

Ecological site R040XA125AZ Sandy Bottom, Woodland 10"-13" p.z.

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 040X–Sonoran Basin and Range

Major Land Resource Area (MLRA) 40 is the portion of Sonoran Desert that extends from northwest Mexico into southwestern Arizona and southeastern California. This MLRA is hot desert characterized by bimodal precipitation coupled with hot summers and mild winters. These conditions give rise to a rich biological diversity visually dominated by columnar cactus (saguaro) and leguminous trees (palo verde). This unit occurs within the Basin and Range Physiographic Province and is characterized by numerous mountain ranges that rise abruptly from broad, plain-like valleys and basins. Igneous and metamorphic rock classes dominate the mountain ranges, and basin sediments are combinations of fluvial, lacustrine, colluvial and alluvial deposits.

LRU notes

Land Resource Unit (LRU) 40-1, Upper Sonoran Desert, is characterized by desert scrub vegetation with no desert pavement present. Trees grow on uplands as well as in washes and on hillslopes. Elevations range from 2000 to 3800 feet, and precipitation averages 10 to 13 inches per year. Vegetation includes saguaro, palo verde, mesquite, creosotebush, triangle bursage, prickly pear, cholla, limberbush, wolfberry, bush muhly, threeawns, ocotillo, and globe mallow. The soil temperature regime is thermic and the soil moisture regime is typic aridic.

Classification relationships

USDA-NRCS Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin: Western Range and Irrigated Region D Major Land Resource Area 40 - Sonoran Basin and Range Land Resource Unit 1 - Upper Sonoran Desert Ecological Site Sandy Bottom, Woodland, 10"-13" p.z.

U.S. Environmental Protection Agency, Ecological Regions of North America: Level I, Region 10 North American Deserts Level II, 10.2 Warm Deserts Level III, Ecoregion 81, Sonoran Basin and Range Level IV, 81I, 81n, 81o

USDA-USFS Ecological Subregions: Sections of the Conterminous United States Section 322 American Semidesert and Desert Province Section 322B, Sonoran Desert

Ecological site concept

Sandy Bottom, Woodland, 10"–13" p.z. occurs on a bottom position, receiving both rainfall and run-on moisture. The shallow water table fluctuates in depth but is available to the plant community year-round. Soils have visible redoximorphic features with 80" of surface. Reference plant community is dominated by tall trees with a diverse understory. Obligate and facultative wetland plants occur along reaches of surface or near surface water flow. Aspect is a gallery woodland.

Associated sites

R040XA124AZ	Loamy Bottom, Woodland 10"-13" p.z. adjacent stream terraces, no soil redox features
R040XA115AZ	Sandy Wash 10"-13" p.z. stream channel with ephemeral water flows, no soil redox features

Similar sites

F040XB215AZ	Sandy Bottom, Woodland 7" - 10" p.z. Elevations 1,200' to 2,000'
F040XC327AZ	Sandy Bottom, Woodland 3"-7" p.z. Elevations 300' to 1,200'

Table 1. Dominant plant species

Tree	(1) <i>Populus fremontii</i> (2) <i>Salix gooddingii</i>
Shrub	Not specified
Herbaceous	(1) <i>Sporobolus wrightii</i>

Physiographic features

This site occurs on floodplains, low stream terraces and in channels of major drainageways and first and second order tributaries. The site experiences regular overbank flood events, and has a shallow water table, ranging from 3 to 10 feet in depth. Slopes range from 0% to 2%, and elevations range from 2200 to 3600 feet.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace (3) Channel
Elevation	671–1,097 m
Slope	0–2%

Climatic features

Annual precipitation ranges from 10 to 13 inches in the southern part of this LRU, with elevations between 1900 and 3200 feet. Annual precipitation in the northern part ranges from 11 to 14 inches, with elevations between 2000 and 3800 feet. Rainfall ratios range from 40:60 (winter:summer) in the southern part, 50:50 in the central portion, and 60:40 in the northern part.

Overall, average annual rainfall is variable, but increases in variability from east to west across the region. For long-term precipitation data, the coefficient of variation, the ratio of the standard deviation to the mean expressed as a percentage, increases from 29% at Tucson (east) to 36% at Carefree (west).

Rainfall intensity differs between rainfall seasons. Winter frontal storms develop in the Pacific Ocean and Gulf of California, producing widespread, low-intensity and long duration precipitation events. Snowfall is rare and seldom last for more than a few hours. During summer months (July-September), atmospheric activity in the Gulf of Mexico produces convective thunderstorms of short duration, usually less than 30 minutes, but of moderate to heavy intensity. May and June are the driest months of the year. Humidity is generally very low.

Winter temperatures are mild, with only a few days of freezing temperatures overnight. Summer temperatures are warm to hot, with several days in June and July exceeding 105°F.

