USDA Natural Resources
Conservation Service

Ecological site QX197X01X509
Very Steep Forest

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.

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.

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.

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, Ofu, and Olosega in American Samoa. It occurs on very steep (70 to 130 percent) mountain side slopes at elevations ranging from 0 to 2100 feet (0 to 646 meters) elevation. Access is very difficult.

Soils are in the Mollisols and Andisols orders. They formed in volcanic ash and residuum overlying basic igneous rock or cinders. Soil temperature regimes are isohyperthermic; soil moisture regimes are udic. Average annual rainfall ranges from 150 to 250 inches (3750 to 6250 millimeters), and cloud cover and fog occur frequently at the higher elevations of the ecological site. Water runoff is very rapid.

The forest canopy grows to 60 to 80 feet (18 to 25 meters) tall. Ground cover is sparse under the trees and there are few epiphytes.

Associated sites

QX197X01X502	**Sandy Littoral Forest** Sandy Littoral Forest adjoins Very Steep Forest where very steep mountain slopes descend to the sea coast. Sandy Littoral Forest ascends to 15 feet elevation, undergoes occasional, very brief to brief flooding by seawater, and has somewhat excessively to excessively drained soils, in contrast with Very Steep Forest, which occurs on slopes up to 2100 feet in elevation, undergoes no flooding, and has well drained soils.
QX197X01X504	**Alluvial Valley Forest** Alluvial Valley Forest adjoins Very Steep Forest where very steep mountain slopes descend to alluvium-filled valleys near the coast. Alluvial Valley Forest ascends only to 250 feet elevation, undergoes occasional brief flooding, and has somewhat poorly drained soils, in contrast with Very Steep Forest, which occurs on slopes up to 2100 feet in elevation, undergoes no flooding, and has well drained soils.
QX197X01X505	**Skeletal Pachic or Fulvic Forest** Skeletal Pachic or Fulvic Forest adjoins Very Steep Forest where higher-elevation, very steep mountain slopes descend to lower-elevation, less-steep slopes. Skeletal Pachic or Fulvic Forest consists of Fulvudands and Pachic Mollisols on slopes of 6 to 60 percent that have high organic carbon content and high rock content. Very Steep Forest consists of Andisols and Andic Mollisols on slopes of 70 to 130 percent and have variable rock content and lower organic carbon content.

QX197X01X507	**Dry Coastal Forest** Dry Coastal Forest adjoins Very Steep Forest where very steep mountain slopes descend to meet lower-elevation, less-steep slopes. Dry Coastal Forest consists of Andisols on slopes of 0 to 40 percent, at elevations of 0 to 400 feet, and having mean annual rainfall of 120 to 160 inches. Very Steep Forest consists of Andisols, Andic Mollisols, and Mollisols on slopes of 70 to 130 percent, at elevations of 0 to 2100 feet, and having mean annual rainfall of 150 to 250 inches.
QX197X01X508	**Cinder Subsurface Forest** Cinder Subsurface Forest adjoins Very Steep Forest where very steep slopes border on less-steep slopes on mountainsides at high elevations. Cinder Subsurface Forest has slopes of 6 to 40 percent and occurs at elevations of 900 to 3000 feet. Very Steep Forest has slopes of 70 to 130 percent and occurs at elevations of 0 to 2100 feet.

Table 1. Dominant plant species

Tree	(1) *Syzygium* (2) *Canarium*
Shrub	Not specified
Herbaceous	(1) *Freycinetia storckii*

Legacy ID

F197XY509AS

Physiographic features

This ecological site occurs on very steep to nearly vertical mountain slopes.

Table 2. Representative physiographic features

Landforms	(1) Island > Mountain slope
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	0–640 m
Slope	70–75%
Water table depth	152 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 170 to 194 inches (4320 to 4930 centimeters). Rainfall varies over short distances due to topography. Cloud cover and fog occur frequently at the higher elevations of the ecological site, resulting in addition to soil moisture by fog drip. Air temperatures range from 74 to 80 F (23 to 27 C). 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.

