10130

Western Great Plains Dry Bur Oak Forest and Woodland

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Forest and Woodland

Map Zones

31, 38, 39, 40

Geographic Range

This system is found in map zones (MZs) 31, 38, 39, and 40. It's not that common but interspersed throughout each. Bur oak occurs throughout the eastern half of MZ31 in a range of suitable sites. It would occur in all of MZ31 ECOMAP subsections except for 332Cd, 331Fn, 331Fk, 331Fj, and 331fb. Bur oak woodland systems are fairly common along the Missouri River bluffs and within the prairie pothole region (eastern South Dakota) as well as along the Niobrara. It is found along the Niobrara River and tributaries (especially in northeastern Nebraska). In MZ39, it occurred in ECOMAP subsections 332Bd, Be, De, Dd, Df, Dg and 251Ba, Bb, Bd, Bf, Ga, and Ha. In MZ40, it would have also occurred in ECOMAP subsection 251Aa and maybe others.

This system is found in the northern part of the Great Plains. Bur oak occurs in McKenzie County, ND, principally the Blue Buttes and the northeast corner of the county in addition to the Killdeer Mtns. Bur oak woodlands/forests are found in the Pembina Hills of northeastern North Dakota. The Turtle Mountain area also would have bur oak stands as would some areas in the southcentral portion of the state. In South Dakota, stands will occur in the Badlands and along natural fire breaks, as well as along river breaks, including the White and Missouri river breaks (Dave Ode, personal communication) and within the rugged terrain of the Prairie Coteau in eastern South Dakota and southwestern Minnesota. In Nebraska, the system is found in the Pine Ridge and along the Niobrara River and tributaries as well as in northeastern Nebraska along the Missouri River bluffs.

Biophysical Site Description

This system occurs on soils ranging from eolian sands, loess, coarse alluvial floodplain deposits, and heavy, fine-textured valley soils, with dry to mesic moisture.

Moving westward in the zone, bur oak is increasingly restricted to favorable microsites, such as wooded draws, riparian areas, and other sites receiving extra moisture. However, in drier sites, dwarfed individuals can exist at low densities, e.g., on upper canyon slopes.

Bur oak is well adapted to growth on moist, rich bottomlands with sufficient, but not excessive, amounts of water. It grows in areas receiving 15-40in annual precipitation but does best where maximum annual precipitation averages 30-40in (Tirmenstein 1988).

The species is unusually plastic, varying directly in tree size and density with increasing moisture and other favorable factors such as soil and landscape position. Mature trees can range from very large to stunted shrubs of ~1m height. Density can range from >100 stems/acre with closed canopy to more savanna like densities of a few/acre.

This system is found in upland areas throughout the northern part of the Western Great Plains. Soils are predominately dry to mesic.

*Quercus macrocarpa/Prunus virginiana* habitat type forms relatively extensive communities on backslopes of intermittent streams and drainageways. This habitat type was limited to glaciated areas. The *Populus tremuloides/Quercus macrocarpa* community type occupied erosive slopes. Once these areas become stabiliized, the *Quercus macrocarpa/Prunus virginiana* habitat type will probably result because *Quercus macrocarpa* reproduces in the understory. The *Quercus macrocarpa/Corylus* species habitat type is found in the Killdeer Mountains and adjacent areas. This habitat type is on gentle slopes, and the soils are more leached than many of the other types. The *Betula papyrifera/Corylus cornuta* community type occupies similar sites and is seral to *Quercus macrocarpa/Corylus* species habitat type (Girard et al. 1989)

Vegetation Description

Bur oak is the only hardwood tree species able to survive frequent fire in more arid part of the zone. In more mesic and other areas of lower fire frequency, other woody species can include American elm, green ash, common hackberry, black walnut, American Linden (basswood), and eastern hophornbeam (ironwood). Ground story vegetation is reduced with increasing canopy density. At low density, herbaceous vegetation may be nearly identical with surrounding prairies. At higher densities, cool-season herbs become more dominate, including wild ryes and bluegrasses.

Associated shrubs can include plums, currents, grape, chokecherry, rhus species, and poison ivy.

This system is typified by the predominance of *Quercus macrocarpa* constituting at least 10% of the vegetation cover in any given example of this system. Other species, such as *Tilia americana*, *Juniperus virginiana*, and *Fraxinus* spp., may be also present. Understory vegetation can range from sparsely vegetated to more dense and usually exemplifies the surrounding prairie grassland vegetation (NatureServe 2006).

