USDA Natural Resources Conservation Service

Ecological site QX190X01X001
Very Shallow

Last updated: 6/12/2025
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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): 190X–Stratovolcanoes of the Mariana Islands

This MLRA occurs on the Northern Islands group of the Commonwealth of the Northern Mariana Islands. It consists of the islands of Pagan, Anatahan, Agrigan, Alamagan, Sarigan, and five smaller islands. The islands are largely unpopulated due to volcanic activity. The islands are cone-shaped stratovolcanoes covered with volcanic ash and cinder deposits on steep and very steep slopes. Agrigan has the highest elevation, ranging from sea level to 3,185 feet (970 meters). Average annual precipitation is about 80 inches (2,030 millimeters). Rainfall decreases northwards and increases slightly with elevation. Two-thirds of the precipitation falls between July and November. Average annual temperature is 79 degrees F (26 degrees C). The cooler dry season is between January and May. Trade winds blow from the northeast and east-northeast. Typhoons are frequent. Soils are Andisols, Inceptisols, or Entisols. The soil moisture regime is mostly ustic. The soil temperature regime is isohyperthermic. Abandoned coconut plantations occur on low elevation coastal sites. Areas above 330 feet (100 meters) are dominated by Pacific Island silvergrass or swordgrass (*Miscanthus floridulus*). Forest species are mixed tropical hardwoods. Large numbers of feral cows, pigs, and goats are on some of the islands (USDA-Natural Resources Conservation Service, 2006).

Classification relationships

This ecological site occurs within Major Land Resource Area (MLRA) 190 – Stratovolcanoes of the Mariana Islands.

Ecological site concept

This ecological site occurs on the islands of Agrigan, Alamagan, Anatahan, and Sarigan in the Mariana Islands. It occurs on moderately sloping to very steep (8 to 125 percent) slopes on the crests of ridges on the dissected backslopes and footslopes of stratovolcanic islands at elevations ranging from 164 to 2,430 feet (50 to 740 meters) (Soil Survey Staff, 2025; Amidon et al., 2017; Amidon et al., 2019; Carlisle et al., 2001; Fosberg, 1960; Kessler, 2011; Liske-Clark, 2105; USDA-Natural Resources Conservation Service, 2001; Willsey et al., 2019).

Soils are very shallow (1 to 8 inches or 3 to 20 centimeters), well drained Andisols (Lithic Haplustands) that formed in basaltic and andesitic volcanic ash and cinders. Soil temperature regimes are isohyperthermic; soil moisture regimes are ustic. Average annual precipitation is about 80 inches (2,030 millimeters). Water runoff is high or very high; permeability is very slow (impermeable). Effective rooting depth is about 5 inches (13 cm). Available water holding capacity is very low (0 to 1 inches). The soils are strongly acidic (pH 5 to 6.6). Native and naturalized vegetation includes Pacific Island silvergrass or swordgrass (*Miscanthus floridulus*) and assorted short grasses (Soil Survey Staff, 2025; Amidon et al., 2017; Amidon et al., 2019; Carlisle et al., 2001; Fosberg, 1960; Kessler, 2011; Liske-Clark, 2105; USDA-Natural Resources Conservation Service, 2001; Willsey et al., 2019).

A large portion of the land area of these islands is mapped by the Soil Survey as either Miscellaneous Land Types or are classified only to the Great Group level. These map units are not used in ecological site work. The components of most of these map units are very steep (typically 45 to 150 percent slopes). The Miscellaneous Land Types are mostly Cinderlands, Lava flows, Rubble land, or Rock outcrops. The Great Group soil components are mostly complexed with Rock outcrops. Vegetation can be sparse to nonexistent on these areas (USDA-Natural Resources Conservation Service, 2001). However, some of them probably support vegetation like that found in this ecological site.

Associated sites

QX190X01X501	**Aquic** Soils of QX190X01X501 (The Somewhat Poorly and Poorly Drained Limestone Basins Ecological Site) occur in depressional basins surrounded by the slopes of QX190X01X001 (The Very Shallow Ecological Site). Water will move from the Very Shallow Ecological Site into the Somewhat Poorly and Poorly Drained Limestone Basins Ecological Site. Soils in both sites developed from basaltic and andesitic ash. Soils in the Very Shallow Ecological Site have effective rooting depths of about 5 inches, very low available water holding capacity, and support mostly Pacific Island silvergrass (swordgrass). Soils in the Somewhat Poorly and Poorly Drained Limestone Basins Ecological Site have effective rooting depths of about 60 inches, very high water holding capacity, a water table at the soil surface, are frequently ponded, can support trees and crops, and may be swampy during the rainy season.