Table 3. Representative climatic features

Frost-free period (characteristic range)	365 days
Freeze-free period (characteristic range)	365 days
Precipitation total (characteristic range)	4,318-4,928 mm
Frost-free period (actual range)	365 days
Freeze-free period (actual range)	365 days
Precipitation total (actual range)	2,845-5,410 mm
Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	4,623 mm

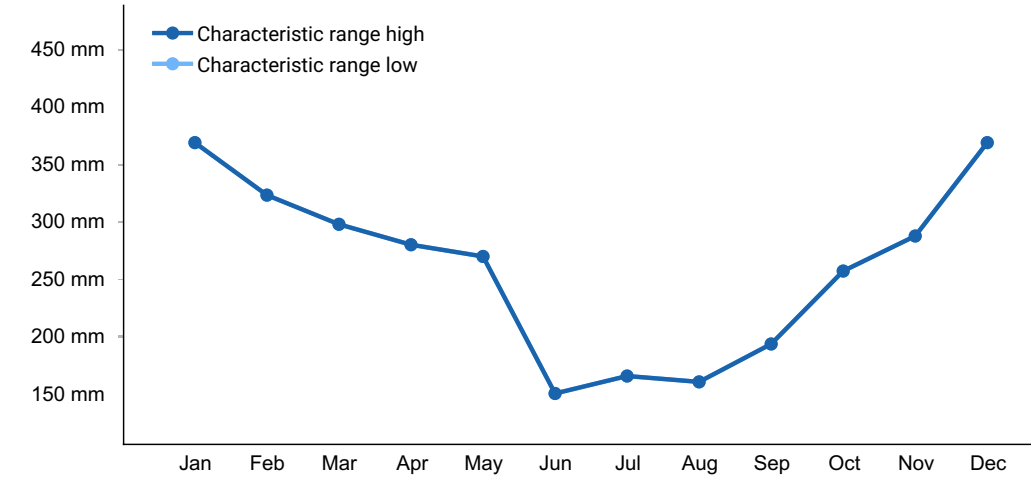

Figure 1. Monthly precipitation range

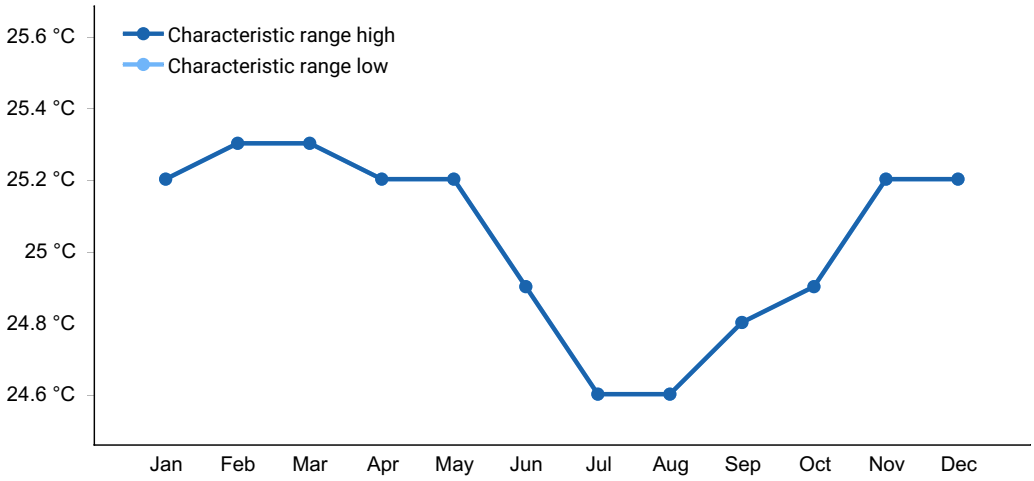

Figure 2. Monthly minimum temperature range

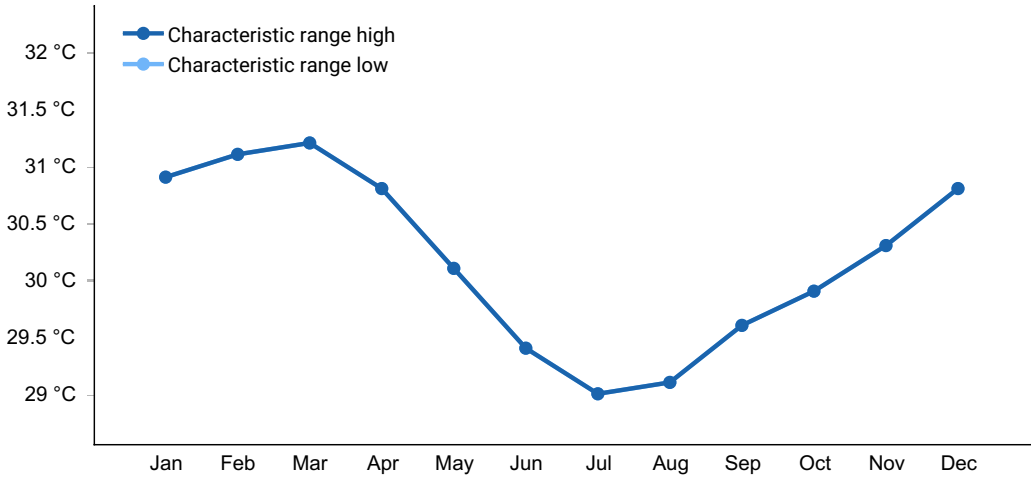

Figure 3. Monthly maximum temperature range

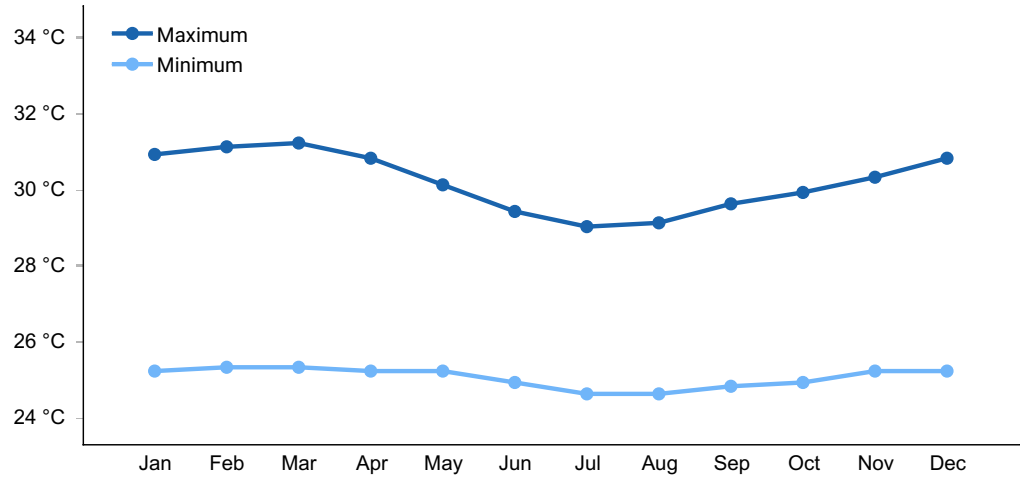

