USDA Natural Resources
Conservation Service

Ecological site QX197X01X501
Mangrove Swamp

Last updated: 6/12/2025
Accessed: 03/12/2026

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): 197X–Volcanic Islands of American Samoa

This MLRA consists of the islands of Tutuila, Aunuu, Ofu, Olosega, and Tau. The islands have extremely steep, highly dissected mountains, small valleys, and a narrow coastal plain. More than half of the area has slopes of more than 70 percent. The highest elevations are 3,056 feet (931 meters) on Tau and 2,142 feet (653 meters) on Tutuila. The islands consist of Pleistocene-age, basic igneous rocks, mainly basalt with some andesite and trachyte (USDA-NRCS, 2006).

The climate is moist, warm, and humid. Average annual rainfall ranges from 125 inches (3,175 millimeters) to more than 250 inches (6,350 millimeters). Rainfall varies over short distances due to topography. The driest months are June through September; the wettest months are December through March. Average annual temperature is 81 degrees F (27 degrees C). Relative humidity is 73 to 90 percent throughout the year. Prevailing winds are easterly trade winds. Cyclones occasionally strike the area (USDA-NRCS, 2006).

Soils are Mollisols, Andisols, Entisols, Oxisols, and Histosols. Soil moisture regimes are udic or perudic; the soil temperature regime is isohyperthermic. Natural vegetation is mostly tropical hardwood forest (USDA-NRCS, 2006).

Classification relationships

This ecological site occurs within Major Land Resource Area (MLRA) 197 – Volcanic Islands of American Samoa.

Ecological site concept

This ecological site occurs on the islands of Tutuila and Aunuu in American Samoa. It occurs on nearly level (0 to 1 percent) coastal plains at elevations ranging from 0 to 20 feet (0 to 6 meters) elevation. It is most easily accessible along the Pala Lagoon shore at Pago Pago on Tutuila (USDA-SCS, 1984).

Soils are in the Histosols order. They consist of mucky peat that formed from organic matter derived from mangrove roots and litter deposited along the seashore of coastal plains. Soil temperature regimes are isohyperthermic; soil moisture regimes are aquic. Average annual rainfall ranges from 125 to 225 inches (3130 to 5630 millimeters). Water runoff is very slow and ponded in spots, and flooding by seawater occurs twice daily at a duration of 12 hours daily. Effective rooting depth is 40 to 60 inches (100 to 150 centimeters) (USDA-SCS, 1984).

This ecological site is forest consisting of shorter, more salt-resistant *Rhizophora mangle* facing the sea and taller (to 53 feet or 15 meters) Bruguiera gymnorrhiza on the landward side. The forest floor is bare except for mangrove seedlings. The landward forest, being protected from salt spray, supports many epiphytes (USDA-SCS, 1984; Whistler, 2002).

Associated sites

QX197X01X502	**Sandy Littoral Forest** Sandy Littoral Forest occurs on coastlines and on bars adjacent to Mangrove Swamp. Soils are somewhat excessively to excessively drained, in contrast with very poorly drained Mangrove Swamp soils.
QX197X01X504	**Alluvial Valley Forest** Alluvial Valley Forest occurs on valley floors and coastal plains, where it may adjoin Mangrove Swamp. Alluvial Valley Forest differs from Mangrove Swamp in being somewhat poorly drained rather than very poorly drained, having fresh water rather than salt water, and by undergoing occasional, brief flooding rather than twice-daily tidal flooding.
QX197X01X506	**Tuff or Rock Subsurface Forest** Tuff or Rock Subsurface Forest adjoins Mangrove Swamp where uplands and mountain slopes descend to partially-protected areas of the coast that are open to seawater. It occurs on slopes up to 1500 feet in elevation and has well drained soils, in contrast with Mangrove Swamp, which ascends to 20 feet elevation and has very poorly drained soils.

