

11090

Sonoran Paloverde-Mixed Cacti Desert Scrub

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Shrubland

Map Zones

4, 13

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 temperatures cause near-total mortality of 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, paloverde, barrel cactus, and ocotillo. Velvet mesquite, catclaw acacia, and ironwood are sometimes 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 about 1-20%. The number and variety of lifeforms range from few to many and, apparently, are 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 timescales, 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 associated with dry lightning were coincident with monsoonal storms during years when previous winter precipitation was sufficient to create a thick, fine-fuel bed of annual plants. Fires were probably very patchy as a result of heavier fuels in patchy microsites, or linear when high winds were associated with convection storms.

Replacement fire was very rare or absent (average fire return interval, 100-1,000yrs, and perhaps longer). If it occurred, it 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 fire, even those of low intensity (McLaughlin and Bowers 1982; Esque et al. 2004).

Prolonged weather-related stress 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.

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	1292	100	50	10000
Moderate (Mixed)				
Low (Surface)				
All Fires	1292	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 tens of thousands of acres, although the more common scale is thousands 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 (biophysical setting [BPS] 1108) and at lower elevations or on poorly developed geomorphic surfaces by Sonora-Mojave Creosote-White Bursage Desert Scrub (BPS 1087).

Two major modern issues -- climate change and invasive nonnative plant species (especially the annual grasses red brome and Mediterranean grass, and perennial grass buffalograss) -- led to non-equilibrium 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 and result in more intense, widespread fires. Moreover, fire from adjacent BpSs invaded by annual grasses spreads more frequently into in BpS 1109, which is exceptionally fire sensitive.

Issues or Problems

West of the Colorado River, fire was probably extremely rare, because 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% (remote sensing) 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 the presence of an ignition source (primarily lightning), this phenomenon may contribute to stand-replacement fire across tens of thousands of acres. However, this speculation is supported by a single anecdote from a potentially dissimilar ecosystem.

Comments

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	UN	UN	UN	UN	UN	UN	UN
Herb	0.5-1.0	A	A	A	UN	UN	UN	UN	UN	UN	UN
Herb	>1.0	A	A	A	UN	UN	UN	UN	UN	UN	UN
Shrub	0-0.5	B	B	B	UN	UN	UN	UN	UN	UN	UN
Shrub	0.5-1.0	B	B	B	UN	UN	UN	UN	UN	UN	UN
Shrub	1.0-3.0	B	B	B	UN	UN	UN	UN	UN	UN	UN
Shrub	>3.0	B	B	B	UN	UN	UN	UN	UN	UN	UN
Tree	0-5	C	C	C	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	C	C	C	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	C	C	C	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	C	C	C	UN	UN	UN	UN	UN	UN	UN
Tree	>50	C	C	C	UN	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	5	Early Development 1 - Open
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ENFA	<i>Encelia farinosa</i>	Goldenhills	Upper

Description

Initial post-disturbance community dominated by brittlebush.

Maximum Tree Size Class

None

Class B	19	Mid Development 1 - Open
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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	76	Late Development 1 - Closed
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Upper Layer Lifeform Is Not the Dominant Lifeform

Dominant lifeform is bursage, with canopy cover of 5-30% and height of 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, 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
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: Frost

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