10190

Great Basin Pinyon-Juniper Woodland

BpS Model/Description Version: Aug. 2020

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*, *Ceanothuss greggii*, *Symphoricarpus 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

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

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-equilibrial 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 pines 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**

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

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

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

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

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

Probabilistic Transitions

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: USDA Forest Service, Intermountain Forest and Range Experiment Station. 22 pp.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown, 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.

Barney, M.A. and N.C. Frischknecht. 1974. Vegetation changes following fire in the Pinyon-Juniper type of West-Central Utah. Jour. Range Manage. 27: 91-96

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.

Despain, D.W. and J.C. Mosely. 1990. Fire history and stand structure of a pinyon-juniper woodland at Walnut Canyon National Monument, Arizona. USDI National Park Service Technical Report No. 34. Cooperative National Park Resources Studies Unit, University of Arizona, Tucson AZ. 27 pp.

Eisenhart, K.S. 2004. Historic range of variability and stand development in pinon-juniper woodlands of western Colorado. Boulder, Colorado: University of Colorado. Dissertation.

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.

Fowler, C.S, P. Esteves, G. Goad, B. Helmer and K. Watterson. 2003. Caring for the Trees: Restoring Timbisha Shoshone Land Management Practices in Death Valley National Park. Ecological Restoration 21: 302-306.

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. 1999. Historical and modern roles of fire in pinyon-juniper. Pages 24-28 in: S.B. Monsen and R. Stevens, compilers. Proceedings: ecology and management of pinyon-juniper communities within the Interior West: Sustaining and restoring a diverse ecosystem; 1997 September 15-18; Provo, UT. Proceedings RMRS-P-9. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

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.

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.

Nachlinger, J. and G.A. Reese. 1996. Plant community classification of the Spring Mountains National Recreation Area, Clark and Nye Counties, Nevada. Report submitted to USDA Forest Service, Humboldt-Toiyabe National Forest.

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.

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

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.

Rondeau, R. 2001. Ecological System Viability Specifications for Southern Rocky Mountain Ecoregion. Colorado Natural Heritage Program. 181 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., N.E. West and A.A. Nabi. 1981. Tree Age and Dominance Patterns in Great Basin Pinyon-Juniper Woodlands. Jour. Range. Manage. 34: 259-264.

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

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.

Zouhar, K.L. 2001. Pinus monophylla. In: Fire Effects Information System [Online] USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed: 11/15/04].

Zlatnik, E. 1999. Juniperus osteosperma. In: Fire Effects Information System [Online] USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [Accessed: 11/15/04].