Similar sites

QX197X01X001	**Coastal Marsh** Like Mangrove Swamp, Coastal Marsh occurs on very poorly drained soils to elevations no greater than 20 feet. However, Coastal Marsh is protected from seawater, making its waters fresh rather than saline, undergoes occasional to frequent flooding rather than twice-daily tidal flooding, and is not accessible to mangrove seeds and seedlings.

Table 1. Dominant plant species

Tree	(1) *Rhizophora mangle* (2) *Bruguiera gymnorhiza*
Shrub	Not specified
Herbaceous	Not specified

Legacy ID

F197XY501AS

Physiographic features

This ecological site occurs on organic matter deposited in mangrove swamps. These mangrove swamps are inundated by ocean tides twice daily. Ponding can occur in low spots (USDA-SCS, 1984).

Table 2. Representative physiographic features

Landforms	(1) Island > Mangrove swamp
Runoff class	Very low
Flooding frequency	Frequent
Elevation	0–6 m
Slope	0–1%
Water table depth	0 cm
Aspect	Aspect is not a significant factor

Climatic features

The area is characterized by abundant rain and warm, humid days and nights. Average annual precipitation in this ecological site ranges from 96 to 183 inches (2440 to 4650 millimeters). Mean annual air temperature is 80F (27C). The driest period is June through September (winter), and the wettest is December through March (summer), although heavy showers and long, rainy periods can occur in any month. June, July, and August are the coolest months, and January, February, and March are the warmest. Daytime

temperatures typically reach the upper 80s in summer and the middle 80s F in winter, while nighttime temperatures are in the middle 70s in summer and low 70s in winter.

The prevailing winds throughout the year are the easterly trade winds. They tend to be more directly from the east in December through March and mostly from the east-southeast and southeast during the rest of the year. The trade winds are less prevalent in summer than in winter. About 25 to 30 thunderstorms occur in an average year, mainly during the rainy season. The area lies across the path of tropical disturbances, including cyclones, that come usually from the north, but occasionally from east or west (USDA-SCS, 1984; USDI-FWS, 1982).

Table 3. Representative climatic features

Frost-free period (characteristic range)	365 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	2,438-4,648 mm
Frost-free period (actual range)	365 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	2,438-4,648 mm
Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	4,039 mm

