10240

Madrean Lower Montane Pine-Oak Forest and Woodland

BpS Model/Description Version: Aug. 2020

**Reviewer:** Charlotte Reemts

Vegetation Type

Forest and Woodland

Map Zone

26

Geographic Range

Sierra Madre Occidentale and Sierra Madre Oriental in Mexico, Trans-Pecos Texas, New Mexico, and Arizona, generally south of the Mogollon Rim. In map zone 26, this Biophysical Setting (BpS) is limited to the Sky Islands of the Davis, Guadalupe, Eagle, Quitman, Sierra Diablo, Glass, Chisos and Chinati mountains.

Biophysical Site Description

The Madrean pine-oak forest and woodland of the interior North American Southwest is characterized by scrub oaks, alligator junipers, and Mexican pines that range in height from 15-50ft (6-15m); the understory is dominated by graminoids (Brown 1994). Elevation ranges from 5,500-7,000ft. With increasing elevation, alligator juniper give way to a mixture of relatively mesic scrub oak species and pines. This area is a transition zone with Rocky Mountain influence from the north, Appacherian influence from the west, and Madrean from the south. These influences determine the dominant species’ compositions and structure. However, the model for these areas remains the same. Kuchler (1964) includes this type within type number 31, the oak-juniper woodland.

Vegetation Description

These forests and woodlands are composed of Madrean pines and evergreen oaks intermingled with patchy shrublands on most mid-elevation slopes (1,500-2,300m elevation). Throughout the BpS, the vegetation varies due to the surrounding mountain ranges and dominance changes throughout. Tree species include Emory oak (*Q. emoryi*), gray oak (*Q. grisea*), Gambel oak (*Q. gambelii*), Arizona cypress (*Cupressus arizonica*), alligator juniper (*Juniperus deppeana*), drooping juniper (*Juniperus flaccida*), Douglas-fir (*Pseudotsuga menziesii*), Arizona pine (*Pinus arizonica*), southwestern white pine (*P. strobiformis*), and ponderosa pine (*P. ponderosa*). Subcanopy and shrub layers may include typical encinal and chaparral species such as agave (*Agave* spp.), Texas madrone (*Arbutus xalapensis*), mountain mahogany (*Cercocarpus montanus*), Wright silktassel (*Garrya wrightii*), nolina (*Nolina* spp.), and silverleaf oak (*Q. hypoleucoides*). Some stands have moderate cover of perennial warm-season grasses such as sideoats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*), bull grass (*Muhlenbergia emersleyi*), and Texas bluestem (*Schizachyrium cirratum*) (Powell 1994; Powell 1998). Graminoids decrease in cover and biomass with increasing cover of woody plants.

BpS Dominant and Indicator Species

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

Disturbance Description

In this BpS, most fires likely occurred during early summer as a result of lightning associated with early summer thunderstorms. Surface fires were frequent with an interval of approximately 9yrs (Helen Mills Poulos fire history research 2005-2006 in Davis, Chisos, and Maderas del Carmen [MX] Mountains), and mixed-severity fires likely occurred less frequently, perhaps on the magnitude of every 13yrs (Mills Poulos, with 10% filter applied and same area as above). This system likely is predisposed to stand-replacement fires during any stage of stand development; however, replacement fires are assumed to have occurred every century or so coincident with hot, dry, windy conditions during early summer. Multi-decadal drought probably thinned stands but did not cause or contribute to stand replacement.

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

This type usually was distributed across the landscape in patches of 100s-1000s of acres. In particularly dissected topography, this type may have occurred in smaller patches.

Adjacency or Identification Concerns

This system generally is bordered by pinyon-juniper woodland in lower elevations and ponderosa pine woodland at higher elevations (e.g., Madrean or Southern Rocky pinyon-juniper woodland). Indicator species of this type include alligator juniper, scrub oaks, Mexican pines, mountain muhly (*M. montana*), blue grama, and sideoats grama.