Figure 4. Monthly average minimum and maximum temperature

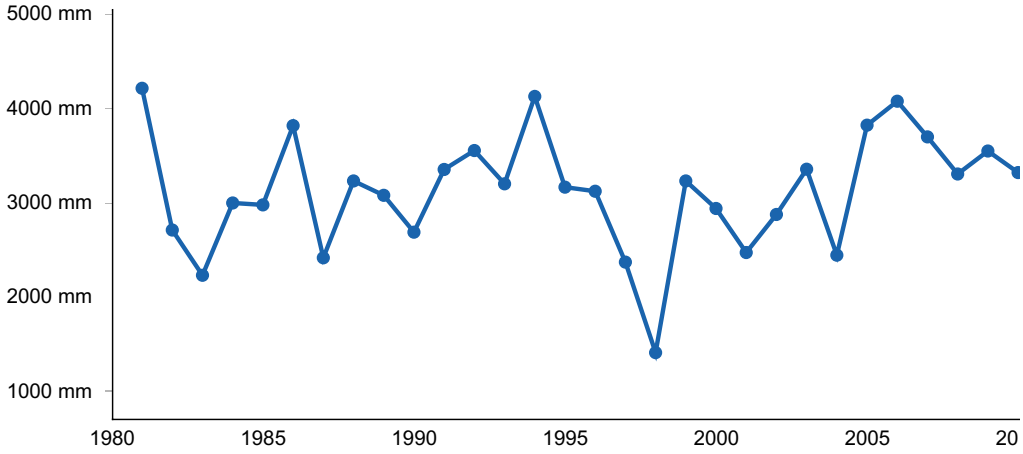

Figure 5. Annual precipitation pattern

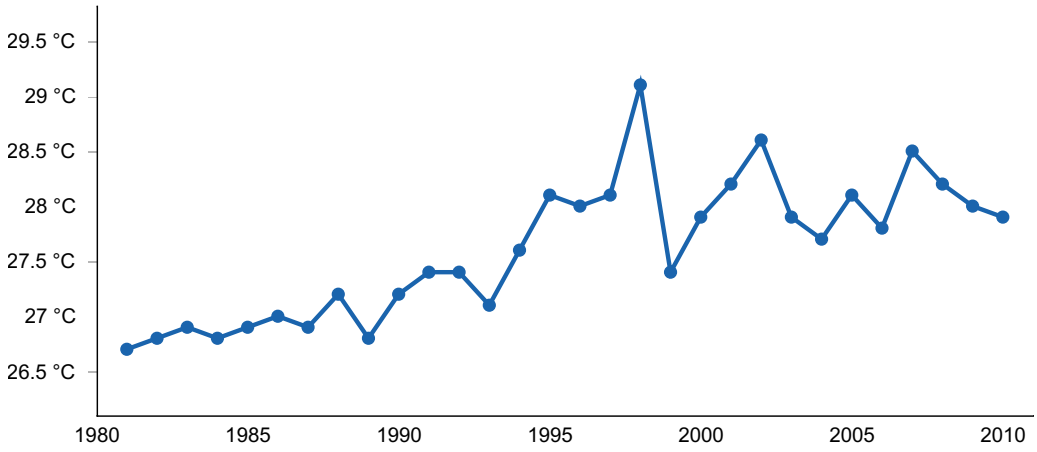

Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

There are no water features in this ecological site.

Soil features

FAGASA, OLOAVA

Soils are in the Mollisols and Andisols orders. They formed in volcanic ash and residuum overlying basic igneous rock or cinders. Soil temperature regimes are isohyperthermic; soil moisture regimes are udic to perudic. Effective rooting depths range from 11 to over 31 inches (28 to 79 centimeters).

Table 4. Representative soil features

Parent material	(1) Residuum (2) Volcanic ash (3) Cinders
Surface texture	(1) Silty clay loam
Family particle size	(1) Fine (2) Medial over pumiceous or cindery
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	28–79 cm
Soil depth	28–79 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–10.16 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)	5.1–6.5
Subsurface fragment volume <=3" (0-101.6cm)	12–33%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

The main natural disturbances are landslides and strong storms that can damage or kill vegetation by high wind speeds. The main human disturbance is clearing or burning of native vegetation that results in at least temporary dominance of introduced weedy plants.