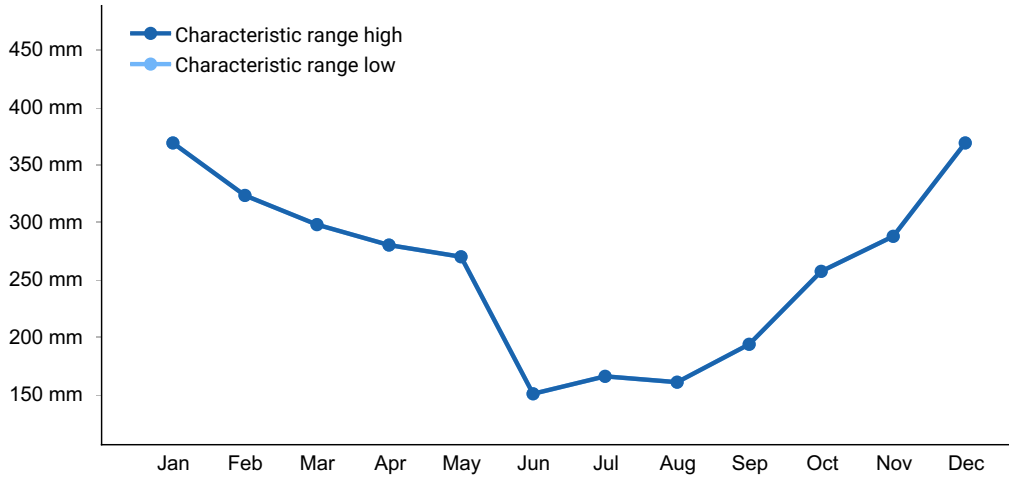

Figure 1. Monthly precipitation range

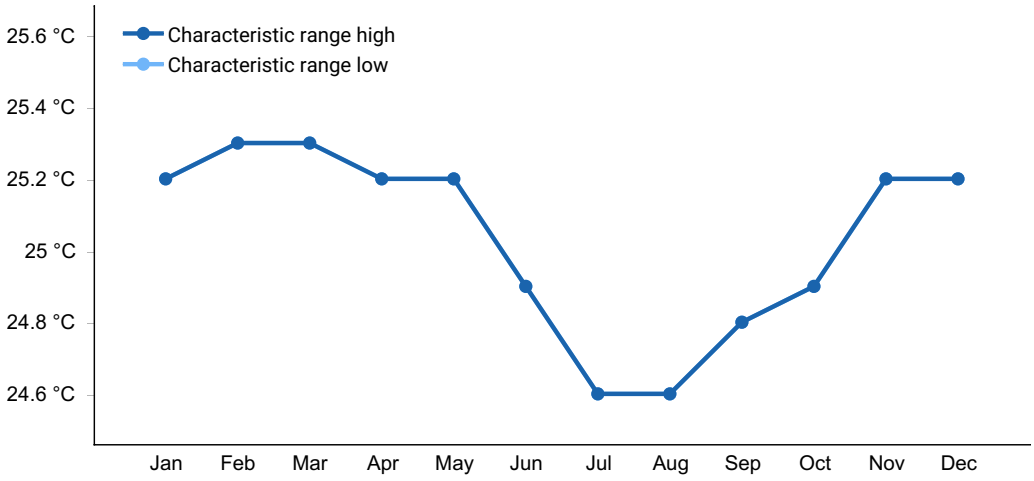

Figure 2. Monthly minimum temperature range

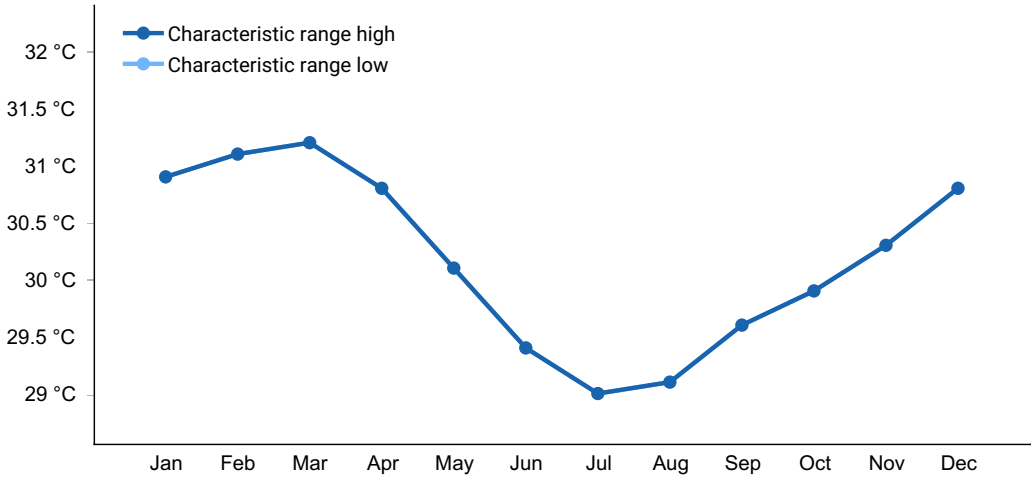

Figure 3. Monthly maximum temperature range

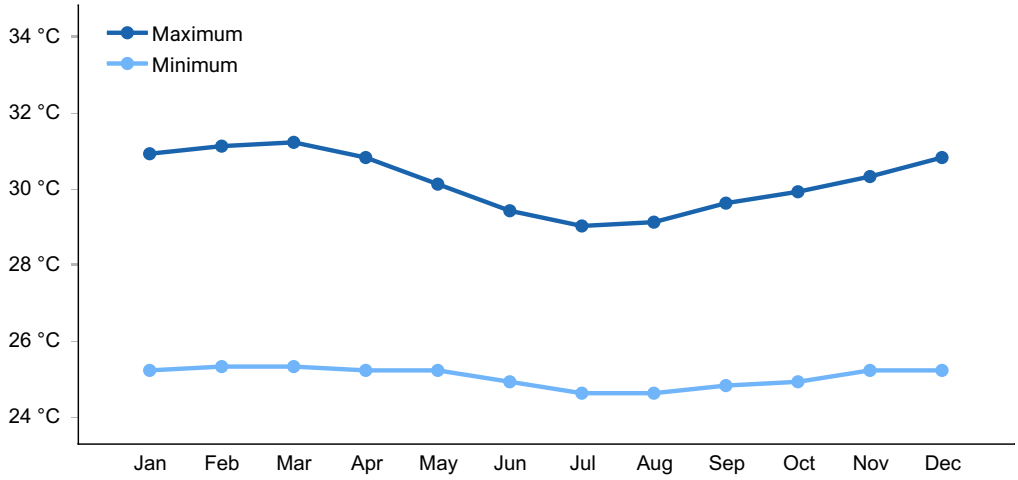

Figure 4. Monthly average minimum and maximum temperature

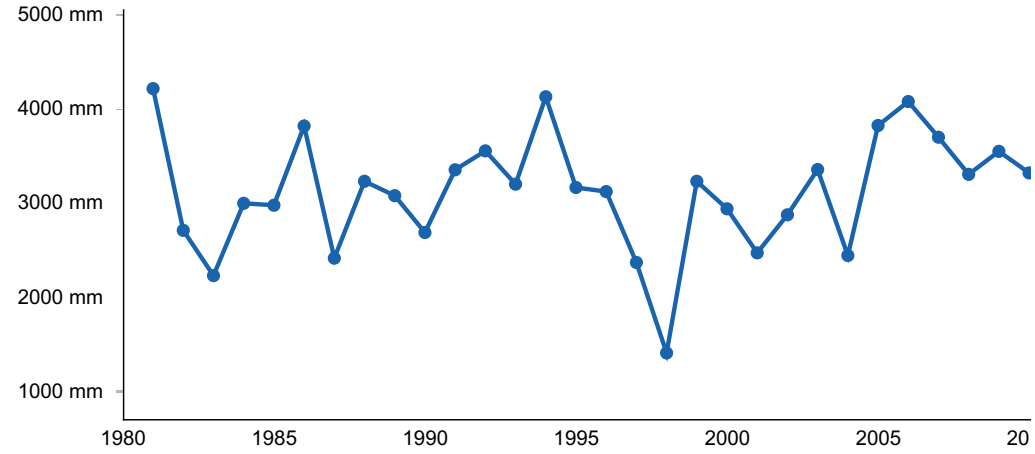

