

10190

Great Basin Pinyon-Juniper Woodland

BpS Model/Description Version: Aug. 2020

Modelers		Reviewers	
Jim Hurja	jhurja@fs.fed.us	Jan Nachlinger	jnachlinger@tnc.org
None	None	None	None
None	None	None	None

Vegetation Type

Forest and Woodland

Map Zones

13, 14

Geographic Range

This ecological system occurs on mountain ranges of the Mojave Desert region and eastern foothills of the Sierra Nevada into Arizona.

Biophysical Site Description

System typically found from 5,500-8,000ft above the blackbrush (*Coleogyne ramosissima*) zone. This type generally occurred on most soil types and landforms, including fire-safe sites of steep and rocky slopes. Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay.

Vegetation Description

Woodlands dominated by a mix of *Pinus monophylla* and *Juniperus osteosperma*, pure or nearly pure occurrences of *Pinus monophylla*, or woodlands dominated solely by *Juniperus osteosperma* comprise this system. *Cercocarpus ledifolius* is a common associate. Understory layers are variable. Associated species include shrubs such as *Arctostaphylos patula*, *Arctostaphylos pungens*, *Artemisia nova*, *Artemisia tridentata*, *Cercocarpus ledifolius*, *Cercocarpus intricatus*, *Coleogyne ramosissima*, *Purshia stansburiana*, *Ceanothus greggii*, *Symphoricarpos oreophilus*, *Garrya flavescens*, *Yucca baccata*, and bunchgrasses *Pseudoroegneria spicata*, *Achnatherum hymenoides*, *Elymus elymoides*, and *Poa fendleriana*. *Quercus gambelii* and *Quercus turbinella* may be present. *Sphaeralcea* is a common forb.

Because disturbance was uncommon to rare in this ecological system and because the overstory conifers may live several hundred years, patches were primarily composed of later seral stages (D; see below) that did not occur as extensive woodlands and that should be distinguished from shrubland ecological sites encroached by pinyon or juniper during the last 150yrs. The age structure may vary from uneven to even aged. The overstory cover is normally <25%, although it can sometimes be higher (<50%) where pinyon occurs.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
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PIMO	<i>Pinus monophylla</i>	Singleleaf pinyon
JUOS	<i>Juniperus osteosperma</i>	Utah juniper
CELE3	<i>Cercocarpus ledifolius</i>	Curl-leaf mountain mahogany
SYOR	<i>Symphoricarpos orbiculatus</i>	Coralberry
PUST	<i>Purshia stansburiana</i>	Stansbury cliffrose
ARPA6	<i>Arctostaphylos patula</i>	Greenleaf manzanita
ARTEM	<i>Artemisia</i>	Sagebrush
ELEL5	<i>Elymus elymoides</i>	Squirreltail

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

Disturbance Description

Uncertainty exists about the fire frequencies of this ecological system, especially since these ecological system groups different types of pinyon-juniper communities for different slopes, exposures, and elevations. Replacement fires of a scale beyond a few trees were uncommon to rare (average fire return interval [FRI] of 100-1,000yrs) and occurred primarily during extreme fire behavior conditions and during long droughts. Fire events may be caused by importation from adjacent shrub- and grassland-dominated vegetation of lower and higher altitudinal zones. Mixed-severity fire (average FRI of 100-500yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1ac). There is limited evidence for surface fires (Gruell 1994; Bauer and Weisberg, unpublished data), which likely occurred only in the more productive sites during years where understory grass cover was high, providing adequate fuel. Although fire scars are only rarely found in pinyon-juniper of the Colorado Plateau and elsewhere (Baker and Shinneman 2004; Eisenhart 2004), ongoing studies in the central Great Basin are observing fire-scarred trees, suggesting that surface fires historically occurred at low frequency. Limited evidence to date suggests that while lightning ignitions in this biophysical setting (Bps) may have been common, the resulting fires only rarely spread to affect more than a few trees.