Issues or Problems

Lehmann lovegrass (*Eragrostis lehmanniana*) was purposely introduced into North America in the 1930s and has spread to the lower and drier edge of Madrean encinal and pine-oak woodland. By continuing to spread and therefore add fine fuel, it may contribute to significantly increased fire frequency in this system. Lehmann lovegrass may have an advantage over native grasses following fire. Fire frequency greatly decreased after the introduction of livestock. Currently, livestock grazing may still preclude wildfire by reducing fine fuel loads.

Native Uncharacteristic Conditions

Tree cover >70% is uncharacteristic.

Comments

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 29 Early Development 1 - All Structures

Indicator Species

Description

Post-fire graminoids and herbaceous dicots with 10-30% cover dominated by grama and muhly grasses, asters, penstemons, and mid-height shrubs such as silktassel along with seedlings of overstory pine and oak.

Herbs dominant are the dominant lifeform (grasses and dicots); however, seedlings may overtake the grasses in later stages of the class.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 6 Mid Development 1 - Open

Indicator Species

Description

Sapling size trees of overstory species and a reduced herbaceous understory depending on the density of the canopy. Actual height of tree species is 3-5m.

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

Class C 65 Late Development 1 - Open

Indicator Species

Description

Open woodland with 20-70% dominated by alligator juniper, ponderosa pine, oaks, mountain muly, blue grama, and sideoats grama.

Herbs are the dominant lifeform (especially warm-season perennial grasses) with 25-70% cover.

*Maximum Tree Size Class*  
Very Large >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.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and 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. 257 pp.

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

Barton, A.M. 2002. Intense wildfire in southeastern Arizona: transformation of a Madrean oak-pine forest to oak woodland. Forest Ecology and Management 165: 205-212.

Barton, A.M. 1999. Pines versus oaks: effects of fire on the composition of Madrean forests in Arizona. Forest Ecology and Management 120: 143-156.

Brown, D.E., editor. 1982. Biotic communities -- southwestern United States and northwestern Mexico. Desert Plants 4(1-4): 1-342.

Brown, D.E. 1994. Biotic communities: Southwestern United States and Northwestern Mexico. Salt Lake City, UT:University of Utah Press. 342 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.

DeBano, L.F., P.F. Ffolliott, A. Ortega-Rubio, G.J. Gottfried, R.H. Hamre and C.B. Edminster, technical coordinators. 1995. Biodiversity and management of the Madrean Archipelago: The Sky Islands of the southwestern United States and northern Mexico. General Technical Report RM-264. Fort Collins, CO: USDA Forest Service Rocky Mountain Experiment Station.

Dick-Peddie, W.A. 1993. New Mexico vegetation: past, present, and future. University of New Mexico Press, Albuquerque, NM. 244 pp.

Ffolliott, P.F., G.J. Gottfried, D.A. Bennett, V.M. Hernandez, A. Ortega-Rubio and R.H. Hamre, technical coordinators. 1992. Ecology and management of oak and associated woodlands: Perspectives in the Southwestern United States and Northern Mexico. General Technical Report RM-218. Fort Collins, CO: USDA Forest Service Rocky Mountain Experiment Station.

Ffolliott, P.F. and others, technical coordinators. 1996. Effects of fire on Madrean Province ecosystems. Proceeding from the second conference on the Madrean Archipelago/Sky Island ecosystem, 11-15 March 1996, Tucson, AZ. General Technical Report RM-GTR-289. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 277 pp.

Germaine, H.L. and G.R. McPherson. 1999. Effects of biotic factors on emergence and survival of Quercus emoryi at lower treeline. Ecoscience 6: 92-99.

Gruell, G.E. 1999. Historical and modern roles of fire in pinyon-juniper. Pages 24-28 in: S.B. Monsen, R. Stevens, R.J. Tausch, R. Miller and S. Goodrich, compilers. Proceedings: ecology and management of pinyon-juniper communities within the Interior West. 15-18 Sept 1997, Provo, UT. Proceedings RMRS-P-9. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.

Haworth, K. and G.R. McPherson. 1994. Effects of Quercus emoryi on herbaceous vegetation in a semi-arid savanna. Vegetation 112: 153-159.

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

McClaran, M.P. and G.R. McPherson. 1999. Oak savanna of the American Southwest. Pages 275-287 in R.C. Anderson, J.S. Fralish and J. Baskin, editors, Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge University Press, Cambridge, England.