Figure 5. Annual precipitation pattern

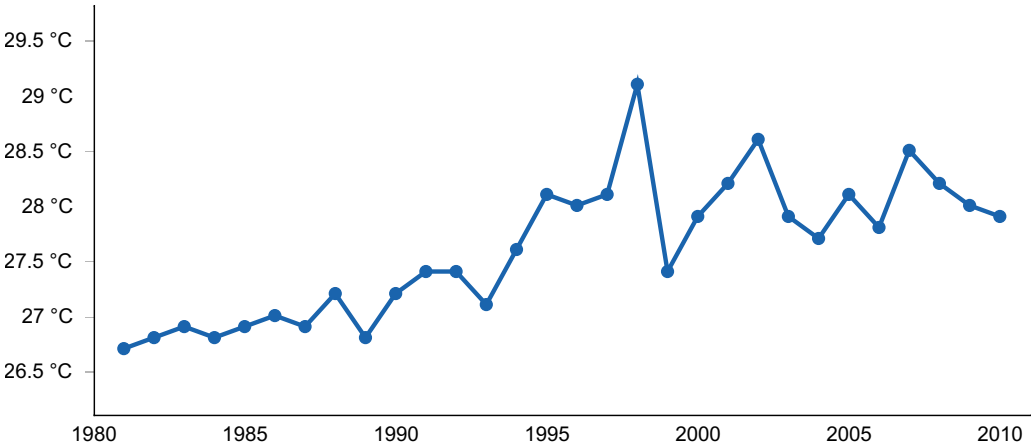

Figure 6. Annual average temperature pattern

Climate stations used

- (1) PAGO PAGO WSO AP [AQW00061705], AS

Influencing water features

These wetlands are classified in the Cowardin system as estuarine, intertidal, forested, broad-leaved evergreen, regularly flooded, euhaline, organic soil (Federal Geographic Data Committee; 2019; USDI-FWS, 1979).