Ethnobiological studies of Great Basin and Mojave Desert tribes (Fowler et al. 2003) describe the common use of fire for stimulating tobacco growth in the gaps between old pinyons and junipers, in addition to the common practice of roasting pine cones in pits. Burning for tobacco could be the source of mixed-severity and surface fires in these systems and of fire scars.

Prolonged weather-related stress (drought mostly) and insects and tree pathogens are coupled disturbances that thin trees to varying degrees and kill small patches every 250-500yrs on average, with greater frequency in more closed stands.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	473	33	100	1000
Moderate (Mixed)	337	47	100	500
Low (Surface)	778	20	5	1000
All Fires	157	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

BpS 131019 occurs at scales of 10,000ac, although the more common scale is 1,000s of acres.

The most common disturbance in this type is very small-scale -- either single-tree or small groups. If the conditions are just right, then it will have replacement fires that burn stands up to a maximum of 1,000s of acres. This type may also have mixed-severity fires of 10-100s of acres.

Adjacency or Identification Concerns

This system occurs at lower elevations than Colorado Plateau Pinyon-Juniper Woodland (BPS 1016) where sympatric and is generally found at higher elevations than Inter-Mountain Basins Juniper Savanna (BpS 131115).

Due to livestock removal of grasses, thus competition for tree seedlings, and fire exclusion for more than a century, pinyon-juniper stands have experienced densification. Older trees (>300yrs) are surrounded by younger conical trees <100yrs old. The shrubland matrix around these woodlands has also experienced invasion of pinyon and juniper and the greater occurrence of crown fires that spread to true woodlands.

Two major modern issues, climate change and invasive plant species (especially annual grasses red brome and cheatgrass), lead to non-equilibrium vegetation dynamics for this ecological system, making it difficult to categorize and usefully apply natural disturbance regimes. Sites with an important annual grass component in the understory experience greater fire frequency and result in more intense fire and greater spread. Moreover, fire from adjacent BpS invaded by annual grasses will spread more frequently into BpS 1019, which is fire-sensitive.

Since disturbance was uncommon to rare in this ecological system and since the overstory conifers may live several hundred years, patches were primarily composed of later seral stages (D; see below) that did not occur as extensive woodlands and that should be distinguished from shrubland ecological sites encroached by pinyon or juniper during the last 150yrs. The age structure may vary from uneven to even aged. The overstory cover is normally <25%, although it can sometimes be higher (<50%) where pinyon occurs.

Issues or Problems

There is much uncertainty in model parameters, particularly the fire regime. Quantitative data are lacking, and research is ongoing. The literature for this ecological system's fire history is based on the chronologies from other pine species that are better fire recorders, growing under conditions that may not represent fire environments typical of infrequent-fire pinyon and juniper communities. For example, surface fire, which leaves scars on these other pine species (but not generally on fire-sensitive pinyon or juniper), has no effect on the dynamics of the model, although surface fire, perhaps of Native American origin, maintains the open structure of Class D by thinning younger trees.

Further study is needed to better elucidate the independent and interactive effects of fire, insects, pathogens, climate, grazing, and anthropogenic impacts on historical and current vegetation dynamics in the Great Basin Pinyon-Juniper Woodland type.

Native Uncharacteristic Conditions

Cover >60% cover of trees is uncharacteristic. (>40% on the ground is uncharacteristic; >60% via remote sensing). Cover of shrubs >60% (via remote sensing) is uncharacteristic (40% on the ground).

Comments

Map zones 13 and 14 were combined during 2015 BpS Review.