State and transition model

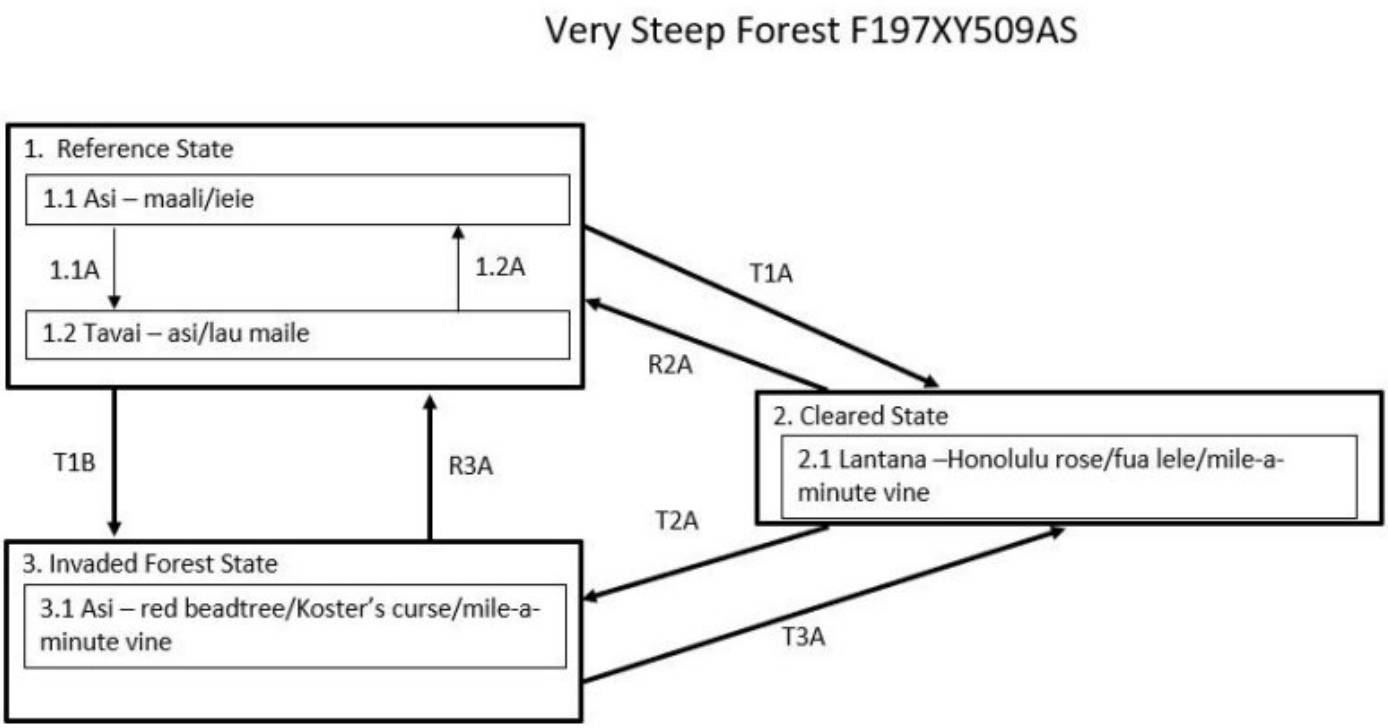

Figure 7. State and Transition Model (STM) for F197XY509AS (Very Steep Forest).

State 1
Reference State

This ecological site is a native forest with a tree canopy that is 60 to 80 feet (18 to 25 meters) tall. Ground cover is sparse. Epiphytes are few.

Community 1.1
Asi – maali/ieie

Among the dominant tree species are asi (Syzygium inophylloides), maali (Canarium samoense), Buchanania merrillii, tamanu (*Calophyllum inophyllum*), auauli (Diospyros samoensis), mafoa (Canarium harveyi), atone (Myristica inutilis), and ifilele (*Intsia bijuga*). Common ferns include asaua (*Dicranopteris linearis*) under canopy openings, bird's nest fern (*Asplenium nidus*), leather fern (*Davallia solida*), musk fern (Microsorum grossum), and *Asplenium polyodon*. The scandent shrub gau (*Alyxia bracteolosa*) is common. Climbers and lianas include 'ie'ie (*Freycinetia storckii*), maile (*Alyxia stellata*), and *Gynochthodes epiphytica*.

Dominant plant species

- syzygium (*Syzygium*), tree
- olive (*Canarium*), tree
- freycinetia (*Freycinetia storckii*), other herbaceous

Community 1.2
Tavai – asi/lau maile

The same tree species as in Community Phase 1.1 remain in this phase, but other native tree species, commonly tavai (*Rhus taitensis*) and beach hibiscus (*Hibiscus tiliaceus*), can join the canopy as the forest regrows. Ground vegetation becomes temporarily more abundant. Epiphytes are less common than in 1.1.

Dominant plant species

- (*Rhus taitensis*), tree
- syzygium (*Syzygium*), tree
- Maile (*Alyxia stellata*), other herbaceous

Pathway P1.1A
Community 1.1 to 1.2

Storms or landslides that damage or kill trees or clearing of small plots by humans when there is no significant source of invasive introduced plant species nearby causes a phase change from 1.1 to 1.2 typified by a partial, temporary change in dominant tree species and a temporary increase in ground level vegetation.

Pathway P1.2A
Community 1.2 to 1.1

This community phase will revert to phase 1.1 with gradual regrowth of typical dominant native species when given adequate time to recover after disturbance.

