11160

Madrean Juniper Savanna

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
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Vegetation Type

Steppe/Savanna

Map Zones

15, 25

Model Splits or Lumps

This Biophysical Setting (BpS) is lumped with: 2510250 and 1510250.

Geographic Range

Sierra Madre Occidentale and Sierra Madre Oriental in Mexico, Trans-Pecos Texas, southern New Mexico, southern Arizona (south of the Mogollan Rim), and southwestern New Mexico.

Biophysical Site Description

This BpS typically is found at elevations between 1,400-2,200m. Madrean juniper savannas occur at the lower altitudinal limits for foothill tree species, below the pinyon-juniper (PJ) woodlands, but at or above semi-desert grassland where soil moisture limits cover of montane woody plants. At higher and therefore moister elevations, woodlands grade into Madrean encinal or, less frequently, montane pine-oak woodlands characterized by taller and denser vegetation than these woodlands. Savannas and woodlands are found on many and varied topographic positions, including low- to mid-elevation mountain slopes, hills, plateaus, basins, and flats.

Vegetation Description

The upper vegetation canopy is composed of open to moderately dense tree layer dominated by *Pinus cembroides*, *Pinus discolor*, *Pinus edulis*, *Juniperus depeanna*, and/or *Juniperus monosperma*. Madrean oaks such as *Quercus arizonica*, *Q. emoryi*, *Q. grisia*, *Q. oblongifolia*, or *Q. mohriana* may be present to co-dominant with pinyon and/or juniper trees. In southwest New Mexico, *Q. grisia* may be dominant. *Pinus engelmannii* occurs infrequently, and *P. ponderosa* and *P. arizonica* are absent. *Juniperus monosperma* is often present to dominant on the Gila National Forest. Understory layers are variable and may be dominated by shrubs such as manzanita (*Arctostaphylos pungens*, *A. pringlei*), cliffrose (*Cowania mexicana*), Apache plume (*Fallugia paradoxa*), or barberry (*Berberis* spp.). Graminoids may form dense (savanna) to sparse canopy. Common species include sideoats grama (*Bouteloua curtipendula*), cane bluestem (*Bothriochloa barbinodis*), muhly grasses (*Muhlenbergia emerslyei*, *M. torreyi*, *M. porteri*). Graminoids decrease in cover and biomass with increasing cover of woody plants.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| JUDE | *Juncus debilis* | Weak rush |
| PIED | *Pinus edulis* | Twoneedle pinyon |
| PIDI3 | *Pinus discolor* | Border pinyon |
| QUAR | *Quercus arizonica* | Arizona white oak |
| QUEM | *Quercus emoryi* | Emory oak |
| QUGR3 | *Quercus grisea* | Gray oak |
| QUOB | *Quercus oblongifolia* | Mexican blue oak |
| PILE | *Pinus leiophylla* | Chihuahuan pine |

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

Disturbance Description

The fire regime of this ecological system is almost completely unknown. There are essentially no data about fire frequency, fire history, or fire behavior. The occasional paper that addresses fire includes considerably more speculation than data. It would seem that fire occurrence was determined primarily by fire occurrence in the surrounding matrix vegetation and was ignited by lightning during early summer. However, even this information is speculative and undocumented; based on contemporary ecological knowledge, models that assume specific fire regimes are little more than wild guesses. Such a model follows, in the sincere hope that it will be ignored or improved upon.

This system is likely predisposed to stand-replacement fires during the earliest stage of stand development. Replacement fires are assumed to have occurred every century or so and mixed-severity fires slightly less frequently. Significant drought occurs about every 60yrs and, in combination with herbivory from invertebrates, causes disproportional mortality of large, old trees.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 136 | 34 | 20 | 1000 |
| Moderate (Mixed) | 208 | 22 | 20 | 1000 |
| Low (Surface) | 107 | 44 |  |  |
| All Fires | 46 | 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

Pinyon-juniper woodland usually was distributed across the landscape in patches between 100s-1,000s of acres in size. In particularly dissected topography, this type may have occurred in smaller patches.

Adjacency or Identification Concerns

This system generally is found at higher elevations and more mesic sites than semi-desert grassland. Typically, it is bordered at higher elevations by Madrean Pine-Oak Woodlands.

Cover and density of juniper and pinyon trees at lower elevations in this type doubtless have increased as a result of fire suppression (possibly as mitigated by livestock grazing). This phenomenon is characteristic of BpS 1116 (juniper savanna), with which BpS 1025 (pinyon-juniper woodland) has been lumped for map zone (MZ)15. Bordered at low elevation by Madrean Encinal and Desert Grasslands on Gila NF.

Issues or Problems

Virtually no components of the fire regimes are known with any certainty. Fire scars are rare, and trees in this system cannot be aged with conventional dendrochronological techniques. Information about fire regimes is extrapolated from adjacent systems, and extreme caution is warranted when interpreting these models. Fire season can be inferred more reliably than fire frequency; the former likely is equally or more important than the latter.

This ecological system was originally described assuming evergreen oak species are present to co-dominant in the understory or canopy in MZ15 (Schulz, personal communication). This system also includes pinyon-juniper woodlands and savannas with understories dominated by other shrubs or a grass layer and lacks evergreen oaks, which may have a different fire behavior.

Native Uncharacteristic Conditions

Comments

Lower moisture levels due to drought may cause this BpS to decline in area since it occurs in a mesic habitat. Fire behavior and fire intervals will increase because of loss of understory fuels.

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 | A | A | A | A | A | A | A | A | A | A |
| Herb | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Herb | >1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0-0.5 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | B | B | B | B | B | B | B | B | B | B |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | C | C | C | C | C | C | C | C | C | C |
| Tree | 25-50 | C | C | C | C | C | C | C | C | C | C |
| Tree | >50 | C | C | C | C | C | C | C | C | C | C |

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 5 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| BOCU | Bouteloua curtipendula | Sideoats grama | Upper |
| BOBA3 | Bothriochloa barbinodis | Cane bluestem | Upper |
| QUAR | Quercus arizonica | Arizona white oak | Upper |
| QUEM | Quercus emoryi | Emory oak | Upper |

Description

Initial post-fire community dominated by perennial caespitose grasses. Evidence of past fires may be observed, including charcoal and resprouting woody plants.

*Maximum Tree Size Class*  
None

Class B 57 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| JUDE | Juncus debilis | Weak rush | Upper |
| PIED | Pinus edulis | Twoneedle pinyon | Upper |
| QUAR | Quercus arizonica | Arizona white oak | Upper |
| QUEM | Quercus emoryi | Emory oak | Upper |

Description

Community dominated by young to mature alligator juniper and evergreen oak trees of various ages.

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

Class C 38 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| JUDE | Juncus debilis | Weak rush | Upper |
| PIED | Pinus edulis | Twoneedle pinyon | Upper |
| QUAR | Quercus arizonica | Arizona white oak | Upper |
| QUEM | Quercus emoryi | Emory oak | Upper |

Description

Site dominated by relatively dense old alligator juniper and evergreen oak trees.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 9 |
| Mid1:CLS | 10 | Late1:CLS | 84 |
| Late1:CLS | 85 | Late1:CLS | 984 |

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 | 0.1 | 10 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.005 | 200 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.005 | 200 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:CLS | 0.015 | 67 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.025 | 40 | No | 0 |

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