11150

Inter-Mountain Basins Juniper Savanna

BpS Model/Description Version: Aug. 2020

Update: 6/5/2018

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
| Peter Weisberg | pweisberg@cabnr.unr.edu |  |  |
| Crystal Kolden | ckolden@gmail.com |  |  |
|  |  |  |  |

Vegetation Type

Steppe/Savanna

Map Zones

17

Geographic Range

In Nevada and western Utah.

Biophysical Site Description

This ecological system is typically found at lower elevations ranging from 1,500-2,300m. Occurrences are found on lower mountain slopes, hills, plateaus, basins and flats. Juniper savanna ecotype generally occurs in local, geologically confined, badland environments and is limited in its distribution. Occurs at the lower altitudinal limits for tree species, below the pinyon-juniper woodland type but at or above sagebrush semi-desert and salt desert shrubland in locations where soil moisture is limiting.

Vegetation Description

The vegetation is typically open savanna, although there may be inclusions of more dense juniper woodlands. This savanna is typically dominated by *Juniperus osteosperma* trees with sparse cover of black sagebrush and perennial bunch grasses and forbs, with *Elymus elymoides, Achnatherum hymenoides* (= *Oryzopsis hymenoides*), *Hesperostipa comate,* and *Pleuraphis jamesii* (more southern locations) being most common. Pinyon trees are typically not present because sites are outside the ecological or geographic range of *Pinus edulis* and *Pinus monophylla*.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| JUOS | *Juniperus osteosperma* | Utah juniper |
| ARNO4 | *Artemisia nova* | Black sagebrush |
| HECO26 | *Hesperostipa comata* | Needle and thread |
| ACHY | *Achnatherum hymenoides* | Indian ricegrass |
| ELEL5 | *Elymus elymoides* | Squirreltail |
| PLJA | *Pleuraphis jamesii* | James' galleta |

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. It is likely that fires were very infrequent in this ecotype with inherently low productivity. Fire occurrence was primarily determined by fire occurrence in the surrounding matrix vegetation. Lightning-ignited fires typically did not affect more than a few individual trees. Replacement fires were rare (average fire return interval [FRI] of greater than 300-1,000yrs) and occurred primarily during extreme fire behavior conditions, particularly when preceded by wetter years associated with high herbaceous production. Fire regime primarily determined by adjacent communities, as fire rarely originated within the community. Mixed severity fire (average FRI of 200-500yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1ac). Surface fire could occur in stands where understory grass cover was high and provided adequate fuel. Surface fire was primarily responsible for producing fire scars on juniper trees in older stands (average FRI of 500yrs).

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 810 | 23 | 100 | 1000 |
| Moderate (Mixed) | 426 | 43 | 100 | 1000 |
| Low (Surface) | 551 | 34 |  |  |
| All Fires | 185 | 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

Juniper steppe was usually distributed across the landscape in patches that range from 10s-100s of acres in size. In areas with very broken topography and/or mesa landforms this type may have occurred in patches of several hundred acres.

Adjacency or Identification Concerns

This system is generally found at lower elevations and more xeric sites than Great Basin Pinyon-Juniper Woodland (biophysical setting [BpS] 1019) or Colorado Plateau Pinyon-Juniper Woodland (BpS 1016).

In modern days, surrounding matrix vegetation has changed to young-mid aged woodlands that encroached the former sagebrush matrix during the last century of fire exclusion or livestock grazing. The woodlands burn more intensely than the former sagebrush matrix. Many lay-people confuse these younger pinyon and juniper woodlands with true woodland sites dependent on naturally fire-protected features.

Issues or Problems

Uncertainty exists about the fire frequencies of this ecological system because juniper does not generally survive fire and most fire study for pinyon and/or juniper are from other regions with fire scars recorded on conifers that experience more frequent fire.

Native Uncharacteristic Conditions

Comments

This is essentially the same model as the Rapid Assessment model R2PIJU developed by Steve Bunting (sbunting@uidaho.edu), Krista Waid-Gollnick (krista\_waid@blm.gov), and Henry Bastian (henry\_bastian@ios.doi.gov) for juniper and/or pinyon savanna. Mean FRIs are somewhat longer due to the more arid Great Basin context. Reviewers of R2PIJU were George Gruell (ggruell@charter.net), Jolie Pollet (jpollet@blm.gov) and Peter Weisberg (pweisberg@cabnr.unr.edu).