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	B	B	C	C	C	C	UN	UN	UN	UN
Shrub	0.5-1.0	B	B	C	C	C	C	UN	UN	UN	UN
Shrub	1.0-3.0	B	B	C	C	C	C	UN	UN	UN	UN
Shrub	>3.0	B	B	C	C	C	C	UN	UN	UN	UN
Tree	0-5	C	C	C	C	C	C	UN	UN	UN	UN
Tree	5-10	C	C	D	D	D	D	UN	UN	UN	UN
Tree	10-25	D	D	D	D	D	D	UN	UN	UN	UN
Tree	25-50	D	D	D	D	D	D	UN	UN	UN	UN
Tree	>50	D	D	D	D	D	D	UN	UN	UN	UN

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 2 Early Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ELEL5	Elymus elymoides	Squirreltail	Mid-Upper
SPHAE	Sphaeralcea	Globemallow	Upper
ZIPA2	Zigadenus paniculatus	Foothill deathcamas	Mid-Upper
POFE	Poa fendleriana	Muttongrass	Mid-Upper

Description

Initial post-fire community dominated by annual grasses and forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Evidence of past fires (burnt stumps and charcoal) should be observed.

Maximum Tree Size Class

None

Class B**7****Mid Development 1 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARTR2	Artemisia tridentata	Big sagebrush	Upper
ARPU5	Arctostaphylos pungens	Pointleaf manzanita	Middle
PIMO	Pinus monophylla	Singleleaf pinyon	Lower
JUOS	Juniperus osteosperma	Utah juniper	Lower

Description

Dominated by shrubs, perennial forbs and grasses. Tree seedlings starting to establish on favorable microsites. Total cover remains low due to shallow unproductive soil. It is important to note that replacement fire at this stage does not eliminate perennial grasses. Mixed-severity fire thins the woody vegetation.

*Maximum Tree Size Class*None

Class C**27****Mid Development 2 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIMO	Pinus monophylla	Singleleaf pinyon	Upper
JUOS	Juniperus osteosperma	Utah juniper	Upper
ARTR2	Artemisia tridentata	Big sagebrush	Middle
CELE3	Cercocarpus ledifolius	Curl-leaf mountain mahogany	Middle

Description

Shrub- and tree-dominated community with young juniper and pinyon seedlings becoming established. Dominant lifeform is shrub (canopy cover 10-40%, height 0.5-3m). It is important to note that replacement fire at this stage does not eliminate perennial grasses. Mortality from insects, pathogens, and drought affects older trees.

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

Class D**64****Late Development 1 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIMO	Pinus monophylla	Singleleaf pinyon	Upper
JUOS	Juniperus osteosperma	Utah juniper	Upper
CELE3	Cercocarpus ledifolius	Curl-leaf mountain mahogany	Middle
ARTR2	Artemisia tridentate	Big sagebrush	Middle

Description

Community dominated by young (<300yrs) to old (>300yrs) junipers and pines of mixed age structure. Juniper and pinyon becoming competitive on site and beginning to affect understory composition. Tree pathogens and insects such as pinyon Ips become more important for woodland dynamics, including both patch mortality and thinning of isolated individual trees.

Maximum Tree Size Class

Large 21-33" DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:OPN	0	Mid1:OPN	9
Mid1:OPN	10	Mid2:OPN	29
Mid2:OPN	30	Late1:OPN	99
Late1:OPN	100	Late1:OPN	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:OPN	Early1:OPN	0.003	333	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.005	200	No	0
Replacement Fire	Mid1:OPN	Early1:OPN	0.005	200	Yes	0
Insects or Disease	Mid2:OPN	Mid1:OPN	0.001	1000	Yes	0
Replacement Fire	Mid2:OPN	Early1:OPN	0.004	250	Yes	0
Mixed Fire	Mid2:OPN	Mid2:OPN	0.005	200	No	0
Replacement Fire	Late1:OPN	Early1:OPN	0.001	1000	Yes	0
Insects or Disease	Late1:OPN	Mid2:OPN	0.002	500	Yes	0
Insects or Disease	Late1:OPN	Mid1:OPN	0.002	500	Yes	0
Surface Fire	Late1:OPN	Late1:OPN	0.002	500	No	0
Mixed Fire	Late1:OPN	Late1:OPN	0.002	500	No	0

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