Bur oak is the indicator species. In MZ31, other tree species would have been mostly absent under historical conditions. Shrubs named are merely grassland species that would co-occur.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| QUMA2 | *Quercus macrocarpa* | Bur oak |
| PRVI | *Prunus virginiana* | Chokecherry |
| TIAM | *Tilia americana* | American basswood |
| PRUNU | *Prunus* | Plum |

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

This system is primarily driven by fire. Bur oak sprouts vigorously after fire or other disturbance. It sprouts prolifically from the root crown when the main stem is damaged; however, stump sprouting has also been well documented (in Tirmenstein 1988). Bur oak bark is thick and fire-resistant. Larger trees often survive fire (Wasser 1982 in Tirmenstein 1988).

Without fire, seedlings of bur oak are unable to compete with other, more shade-tolerant species (Reichman 1987 in Tirmenstein 1988). Bur oak could grow to a large size after fire because of its competitive advantage.

In the northern Black Hills, there is a separate bur oak type with a long mean fire return interval.

In some of the woody draws, there is bur oak. Since it is fire-tolerant, a strong sprouter, and shade-intolerant, bur oak will be enhanced by stand-replacing fire in times with higher moisture.

*Fraxinus pennsylvanica* is even more fire-tolerant than bur oak -- so it would sprout up too after high-intensity fire. Periods with more fires -- bur oak dominates. Without fire -- elm and ash dominate.

There were frequent low-severity fires (or mixed-severity). Less frequent stand-replacement fires were generally associated with periods of exceptionally high moisture conditions immediately followed by severe dry conditions.

Such woodlands do not react as a fuel complex due to their lower density and substantial fire resistance. When fire occurs and affects, it happens on the individual tree level, not the stand level.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 300 | 6 |  |  |
| Moderate (Mixed) | 44 | 38 |  |  |
| Low (Surface) | 30 | 56 |  |  |
| All Fires | 17 | 100 |  |  |

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

This system is usually comprised of smaller patches (1-50ac) as confined by microsite conditions. However, fires were likely from the surrounding grassland systems, so they were part of a larger fire.

Adjacency or Identification Concerns

In the eastern portion of the zone, other trees species may outnumber bur oaks. These drop out moving westward. Thus, setting exact system boundaries may be subjective.

This Biophysical Setting (BpS) grades into more diverse woodlands eastward. The increase of fire-intolerant species such as ash and hackberry would give the appearance of a denser, more diverse woodland than the historical setting.

This bur oak system is confined to microsites but would grade into adjacent prairie types or in the east to denser, more diverse hardwood woodlands.

Stands of bur oak can also be included within Central Mixedgrass Prairie (CES303.659); however, that system would only include small patches or single trees protected from fire. Any stands of bur oak or more substantial woodlands should be included within this system.

Similar systems include hardwood draws throughout this system's range. In the eastern portion (subsection 251B) of these MZs, stands of this system can become more diverse and similar to North-Central Interior Dry-Mesic Oak Forest and Woodland or North-Central Interior Oak Savanna.

Fire suppression within this system can lead to more closed canopies including more fire-intolerant species such as green ash and hackberry and a decrease in the cover of herbaceous grass species in the understory. Grazing, conversion to agriculture, and past timber harvesting can impact this system. Overgrazing can also lead to a decrease in understory species, and timber harvesting can completely eliminate examples of this system.

This system today is probably denser where not cut. Typically, when you burn through this for the first time after decades of fire suppression, there is considerable mortality of mature oaks due to ignition of dead, decadent material that would have burned less intensely with more frequent surface fires. Currently, fire is absent from the system, so when it does burn, it tends to burn all at once.

Bur oak communities may be replaced by oak-basswood or more shade-tolerant oaks (white and red) in the absence of fire in eastern South Dakota.

Typically, the system also is heavily affected currently by cattle grazing, which nearly eliminates reproduction, reduces shrub understory, and alters herbaceous community to exotic cool-season grasses, bluegrass, and smooth brome. Further, stands include fire-intolerant invading species such as ash and hackberry. In the worst cases, it is completely engulfed by eastern red cedar thickets, with eventual loss of oaks expected due to shading.

The exotics or invasives are primarily in the understory. Siberian elm could also be a component in some localized sites. Eastern red cedar also functions as a weed in this system.

In the worst case, cedar forest can completely swallow the oaks which become invisible. Clearcutting cedar reveals dwarfed, dying oaks.

Issues or Problems

Native Uncharacteristic Conditions

Stands are likely more dense today than was the case historically.

