2 White Oak – Black Oak – Hickory / Eastern Hop Hornbeam – Aromatic Sumac / Woodland Brome – This phase forms as a result of periods of no disturbance greater than 10 years. If disturbance frequency becomes more often than every 10 years, this phase will shift back to phase 1.1.

STATE 2 – TIMBER MANAGED STATE

The reference state will transition to this state phase due to fire suppression and timber management. A restoration path is also possible to the reference state by proper prescribed fire, extended rotations and selective thinning. The timber managed state can transition to either a high graded / grazed woodland state or to a fire managed woodland state. The high graded / grazed woodland state is formed by high-grading harvesting and uncontrolled grazing. In order to return to the timber managed state, thinning, forest stand improvement and ceasing grazing are required. The fire managed woodland is formed by prescribed fire and thinning and can return to the timber managed state by fire suppression and forest timber management.

Community Phase 2.1 Black Oak – White Oak / Serviceberry – Hazelnut / Aster – Pennsylvania Sedge – Forest timber management is required to maintain this phase. If this phase remains idle, hickory and maple saplings become more prevalent and the phase becomes phase 2.2.

Community Phase 2.2 Black Oak – White Oak – Hickory / Serviceberry – Maple saplings / Aster – Pennsylvania sedge -- This phase is a result of phase 2.1 if it remains idle. Hickory and maple saplings have become more prevalent. It can be reversed back to phase 2.1 through forest timber management

STATE 3 – FIRE MANAGED WOODLAND STATE

This state has three other possible states it can change to, the timber managed woodland, the high-graded / grazed woodland and restoration to the reference state. Restoration requires extended rotations and selective thinning. Transitioning to the timber managed woodland requires fire suppression and forest timber management. High-grading harvesting and uncontrolled grazing will cause a transition to the high-graded / grazed woodland state.

Community Phase 3.1 black oak – white oak – hickory / buckbrush / woodland brome -- A lack of activity, remaining idle and fire suppression will cause a shift from phase 3.1 to 3.2. Conversely, prescribed fire and selective thinning will reverse this transition.

Community Phase 3.2 black oak – white oak – hickory / Oak saplings – black cherry / woodland brome – This phase is a result of lack of activity, remaining idle and fire suppression on phase 3.1. Prescribed fire and selective thinning will reverse this transition back to phase 3.1.

STATE 4 – GRASSLAND STATE

The grassland state has only one possible transition, which is directly from the tall fescue – white clover / multi-flora rose phase to the black oak – hickory / black cherry – buckbrush – gooseberry – multi-flora rose / black snakeroot – geranium phase of the high-graded / grazed woodland state. Two possible transitions to this state are from the reference state and the high-graded / grazed woodland state. Transitioning from the high-graded / grazed woodland state requires clearing, pasture planting and grassland management.

Community Phase 4.1 cool season grasses – legumes -- The reference state can transition directly to this phase of the grassland state with the following processes, clearing, pasture planting, and grassland management. The cool season grasses – legumes phase can transition to phase 4.2 without proper management and overgrazing. Phase 4.2 can transition back to the cool season grasses – legumes phase with proper grassland management, including managing brush and grassland seeding.

Community Phase 4.2 tall fescue – white clover / multi-flora rose – This phase can transition to the cool season grasses – legumes phase with proper grassland management, including managing brush and grassland seeding. Without proper management and overgrazing the cool season grasses – legumes phase will transition back to phase 4.2.

Community Phase 4.3 native warm season grasses -- In some instances, this state has been converted to native warm season grasses, primarily big bluestem, switchgrass, and Indian grass or

pure stands of single species. These sites are typically converted through a federal cost share program such as the Conservation Reserve Program (CRP) or the Environmental Quality Incentives Program (EQIP). Some sites are associated with an active rotational grazing system.

STATE 5 – HIGH-GRADED/GRAZED WOODLAND STATE

This state can transition to three other possible states, the grassland state, the timber managed woodland state, and the fire managed woodland state. A transition to the grassland state requires clearing, pasture planting, and grassland management. The timber managed woodland state can be formed by forest stand improvement ceasing grazing, and thinning. Transitioning to the fire managed woodland state also requires forest stand improvement and a ceasing of grazing, but will require prescribed burning as well.

Community Phase 5.1 black oak – hickory / hickory saplings – gooseberry – multi-flora rose / black snakeroot – geranium phase --This phase can transition to phase 5.2 due to no activity and remaining idle. Reversing this transition requires high-grading and uncontrolled grazing.

Community Phase 5.2 the black oak - hickory / black cherry – buckbrush – gooseberry – multi-flora rose / black snakeroot – geranium -- This phase can transition to phase 5.1 due to high-grading and uncontrolled grazing. Reversing this transition requires no activity and remaining idle (Woodland Health, 2004).

Supporting Information

Associated Ecological Sites:

Ecol. Site Name	Site ID	Narrative
Wet Upland Drainageway Prairie	R108DY824IA	Fine and fine-silty soils, including Ackmore, Colo, Vesser and Zook.
Loamy Footslope Savanna	R108DY841IA	Fine-loamy and fine-silty textured soils including Arbor, Ely, Judson and Olmitz series.

Similar Ecological Sites:

Ecol. Site Name	Site ID	Narrative
Loamy Upland Drainageway Prairie	R108DY821IA	Fine-silty soil including the Kennebec series.
Wet Upland Drainageway Prairie	R108DY824IA	Fine and fine-silty soils, including Ackmore, Colo, Vesser and Zook.

Ecological Site Correlation Issues and Questions:

- Plant composition within reference state and alternative states is not yet well documented
- This unit is not a common mapping of the Nodaway series, most of Nodaway is mapped in floodplains.

- Loamy Upland Drainageway Prairie and Loamy Upland Drainageway Woodland need significant evidence to prove they are in fact separate ESDs.

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