State 2
Cleared State

This state consists of one community phase dominated by a variable mixture of introduced and native shrubs, vines, forbs, and grasses that thrive in sunny environments.

Community 2.1
Lantana – Honolulu rose/ fua lele/mile-a-minute vine

This community phase consists of a variable array of shrubs, forbs, vines, and young trees that thrive in sunny environments. Shrubs such as lantana (*Lantana camara*), Honolulu

rose (*Clerodendrum chinense*), Koster's curse (*Clidemia hirta*), and nettleleaf velvetberry (*Stachytarpheta urticifolia*) are dominant. The shrub layer may also include seedlings and saplings of any native trees that have persisted on or near the site or invasive, introduced tree species such as African tulip tree (*Spathodea campanulata*). Mile-a-minute vine (*Mikania micrantha*) and the large, introduced forb fua lele (*Crassocephalum crepidioides*) are commonly present.

Dominant plant species

- lantana (*Lantana camara*), shrub
- stickbush (*Clerodendrum chinense*), shrub
- redflower ragleaf (*Crassocephalum crepidioides*), other herbaceous
- mile-a-minute (*Mikania micrantha*), other herbaceous

State 3
Invaded Forest State

This state consists of one community phase. It is forest with both overstory and understory composed of a variable mix of native and introduced species. The actual species composition on a given site depends on the original native species composition, the disturbance history, and the species composition existing near the site before, during, and after disturbances.

Community 3.1
Asi – red beadtree/Koster's curse/mile-a-minute vine

The overstory consists of large trees. Any of the native species listed for State 1 Reference may be present. Introduced tree species are likely to be present; common examples of these are African tulip tree (*Spathodea campanulata*), tamaligi or peacocks plume (*Falcataria moluccana*), and red beantree (*Adenanthera pavonina*). The understory consists of an unpredictable mixture of native and introduced shrubs, ferns, vines, forbs, and grasses that have some shade tolerance. See State 1 Reference for examples of native species. Common examples of introduced understory species are the shrubs Koster's curse (*Clidemia hirta*) and Honolulu rose (*Clerodendrum chinense*), mile-a-minute vine (*Mikania micrantha*) and running mountaingrass (*Oplismenus compositus*).

Dominant plant species

- syzygium (*Syzygium*), tree
- red beadtree (*Adenanthera pavonina*), tree
- soapbush (*Clidemia hirta*), shrub
- mile-a-minute (*Mikania micrantha*), other herbaceous

Transition T1A
State 1 to 2

The Reference State (1) transitions to the Cleared State (2) by landslides or severe windstorms when a nearby seed source for introduced plant species is present.

Transition T1B
State 1 to 3

The Reference State (1) transitions to the Invaded Forest State (3) by damage to the forest understory by ungulates, especially feral pigs, when there is a source of seeds of invasive species.

Restoration pathway R2A
State 2 to 1

The Cleared State (2) may be restored to the Reference State (1). The intensity of active restoration measures will be determined by the slope of the site, the presence or lack of nearby native forest or, at least, some native trees, and the density and species mix of grasses, vines, shrubs, and invasive trees present on the site, especially if many competitive introduced species are present.

Transition T2A
State 2 to 3

The Cleared State (2) transitions to the Invaded Forest State (3) by growth of an overstory of trees with an understory of shade-tolerant shrubs, vines, ferns, forbs, and grasses. The species mix is variable but may be mostly introduced species or a combination of native and introduced species.

Restoration pathway R3A
State 3 to 1

The Invaded Forest State (3) Invaded Forest can be restored to the Reference State (1). The difficulty, cost, and likelihood of success will depend on the slope of the site, the species composition, and the amount and competitiveness of introduced species present on a given site.

Transition T3A
State 3 to 2

The Invaded Forest State (3) can transition back to the Cleared State (2) due to damage by landslide, a severe storm, or clearing by humans. The Cleared State (2) is likely to rapidly transition back to the Invaded Forest State (3) due to presence of an abundant tree seed bank in the soil.

Additional community tables

Other references

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vegetation types within area of American Samoa National Park on Ta`u.

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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:**

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile**

features which may be mistaken for compaction on this site):

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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:**