Soil features

NGERUNGOR VARIANT

The one soil in this ecological site, Ngerungor variant mucky peat, is a very poorly drained Histosol that formed from mangrove litter and roots. The soil temperature regime is isohypothermic (very warm) with a mean temperature of 80F (27C). The soil moisture regime is aquic. The soils are flooded by ocean tides twice daily to a depth of about 12 inches (30 centimeters). The water table varies twice daily from 0 to 12 inches (0 to 30

centimeters) below the soil surface. Scattered depressions may remain ponded to various depths between high tides (USDA-SCS, 1984).

Table 4. Representative soil features

Parent material	(1) Organic material
Surface texture	(1) Mucky peat
Drainage class	Very poorly drained
Permeability class	Rapid
Depth to restrictive layer	183 cm
Soil depth	183 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–7.3
Subsurface fragment volume <=3" (0-101.6cm)	0%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

Mangrove swamps occur primarily on coastal areas protected by reefs, headlands, or offshore islands; they may occur in river mouths where fresh water enters ocean. They establish on mudflats, estuaries, and sheltered lagoons where sedimentation is occurring in places to which their seeds or sprouted seedlings can reach by floating in the water (Forestry Program, Division of Community and Natural Resources, 2010; Sene, 2020; Whistler, 2002).

The main natural disturbance is strong storms that can damage and kill mangrove trees. The main human disturbances are wood harvesting and filling to claim areas for building construction (Forestry Program, Division of Community and Natural Resources, 2010;

Sene, 2020; Whistler, 2002).

State and transition model

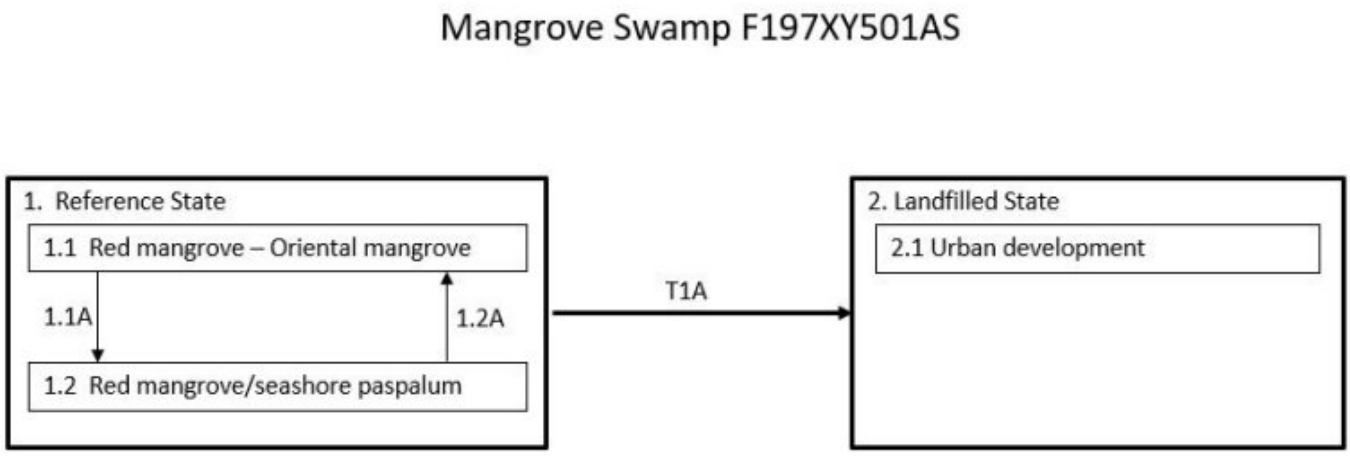

Figure 7. State and Transition Model (STM) for F197XY501AS (Mangrove Swamp).