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 | UN | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | B | B | C | C | UN | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | B | B | C | C | UN | UN | UN | UN | UN | UN |
| Shrub | >3.0 | B | B | C | C | UN | UN | UN | UN | UN | UN |
| Tree | 0-5 | D | D | E | E | UN | UN | UN | UN | UN | UN |
| Tree | 5-10 | D | D | E | E | UN | UN | UN | UN | UN | UN |
| Tree | 10-25 | D | D | E | E | UN | UN | UN | UN | UN | UN |
| Tree | 25-50 | D | D | E | E | UN | UN | UN | UN | UN | UN |
| Tree | >50 | D | D | E | E | UN | UN | 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** |
| HECO26 | Hesperostipa comata | Needle and thread | Upper |
| ELEL5 | Elymus elymoides | Squirreltail | Upper |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Upper |
| CRYPT | Cryptantha | Cryptantha | Lower |

Description

Initial post-fire community dominated by annual forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Evidence of past fires, charcoal, and other evidence can be observed. Infrequent mixed severity fire thins vegetation.

*Maximum Tree Size Class*  
None

Class B 2 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| HECO26 | Hesperostipa comata | Needle and thread | Mid-Upper |
| ARNO4 | Artemisia nova | Black sagebrush | Upper |
| ELEL5 | Elymus elymoides | Squirreltail | Mid-Upper |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Mid-Upper |

Description

Dominated by perennial forbs and grasses, with early shrub establishment. 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 7 Mid Development 2 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ARNO4 | Artemisia nova | Black sagebrush | Middle |
| ELEL5 | Elymus elymoides | Squirreltail | Low-Mid |
| JUOS | Juniperus osteosperma | Utah juniper | Upper |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Low-Mid |

Description

Shrub dominated community (10-25% cover) with young juniper seedlings emerging from the shrubs. Juniper cover may be 5-20%; less than 5m tall. 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*  
Seedling <4.5ft

Class D 23 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| JUOS | Juniperus osteosperma | Utah juniper | Upper |
| ARNO4 | Artemisia nova | Black sagebrush | Middle |
| ELEL5 | Elymus elymoides | Squirreltail | Low-Mid |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Low-Mid |

Description

Community dominated by young to mature juniper of mixed age structure. Juniper becoming competitive on site and beginning to affect understory composition. Duration 300yrs with succession to E unless replacement fire (average FRI of 1000yrs) causes a transition to A. Mixed severity and surface fire are less frequent than in previous states (500yrs).

*Maximum Tree Size Class*  
Large 21-33"DBH

Class E 66 Late Development 2 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| JUOS | Juniperus osteosperma | Utah juniper | Upper |
| ARNO4 | Artemisia nova | Black sagebrush | Middle |
| ELEL5 | Elymus elymoides | Squirreltail | Lower |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Lower |

Description

Site dominated by widely spaced old juniper. Grasses (e.g., *Hesperostipa comata*) present on microsites with deeper soils (>20in) with restricting clay subsurface horizon. Shrubs are present. Rare mixed and surface fires, every 1000yrs on average, will scar ancient trees.

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

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:OPN | 0 | Mid1:OPN | 19 |
| Mid1:OPN | 20 | Mid2:OPN | 39 |
| Mid2:OPN | 30 | Late1:OPN | 99 |
| Late1:OPN | 100 | Late2:OPN | 399 |
| Late2:OPN | 400 | Late2: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 | Early1:OPN | Early1:OPN | 0.005 | 200 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:OPN | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.005 | 200 | No | 0 |
| Replacement Fire | Mid2:OPN | Early1:OPN | 0.003 | 333 | Yes | 0 |
| Mixed Fire | Mid2:OPN | Mid2:OPN | 0.005 | 200 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:OPN | 0.001 | 1000 | Yes | 0 |
| Surface Fire | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| Replacement Fire | Late2:OPN | Early1:OPN | 0.001 | 1000 | Yes | 0 |
| Surface Fire | Late2:OPN | Late2:OPN | 0.002 | 500 | No | 0 |
| Mixed Fire | Late2:OPN | Late2:OPN | 0.002 | 500 | No | 0 |

References

Alexander, R.R and F. Ronco, Jr. 1987. Classification of the forest vegetation on the National Forests of Arizona and New Mexico. Res. Note RM-469. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 10 pp.

Anderson, H.E. 1982. Aids to Determining Fuel Models For Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: UDA Forest Service, Intermountain Forest and Range Experiment Station. 22 pp.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-100 in: J.K. Brownand J. Kapler-Smith, eds. Wildland fire in ecosystems: Effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Baker, W.L. and D.J. Shinneman. 2004. Fire and restoration of pińon-juniper woodlands in the western United States. A review. Forest Ecology and Management 189: 1-21.

Blackburn, W.H. and P.T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada. Ecology 51: 841-848.

Bradley, A.F., N.V. Noste and W.C. Fischer. 1992. Fire Ecology of Forests and Woodlands in Utah. Gen. Tech. Rep. GTR- INT-287. Ogden, UT: USDA Forest Service, Intermountain Research Station. 127 pp.