Comments

Succession Classes

**Mapping Rules**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Upper Layer Lifeform** | **Height (m)** | **Canopy Cover (%)** | | | | | | | | | |
| **0-10** | **11-20** | **21-30** | **31-40** | **41 - 50** | **51-60** | **61-70** | **71-80** | **81-90** | **91-100** |
| Herb | 0-0.5 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0-0.5 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | A | A | A | UN | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | C | C | C | C | B | B | B | B | D | D |
| Tree | 10-25 | C | C | C | C | B | B | B | B | D | D |
| Tree | 25-50 | C | C | C | C | B | B | B | B | D | D |
| Tree | >50 | C | C | C | C | B | B | B | B | D | D |

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

**Description**

Class A 18 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUMA2 | Quercus macrocarpa | Bur oak | Upper |
| ANGE | Andropogon gerardii | Big bluestem | Lower |
| HESP11 | Hesperostipa spartea | Porcupinegrass | Lower |
| CAREX | Carex | Sedge | Lower |

Description

New stands develop primarily when acorns are buried by rodents (fox squirrels) in short grassland near existing trees. During this stage, trees are the tallest plants, but grasses remain dominant and not yet suppressed or altered in species composition by effects from seedling/ sapling trees. Short-statured grasslands are required to allow access by squirrels and probably to reduce fire frequency/severity during the more vulnerable seedling and sapling stages. This process probably is independent of eventual tree size and density. Class A can also result from stand-replacing fire or severe weather events.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Class B 17 Late Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUMA2 | Quercus macrocarpa | Bur oak | None |

Description

This is a relatively stable state, independent of eventual tree size and density. These young stands can be thinned by fire, drought, or storms.

*Maximum Tree Size Class*  
Very Large >33" DBH

Class C 35 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUMA2 | Quercus macrocarpa | Bur oak | None |

Description

This is a thinned, older stand. Creation of these lower-density stands is due to unusual conditions of drought, storm, or fire severity. Lower density may persist for decades or longer when more stable conditions return. Stand differs from local starting Class B condition in having fewer younger trees and so a higher proportion of older, larger trees. This is due to thinning from Class B. Older, larger trees can become decadent, suffer damage from drought, storms, etc., and accumulate. It’s this stage that results.

Due to mixed-severity fires from Class B, stands in Class C will be uneven aged but predominantly older, larger trees, because individuals are long-lived and only rare reproduction is required to maintain density. Also, bur oak resprouts vigorously from the root crown when topkilled by fire, storm, and sometimes by drought. Thus, the same individuals persist, although aerial portions may be of varying ages because of resprouting.

This allows for a renewed bout of reproduction. Without fire, this class can revert to Class D.

*Maximum Tree Size Class*  
Very Large >33" DBH

Class D 30 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| QUMA2 | Quercus macrocarpa | Bur oak | None |

Description

This is a closed stand in the most favorable sites. Movement to higher-density stands from the starting Class B condition, due to favorable moisture cycles and reduced fire frequency/severity. Stand would have higher density than corresponding local Class B, with higher proportion of younger and smaller trees.

A combination of fire and drought can prevent continued excess reproduction, restabilizing stand and returning it to Class B or C.

*Maximum Tree Size Class*  
Very Large >33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Late1:ALL | 20 |
| Late1:ALL | 21 | Late1:ALL | 999 |
| Late1:OPN | 21 | Late1:OPN | 999 |
| Late1:CLS | 21 | Late1:CLS | 999 |

Probabilistic Transitions

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Disturbance Type** | **Disturbance occurs In** | **Moves vegetation to** | **Disturbance Probability** | **Return Interval (yrs)** | **Reset Age to New Class Start Age After Disturbance?** | **Years Since Last Disturbance** |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Optional 1 | Late1:ALL | Late1:OPN | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Late1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Mixed Fire | Late1:ALL | Late1:OPN | 0.03 | 33 | Yes | 0 |
| Surface Fire | Late1:ALL | Late1:ALL | 0.05 | 20 | No | 0 |
| Alternative Succession | Late1:ALL | Late1:CLS | 0.1 | 10 | Yes | 0 |
| Native Grazing | Late1:OPN | Late1:OPN | 0.01 | 100 | No | 0 |
| Wind or Weather or Stress | Late1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Alternative Succession | Late1:OPN | Late1:CLS | 0.02 | 50 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:ALL | 0.02 | 50 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.04 | 25 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:OPN | 0.035 | 29 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:ALL | 0.035 | 29 | Yes | 0 |

Optional Disturbances

Optional 1: Drought

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