State 1
Reference State

This state consists of two community phases dominated by dense stands of mangrove trees occurring saline water at the coast. Zonation by mangrove species is caused by different salt tolerance between species. Shorter statured red mangrove (*Rhizophora mangle*) is dominant on outer areas nearer the ocean; taller Oriental mangrove (*Bruguiera gymnorhiza*) is dominant in more sheltered and less saline parts of the forest away from the ocean (Forestry Program, Division of Community and Natural Resources, 2010; Sene, 2020; Whistler, 2002). Storms or intensive wood harvest that destroy small to large patches of the forest may be recolonized initially by red mangrove. Oriental mangrove gradually recovers dominance over red mangrove in areas where it originally dominated because red mangrove is not shade tolerant (Forestry Program, Division of Community and Natural Resources, 2010; Sene, 2020; Whistler, 2002).

Community 1.1
Red mangrove – Oriental mangrove

The dominant trees in this community are Oriental mangrove (*Bruguiera gymnorhiza*), which can grow to about 50 feet (16 meters) tall, red mangrove (*Rhizophora mangle* (syn. samoensis), which is a shrub or small tree, and, in a few locations in American Samoa, puzzlenut tree (*Xylocarpus moluccensis*). Areas dominated by red mangrove support no epiphytes. However, epiphytes are common under Oriental mangrove in inner portions of the forest where they are protected from salt spray. Among these epiphytes are bird's nest fern (*Asplenium nidus*), haresfoot ferns (Davallia spp.), musk fern (Microsorum grossum), orchids (Dendrobia spp.), and the vine fue selela (Hoya australis). Ground cover under Oriental mangrove consists entirely of Oriental mangrove seedling, which eventually die

off in the shade unless a disturbance of the overstory allows them to grow (Forestry Program, Division of Community and Natural Resources, 2010; Sene, 2020; Stemmermann, 1981; Whistler, 2002).

Dominant plant species

- red mangrove (*Rhizophora mangle*), tree
- Oriental mangrove (*Bruguiera gymnorhiza*), tree

Community 1.2
Red mangrove/seashore paspalum

This community phase is dominated by red mangrove or red mangrove with seedlings and saplings of Oriental mangrove that have been released by overstory removal. In places, the introduced grass species seashore paspalum (*Paspalum vaginatum*) persists in sunny openings. Epiphytes are uncommon until Oriental mangrove regrows enough to provide sheltered growing locations (Forestry Program, Division of Community and Natural Resources, 2010; Sene, 2020; Stemmermann, 1981; Whistler, 2002).

Dominant plant species

- red mangrove (*Rhizophora mangle*), tree
- seashore paspalum (*Paspalum vaginatum*), grass

Pathway P1.1A
Community 1.1 to 1.2

This phase change occurs due to heavy damage and tree mortality from storms or overharvesting of wood.

Pathway P1.2A
Community 1.2 to 1.1

This community phase reverts to phase 1.1 with gradual regrowth of mangroves, particularly Oriental mangroves, when given adequate time to recover after disturbance.

State 2
Landfilled State

This state consists of filled land occupied by buildings.

Community 2.1
Urban Development

The hydrologic conditions of mangrove swamp have been obliterated. Vegetation consists of weedy or intentionally planted species (Forestry Program, Division of Community and

Natural Resources, 2010; Sene, 2020; Stemmermann, 1981; Whistler, 2002).

Transition T1A
State 1 to 2

The Reference State (1) Reference transitions to the Landfilled State (2) by intentional filling of the swamp to produce construction sites.

Additional community tables

Other references

Annotated References for F197XY501AS Mangrove Swamp

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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	03/12/2026
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