Spring and the summer growing seasons are equally important for perennial grass, forb and shrub growth. With above average precipitation, cool and warm season annual forbs and grasses can be common in their respective seasons. Perennial forage species can remain green throughout the year with sufficient available moisture.

Influencing water features

Soil features

These are very young soils on sandy and gravelly alluvium of mixed origin. Soils are deep and have excellent plant-soil moisture relationships due to shallow water tables.

Table 3. Representative soil features

Surface texture	(1) Gravelly sandy loam (2) Loamy fine sand (3) Fine sandy loam
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to well drained
Permeability class	Rapid to moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–30%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	6.35–10.67 cm
Calcium carbonate equivalent (0-101.6cm)	0–3%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–65%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

Sandy Bottom, Woodland, 10-13" p.z. is a gallery woodland associated with large perennial water courses. Dominated by cottonwood and willow, the site is vulnerable to invasion from saltcedar.

State and transition model

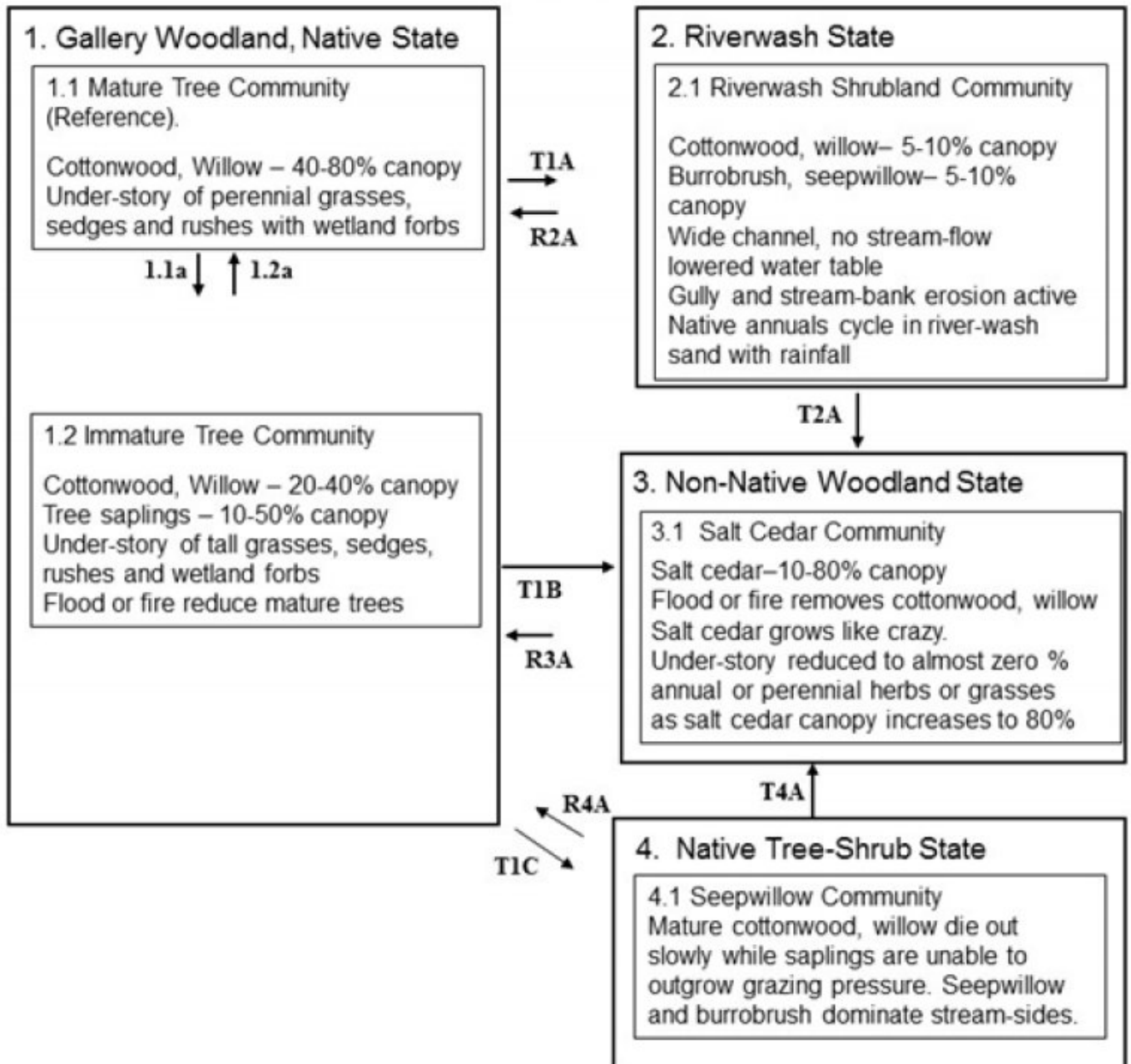


Figure 1. Sandy Bottom, Woodland STM

<p>Transition Pathways</p> <p>T1A. Water-table depleted by groundwater pumping to greater than 20 feet. Mature trees die back to a reduced canopy that periodic flooding can support. Bank erosion widens channel area and wetland grasses and forbs are replaced by annuals. HYMO and BASA colonize areas of river-wash. No return, if pumping is associated with urban areas or development.</p> <p>T1B, T2A, T5A. Introduction of a seed source for salt cedar. As fires, age and floods remove POFR and SAGO, salt cedar increases to assume dominance. As salt cedar canopy closes to 80%, the under-story vegetation is reduced to zero.</p> <p>T1C. CHG. Mature POFR and SAGO die from age, fire or flood. Reproduction of POFR and SAGO is heavily grazed and little recruitment occurs. BASA and HYMO dominate the stream bank vegetation; bermuda, Johnson grass and exotic annuals dominate the under-story vegetation.</p> <p>Restoration Pathways</p> <p>R2A. Cessation of groundwater pumping may allow water tables to rise over time to within 20 feet of the surface. Time depends on depth of depletion and amount of pumping reduced. This will not occur in urban or developing areas unless treated sewage effluent is discharged into the stream system.</p> <p>R4A. Unknown, possible herbicide control of salt cedar and replanting of POFR and SAGO from dormant poles on limited acres. Biological control of salt cedar may be possible using a leaf beetle from China called <i>Diorhabda elongata</i>.</p> <p>R5A. PG/NG will result in return to POFR and SAGO dominance in less than 20 years. Trees will reach maturity in 50-70 years. Native perennial grasses and wetland forbs replace bermuda.</p>