McNab, W.H. and P.E. Avers. 1994. Ecological subregions of the United States: section descriptions. USDA Forest Service, Ecosystem Management, Washington DC. WO-WSA-5. 250 pp. plus appendices and maps.

McPherson, G.R. and J.F. Weltzin. 1998. Response of understory to overstory removal in southwestern oak woodlands. Journal of Range Management 51: 674-678.

McPherson, G.R. and J.F. Weltzin. 2000. The role and importance of disturbance and climate change in U.S./Mexico borderlands: a state-of-the-knowledge review. General Technical Report RMRS-GTR-50. USDA Forest Service, Rocky Mountain Research Station.

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

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.

Poulos, H. M., A. E. Camp, et al. (2007). "A hierarchical approach for scaling forest inventory and fuels data from local to landscape scales in the Davis Mountains, Texas, USA." Forest Ecology and Management **244**: 1-15.

Poulos, H. M., R. Gatewood, et al. (2009). "Fire regimes of the piñon-juniper woodlands of Big Bend National Park and the Davis Mountains, west Texas, USA." Canadian Journal of Forest Research **39**(6): 1236-1246.

Poulos, H. M. and A. E. Camp (2010). "Topographic influences on vegetation mosaics and tree diversity in the Chihuahuan Desert Borderlands." Ecology **91**(4): 1140-1151.

Poulos, H. M., J. Villanueva Díaz, et al. (2013). "Human influences on fire regimes and forest structure in the Chihuahuan Desert Borderlands." Forest Ecology and Management **298**(0): 1-11.

Powell, A.M. 1994. Grasses of the Trans-Pecos and adjacent areas. Austin, TX: University of Texas Press. 377 pp.

Powell, A.M. 1998. Trees and shrubs of the Trans-Pecos and adjacent areas. Austin, TX: University of Texas Press. 498 pp.

Romme, W.H., L. Floyd-Hanna and D. Hanna. 2003. Ancient pinyon-juniper forests of Mesa Verde and the West: a cautionary note for forest restoration programs. Pages 335-350 in: P.N. Omi and L.A. Joyce. tech. eds. Fire, fuel treatments, and ecological restoration: conference proceedings. 16-18 April 2002. Fort Collins, CO. Proceedings RMRS-P-29. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 475 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.

Schussman, H. and E. Smith. 2006. Historical range of variation and state and transition modeling of historic and current landscape conditions for potential natural vegetation types of the Southwest. Southwest Forest Association Project. The Nature Conservancy Arizona report.

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.

Swetnam, T.W. and C.H. Baisan. 1994. Historical fire regime patterns in the southwestern United States since AD 1700. Pages 11-32 in: C.D. Allen, ed. Fire effects in southwestern forests: proceedings of the second La Mesa fire symposium. General Technical Report RM-GTR-286. Fort Collins, CO: USDA Forest Service Rocky Mountain Forest and Range Experiment Station.

Swetnam, T.W. and C.H. Baisan. 1996. Fire histories of montane forests in the Madrean Borderlands. Pages 15-36 in: P.F. Ffolliott and others, technical coordinators. Effects of fire on Madrean Province ecosystems. Proceeding from the second conference on the Madrean Archipelago/Sky Island ecosystem, 11-15 March 1996, Tucson, AZ. General Technical Report RM-GTR-289. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 277 pp.

Tausch, R.J. and N.E. West. 1987. Differential establishment of Pinyon and Juniper following fire. 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].

Webster, G.L. and C.J. Bahre (editors) 2001. Changing Plant Life of La Frontera: Observations on Vegetation in the United States/Mexico Borderlands. University of New Mexico Press, Albuquerque. 260 pp.

Weltzin, J.F. and G.R. McPherson. 1999. Facilitation of conspecific seedling recruitment and shifts in temperate savanna ecotones. Ecological Monographs 69: 513-534.

Weltzin, J.F. and G.R. McPherson. 2000. Implications of precipitation redistribution for shifts in temperate savanna ecotones. Ecology 81: 1902-1913.

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.