Brown, J.K. and J. Kapler-Smith, eds. 2000. Wildland fire in ecosystems: effects of fire on flora. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.

Erdman, J.A. 1970. Pinyon-juniper succession after natural fires on residual soils of Mesa Verde, Colorado. Science Bulletin, Biological Series - -Volume XI, No. 2. Brigham Young University, Provo, UT. 26 pp.

Everett, R.L. and K. Ward. 1984. Early Plant Succession on Pinyon-Juniper Controlled Burns. Northwest Science 58: 57-68.

Eyre, F.H., ed. 1980. Forest cover types of the United States and Canada. Washington, DC: Society of American Foresters. 148 pp.

Goodrich, S. and B. Barber. 1999. Return Interval for Pinyon-Juniper Following Fire in the Green River Corridor, Near Dutch John, Utah. In: USDA Forest Service Proceedings RMRS-P-9.

Gruell, G. E. Historical and Modern Roles of Fire in Pinyon-Juniper. Pages 24-28 in: Proceedings, USDA Forest Service RMRS-P-9.

Gruell, G.E., L.E. Eddleman and R. Jaindl. 1994. Fire History of the Pinyon-Juniper Woodlands of Great Basin National Park. Technical Report NPS/PNROSU/NRTR-94/01. U.S. Department of Interior, National Park Service, Pacific Northwest Region. 27 pp.

Hardy, C.C., K.M. Schmidt, J.P. Menakis and R.N. Samson. 2001. Spatial data for national fire planning and fuel management. Int. J. Wildland Fire. 10(3&4): 353-372.

Hessburg, P.F., B.G. Smith, R.B. Salter, R.D. Ottmar and E. Alvarado. 2000. Recent changes (1930s-1990s) in spatial patterns of interior northwest forests, USA. Forest Ecology and Management 136: 53-83.

Kilgore, B.M. 1981. Fire in ecosystem distribution and structure: western forests and scrublands. Pages 58-89 in: H.A. Mooney et al., technical coordinators. Proceedings: Conference on Fire Regimes and Ecosystem Properties, Honolulu, 1978. Gen. Tech. Rep. WO-GTR-26.

Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States. American Geographic Society Special Publication No. 36. 116 pp.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Ogle, K. and V. DuMond. 1997. Historical Vegetation on National Forest Lands in the Intermountain Region. USDA Forest Service, Intermountain Region, Ogden, UT. 129 pp.

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications. Terrestrial ecological systems of the Great Basin US: DRAFT legend for Landfire project. NatureServe Central Databases. Arlington, VA. Data current as of 4 November 2004.

Ott, J.E., E.D. McArthur and S.C. Sanderson. 2001. Plant Community Dynamics of Burned and Unburned Sagebrush and Pinyon-Juniper Vegetation in West-Central Utah. Pages 177-190 in: Proceedings, USDA Forest Service RMRS-P-9.

Romme, W.H., L. Floyd-Hanna and D. Hanna. 2002. Ancient Pinyon-Juniper forests of Mesa Verde and the West: A cautionary note for forest restoration programs. In: Conference Proceedings – Fire, Fuel Treatments, and Ecological Restoration: Proper Place, Appropriate Time, Fort Collins, CO, April 2002. 19 pp.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Soule’, P.T. and P.A. Knapp. 1999. Western juniper expansion on adjacent disturbed and near-relict sites. Journal of Range Management 52: 525-533.

Soule’, P.T. and P.A. Knapp. 2000. Juniperus occidentalis (western juniper) establishment history on two minimally disturbed research natural areas in central Oregon. Western North American Naturalist (60)1: 26-33.

Stein, S.J. 1988. Fire History of the Paunsaugunt Plateau in Southern Utah. Great Basin Naturalist. 48: 58-63.

Tausch, R.J. and N.E. West. 1987. Differential Establishment of Pinyon and Juniper Following Fire. The American Midland Naturalist 119(1): 174-184.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed: 11/15/04].

Ward, K.V. 1977. Two-Year Vegetation Response and Successional Trends for Spring Burns in the Pinyon-Juniper Woodland. M.S. Thesis, University of Nevada, Reno. 54 pp.

Wright, H.A., L.F. Neuenschwander and C.M. Britton. 1979. The role and use of fire in Sagebrush-Grass and Pinyon-Juniper Plant Communities. Gen. Tech. Rep. INT-GTR-58. Ogden, UT: USDA Forest Service, Intermountain Research Station. 48 pp.

Young, J.A. and R.A. Evans. 1978. Population Dynamics after Wildfires in Sagebrush Grasslands. Journal of Range Management 31: 283-289.

Young, J.A. and R.A. Evans. 1981. Demography and Fire History of a Western Juniper Stand. Journal of Range Management 34: 501-505.