Figure 2. Sandy bottom, woodland, 10-13" p.z. STM Legend

State 1
Gallery Woodland, Native State

Community 1.1
Mature Tree Community (Reference)

Cottonwood and willow dominated, with 40%-80% canopy cover, with an understory of perennial grasses, sedges, rushes, and wetland forbs.

Table 4. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	841	–	1261
Total	841	–	1261

Community 1.2

Immature Tree Community

Cottonwood and willow occupy between 20%-40% of the canopy cover, with tree saplings occupying 10%-50% of the canopy. Understory of tall grasses, sedges, rushes and wetland forbs. Flood or fire reduce mature tree cover.

State 2

Riverwash State

Wide channel, with no streamflow and a lowered water table. Active gully and streambank erosion processes. Native annuals occur on riverwash sands in response to rainfall.

Community 2.1

Riverwash Shrubland Community

Cottonwood and willow occupy 5%-10% of the canopy, with burrobrush and seepwillow also occupying 5%-10% of the canopy.

State 3

Non-Native Woodland State

Cottonwood and willow cover eliminated by flood or fire. Saltcedar rapidly colonizes and achieves up to 80% cover. Understory cover reduced to near zero.

Community 3.1

Salt Cedar Community

Saltcedar occupies from 10%-80% of the canopy. As saltcedar canopy increases, understory decreases or is eliminated.

State 4

Native Tree-Shrub State

Mature cottonwood and willow slowly die out, and saplings remain stunted due to grazing pressure. Seepwillow and burrobrush dominate streambanks.

Community 4.1

Seepwillow Community

Seepwillow and burrobrush dominate streambanks.

Transition T1A

State 1 to 2

Water table is lowered to a depth of greater than 20' by groundwater pumping. Mature trees die back to a level supported by periodic flooding.

Constraints to recovery. Site cannot recover without elimination of groundwater pumping.

Transition T1B

State 1 to 3

Saltcedar introduction.

Transition T1C

State 1 to 4

Continuous heavy grazing suppresses cottonwood and willow seedling maturation. Old trees die-out.

Restoration pathway R2A

State 2 to 1

Cessation of pumping may permit groundwater level to rise with time.

Transition T2A

State 2 to 3

Saltcedar introduction.

Restoration pathway R3A

State 3 to 1

Unknown.

Restoration pathway R4A

State 4 to 1

Unknown.

Transition T4A

State 4 to 3

Saltcedar introduction.

