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Sonoran Paloverde-Mixed Cacti Desert Scrub

BpS Model/Description Version: Aug. 2020

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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

Symbol	Scientific Name	Common Name
PARKI2	<i>Parkinsonia</i>	Paloverde
CAGI10	<i>Carnegiea gigantea</i>	Saguaro
FEROC	<i>Ferocactus</i>	Barrel cactus
FOSP2	<i>Fouquieria splendens</i>	Ocotillo
ACGR	<i>Acacia greggii</i>	Catclaw acacia
PRVE	<i>Prosopis velutina</i>	Velvet mesquite

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

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	1045	100	50	10000
Moderate (Mixed)				
Low (Surface)				
All Fires	1045	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

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

[illegible]

Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	B	B	B	B	B	B	B	B	B	B	B
Shrub	0.5-1.0	B	B	B	B	B	B	B	B	B	B	B
Shrub	1.0-3.0	B	B	B	B	B	B	B	B	B	B	B
Shrub	>3.0	B	B	B	B	B	B	B	B	B	B	B
Tree	0-5	C	C	C	C	C	C	C	C	C	C	C
Tree	5-10	C	C	C	C	C	C	C	C	C	C	C
Tree	10-25	C	C	C	C	C	C	C	C	C	C	C
Tree	25-50	C	C	C	C	C	C	C	C	C	C	C
Tree	>50	C	C	C	C	C	C	C	C	C	C	C

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

Symbol	Scientific Name	Common Name	Canopy Position
ENFA	Encelia farinosa	Goldenhills	Upper

Description

Initial post-disturbance community dominated by brittlebush.

Maximum Tree Size Class

None

Class B 19 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ENFA	Encelia farinosa	Goldenhills	Upper

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

Symbol	Scientific Name	Common Name	Canopy Position
ENFA	Encelia farinosa	Goldenhills	Lower
PARKI2	Parkinsonia	Paloverde	Upper
CAGI10	Carnegiea gigantea	Saguaro	Upper
FEROC	Ferocactus	Barrel cactus	Upper

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

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:OPN	0	Mid1:OPN	19
Mid1:OPN	20	Late1:CLS	94
Late1:CLS	95	Late1:CLS	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
Wind or Weather or Stress	Mid1:OPN	Early1:OPN	0.001	1000	Yes	0
Replacement Fire	Mid1:OPN	Early1:OPN	0.001	1000	Yes	0
Optional 1	Mid1:OPN	Early1:OPN	0.001	1000	Yes	0
Wind or Weather or Stress	Late1:CLS	Early1:OPN	0.001	1000	Yes	0
Replacement Fire	Late1:CLS	Early1:OPN	0.001	1000	Yes	0
Optional 1	Late1:CLS	Early1:OPN	0.001	1000	Yes	0

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. Saguaro 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].