11090

Sonoran Paloverde-Mixed Cacti Desert Scrub

BpS Model/Description Version: Aug. 2020

Vegetation Type

Shrubland

Map Zones

15, 25

Geographic Range

West of the Colorado River, this ecological system occurs at low elevations in association with xeroriparian features and low foothills.

Biophysical Site Description

System typically found below 1,200m, with rare occurrences up to 1,400m. With decreasing elevation, the system typically occurs in xeroriparian habitats and on rock outcrops. In uplands, the system is found on coarse soils that may be associated with poorly developed geomorphic surfaces; at lower elevations, it is found on very stable geomorphic surfaces.

Extended periods of drought or episodes of extreme cold limit this type. Specifically, establishment of dominant species is constrained by decadal or longer periods of below-average precipitation (Turner et al. 1995). Twenty-four hours of below-freezing temperature causes nearly total mortality of the dominant plants. At the southern end of the system's range, interference from more mesic species apparently constrains distribution of this system (Turner et al. 1995).

Vegetation Description

Dominant overstory plants include giant saguaro, palo verde, barrel cactus, and ocotillo. Velvet mesquite, catclaw acacia, and ironwood sometimes are co-dominant species. Bursage is the dominant understory species, and it serves as a frequent nurse plant for the dominant overstory plants (McAuliffe 1988).

Cover of dominant overstory plants ranges from ~1-20%. The number and variety of life-forms ranges from few to many and apparently is controlled to a great extent by soil moisture, as mediated by geomorphic conditions (Brown 1982).

Plant species composition varies significantly over at least two temporal scales. At the annual scale of resolution, above-average precipitation during the winter engenders development of considerable cover and biomass of annual cool-season plants (notably including *Plantago* spp.). At decadal to century-long scales, extended periods of below-average precipitation and episodes of extremely low temperatures cause thinning and, in exceptional cases, replacement of dominant overstory species.

BpS Dominant and Indicator Species

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

Disturbance Description

This system is not thought to have supported fuel loads to sustain large fires prior to European habitation of the region. Fires would have been associated with dry lightning coincident with monsoonal storms during years when previous winter precipitation was sufficient to create a thick fine-fuel bed of annual plants. Fires probably were associated with dry lightning and very patchy due to heavier fuel in patchy microsites or linear when high winds were associated with convection storms.

Replacement fires were very rare or absent (mean fire return interval of 100-1,000yrs and perhaps longer). If they occurred, they did so during conditions of extreme fire behavior after consecutive years of above-average winter precipitation. These rare fires -- which may or may not have occurred -- had tremendous influence on community structure because the dominant overstory plants are extremely susceptible to fires, even those of low intensity (McLaughlin and Bowers 1982; Esque et al. 2004).

Prolonged weather-related stress (drought or frost) thinned dominant overstory plants and, in rare cases, led to stand replacement. We speculate that these events occurred with similar frequency as stand-replacing fires. (In the VDDT model, drought was modeled as "wind/weather/stress" and lethal frost was modeled as "Optional 1.")

Large (presumably old) saguaro plants are susceptible to windthrow, particularly after rainstorms saturate the soil.

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

Within this system, the most common disturbance is blowdown of single plants, or small groups, of saguaro.

Perhaps more important are the infrequent stand-replacing events of fire, drought, and severe cold that affect very large areas.

Adjacency or Identification Concerns

This system is bordered at upper elevations by semi-desert grasslands or Mojave-Sonora Semi-Desert Chaparral (BpS 1108) and at lower elevations or poorly developed geomorphic surfaces by Sonora-Mojave Creosote-White Bursage Desert Scrub (BpS 1087).

This system occurs at lower elevations than Colorado Plateau Pinyon-Juniper Woodland (BpS 1016) where sympatric.

Two major modern issues, climate change and invasive non-native plant species (especially the annual grasses red brome and Mediterranean grass and the perennial grass buffalograss), 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 increased fire frequency, resulting in more intense and widespread fires. Moreover, fire from adjacent BpSs invaded by annual grasses will spread more frequently into BpS 1109, which is exceptionally fire sensitive.

Issues or Problems

West of the Colorado River, fire probably was extremely rare because the vegetation is quite sparse.

There is much uncertainty in model parameters, particularly with respect to the return interval of fire, drought, and lethal cold temperatures.

Native Uncharacteristic Conditions

In map zone (MZ) 13, but not MZ14, cover values >30% are uncharacteristic. Above-average precipitation during the winter engenders development of considerable cover and biomass of annual cool-season plants (notably including *Plantago* spp.). When followed by dry, windy weather and an ignition source (primarily lightning), this phenomenon may contribute to stand-replacement fires across 10s of 1,000s of acres. However, this speculation is supported by a single anecdote from a potentially dissimilar ecosystem.

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 6 Early Development 1 - Open

Indicator Species

Description

Initial post-disturbance community dominated by brittlebush.

*Maximum Tree Size Class*  
None

Class B 19 Mid Development 1 - Open

Indicator Species

Description

Dominated by brittlebush and early-seral shrubs. Dominant succulents and woody plants have established beneath brittlebush plants.

*Maximum Tree Size Class*  
None

Class C 75 Late Development 1 - Closed

Upper-layer lifeform is not the dominant lifeform. Dominant lifeform is bursage with canopy cover of 5-30%, and height is 0.1-0.3m.

Indicator Species

Description

Succulent- and small-tree-dominated community. Persists until infrequent replacement fire or climatic event (drought and frost).

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

Model Parameters

Deterministic Transitions

Probabilistic Transitions

Optional Disturbances

Optional 1: lethal frost

References

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.

Brown, D.E. (editor) 1982. Biotic communities of the American Southwest -- United States and Mexico. Desert Plants 4(1-4): 1-342.

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.

Esque, T.C., C.R. Schwalbe, D.F. Haines and W.L. Halvorson. 2004. Saguaros under siege: invasive species and fire. Desert Plants 20(1): 49-55.

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.

Humphrey, R.R. 1974. Fire in the deserts and desert grassland of North America. Pp. 365-400 in Fire and Ecosystems. Academic Press, New York.

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

McAuliffe, J.R. 1988. Markovian dynamics of simple and complex desert plant communities. American Naturalist 131: 459-490.

McLaughlin, S.P. and J.E. Bowers. 1982. Effects of fire on a Sonoran Desert community. Ecology 63: 246-248.

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.

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.

Turner, R.M. J.E. Bowers, and T.L. Burgess. 1995. Sonoran Desert Plants: An Ecological Atlas. University of Arizona Press. 504 pp.

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].