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				158–211	
	saltgrass	DISP	<i>Distichlis spicata</i>	158–211	–
	knotgrass	PADI6	<i>Paspalum distichum</i>	158–211	–
	vine mesquite	PAOB	<i>Panicum obtusum</i>	158–211	–
2				53–105	
	Havard's threeawn	ARHA3	<i>Aristida havardii</i>	53–105	–
	spidergrass	ARTE3	<i>Aristida ternipes</i>	53–105	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	53–105	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	53–105	–
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	53–105	–
	squirreltail	ELELE	<i>Elymus elymoides</i> ssp. <i>elymoides</i>	53–105	–
	green sprangletop	LEDU	<i>Leptochloa dubia</i>	53–105	–
	rice cutgrass	LEOR	<i>Leersia oryzoides</i>	53–105	–
	mat muhly	MURI	<i>Muhlenbergia richardsonis</i>	53–105	–
	whiplash pappusgrass	PAVA2	<i>Pappophorum vaginatum</i>	53–105	–
	plains bristlegrass	SEVU2	<i>Setaria vulpiseta</i>	53–105	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	53–105	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	53–105	–
	mesa dropseed	SPFL2	<i>Sporobolus flexuosus</i>	53–105	–
	big sacaton	SPWR2	<i>Sporobolus wrightii</i>	53–105	–

3				53-105	
	sedge	CAREX	<i>Carex</i>	53-105	-
	flatsedge	CYPER	<i>Cyperus</i>	53-105	-
	rush	JUNCU	<i>Juncus</i>	53-105	-
4				11-105	
	prairie threeawn	AROL	<i>Aristida oligantha</i>	11-105	-
	Rothrock's grama	BORO2	<i>Bouteloua rothrockii</i>	11-105	-
	Arizona brome	BRAR4	<i>Bromus arizonicus</i>	11-105	-
	brome	BROMU	<i>Bromus</i>	11-105	-
	feather fingergrass	CHVI4	<i>Chloris virgata</i>	11-105	-
	canyon cupgrass	ERLE7	<i>Eriochloa lemmonii</i>	11-105	-
	pitscale grass	HAGR3	<i>Hackelochloa granularis</i>	11-105	-
	bearded sprangletop	LEFUF	<i>Leptochloa fusca ssp. fascicularis</i>	11-105	-
	Mexican sprangletop	LEFUU	<i>Leptochloa fusca ssp. uninervia</i>	11-105	-
	mucronate sprangletop	LEPAB	<i>Leptochloa panicea ssp. brachiata</i>	11-105	-
	delicate muhly	MUFR	<i>Muhlenbergia fragilis</i>	11-105	-
	witchgrass	PACA6	<i>Panicum capillare</i>	11-105	-
	Arizona signalgrass	URAR	<i>Urochloa arizonica</i>	11-105	-
Forb					
5				28-140	
	bigseed alfalfa dodder	CUIN	<i>Cuscuta indecora</i>	28-140	-
	mesquite mistletoe	PHCA8	<i>Phoradendron californicum</i>	28-140	-
	oak mistletoe	PHLE14	<i>Phoradendron leucarpum</i>	28-140	-

Animal community

Grazing pressure should be managed to allow for periodic reproduction of Fremont cottonwood and Godding's willow. Cottonwood and willow seeds will germinate on fresh alluvium deposited by spring or summer floods. Seedlings require one full season to outgrow the reach of grazing livestock. Summer seedlings may require two seasons to reach a height where the terminal bud is out of reach. Seedlings of both species are very palatable to cattle.

Wood products

High water tables and very erodible soils limit wood production on this site. The wildlife habitat value of the site is many times greater than the value for any commercial wood products. Wood removal and cutting should be limited to flood damaged and fallen trees and driftwood.

Type locality

Location 1: Maricopa County, AZ	
Township/Range/Section	T7N R4W S20
General legal description	Phoenix FO - Hassayampa River Preserve - Nature Conservancy
Location 2: Pima County, AZ	
Township/Range/Section	T16S R17E S29
General legal description	Tucson FO - Cienaga Creek - Pima County Property
Location 3: Gila County, AZ	

Township/Range/Section	T4S R17E S34
General legal description	San Carlos FO - Mineral Strip, Deer Creek
Location 4: Pima County, AZ	
Township/Range/Section	T6S R16E S17
General legal description	Tucson FO - San Pedro River between Dudleyville and Winkleman - NW 1/4 Sec.17

Other references

Griffith, G.E., Omernik, J.M., Johnson, C.B., and Turner, D.S., 2014, Ecoregions of Arizona (poster): U.S. Geological Survey Open-File Report 2014-1141, with map, scale 1:1,325,000, <https://dx.doi.org/10.3133/ofr20141141>. ISSN 2331-1258 (online)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Contributors

Dan Robinett, original author
Wilma J Renken, revisions

Approval

Kendra Moseley, 10/17/2024

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	11/24/2024
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**
-
5. **Number of gullies and erosion associated with gullies:**
-
6. **Extent of wind scoured, blowouts and/or depositional areas:**
-
7. **Amount of litter movement (describe size and distance expected to travel):**
-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**
-
12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**
- Dominant:
- Sub-dominant:
- Other:
- Additional:
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**
-
14. **Average percent litter cover (%) and depth (in):**
-
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**