QX190X01X504	**Silt Loam** Soils of QX190X01X504 (The Silt Loam Ecological Site) and QX190X01X001 (The Very Shallow Ecological Site) occur on similar landscapes, soil parent materials, and slopes. The Silt Loam Ecological Site generally occurs at lower elevations than the Very Shallow Ecological Site. The main differences between the two sites are that soils in the Silt Loam Ecological Site have much deeper effective rooting depths, shallower water tables, and higher available water holding capacity than soils in the Very Shallow Ecological Site. This enables the Silt Loam Ecological Site to support forest vegetation rather than just the Pacific Island silvergrass (swordgrass) and other grasses that dominate the vegetation of the Very Shallow Ecological Site.
QX190X01X503	**Sandy Loam or Loam** Soils of QX190X01X503 (The Sandy Loam or Loam Ecological Site) and QX190X01X001 (The Very Shallow Ecological Site) ecological site occur on similar landscapes, soil parent materials, and slopes. The Sandy Loam or Loam Ecological Site generally occurs at lower elevations than the Very Shallow Ecological Site. The main differences between the two sites are that soils in the Sandy Loam or Loam Ecological Site have deeper effective rooting depths and higher available water holding capacity than soils in the Very Shallow Ecological Site. This enables the Sandy Loam or Loam Ecological Site to support forest vegetation and grasses rather than just the Pacific Island silvergrass (swordgrass) and other grasses that dominate the vegetation of the Very Shallow Ecological Site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Miscanthus floridulus* (2) *Dimeria chloridiformis*

Legacy ID

R190XY001MP

Physiographic features

This ecological site occurs on the crests of ridges on the dissected backslopes and footslopes of stratovolcanic islands. Some of the slopes in this ecological site are greater than 100 percent. The depth to the water table is greater than 72 inches (183 centimeters) (Soil Survey Staff, 2025; USDA-Natural Resources Conservation Service, 2001).

Table 2. Representative physiographic features

Landforms	(1) Island > Ridge (2) Island > Mountain slope

Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	164–2,430 ft
Slope	8–100%
Water table depth	72 in
Aspect	Aspect is not a significant factor

Climatic features

Mean annual precipitation in this ecological site is about 80 inches (2,030 millimeters) and ranges from 70 to 90 inches (1,780 to 2,285 millimeters). Rainfall likely decreases northwards and slightly increases with elevation. Climate data are scarce for these remote islands. About two-thirds of the precipitation falls between July and November. Mean annual temperature is about 83 degrees F (28 degrees C) and ranges from 79 to 86 degrees F (26 to 30 degrees C). The cooler dry season is between January and May. It is enhanced by persistent trade winds from the northeast and east-northeast. Typhoons frequently pass close to the Northern Mariana Islands. Typhoons are less common in the north than on the more southerly Mariana Islands that are severely impacted by large storms about once every 8 years on average. This area is freeze-free (Fosberg, 1960; USDA-Natural Resources Conservation Service, 2001).

Observations made on the Northern Stratovolcano Islands suggest that there are local climate differences among islands and at various elevations. Based on observations of frequent clouds and fog at the highest elevations and their apparent correlation with more luxuriant vegetation, fog drip can add significant moisture to the soil in some locations (Fosberg, 1960; USDA-Natural Resources Conservation Service, 2001).

Table 3. Representative climatic features

Frost-free period (actual range)	
Freeze-free period (actual range)	
Precipitation total (actual range)	70-90 in
Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	80 in

Influencing water features

There are ravines in this ecological site that briefly carry water during the rainy season (USDA-Natural Resources Conservation Service, 2001).

Soil features

Soils associated with this ecological site are slope phases of Plasanbola series, which are Andisols (Lithic Haplustands). Soil temperature regimes are isohyperthermic; soil moisture regimes are ustic. They are very shallow (about 1 to 8 inches) and well drained. Available water holding capacity is very low (0 to 1 inches) (Soil Survey Staff, 2025; USDA-Natural Resources Conservation Service, 2001).

Table 4. Representative soil features

Parent material	(1) Basaltic volcanic ash (2) Andesitic volcanic ash (3) Cinders (4) Welded tuff
Surface texture	(1) Highly organic, ashy, very gravelly loam
Family particle size	(1) Medial-skeletal
Drainage class	Well drained
Permeability class	Very slow
Depth to restrictive layer	1–8 in
Soil depth	1–8 in
Surface fragment cover <=3"	0–45%
Surface fragment cover >3"	0%
Available water capacity (1-5in)	0.2–0.9 in
Calcium carbonate equivalent (Depth not specified)	Not specified
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (0-10in)	5–6.6
Subsurface fragment volume <=3" (1-5in)	0–45%
Subsurface fragment volume >3" (1-5in)	0%

Ecological dynamics

The main human disturbance is intentional and frequent burning of highly flammable grasses, especially Pacific Islands silvergrass; this prevents survival of trees and increases erosion. High populations of feral ungulates may graze the vegetation, which is mostly unpalatable and low quality (Amidon et al., 2019; Willsey et al., 2019).

The main natural disturbance is volcanic activity on some islands that can destroy vegetation by lava flows or ash deposition, setting succession back to the primary stage (Amidon et al., 2019; Willsey et al., 2019).

State and transition model

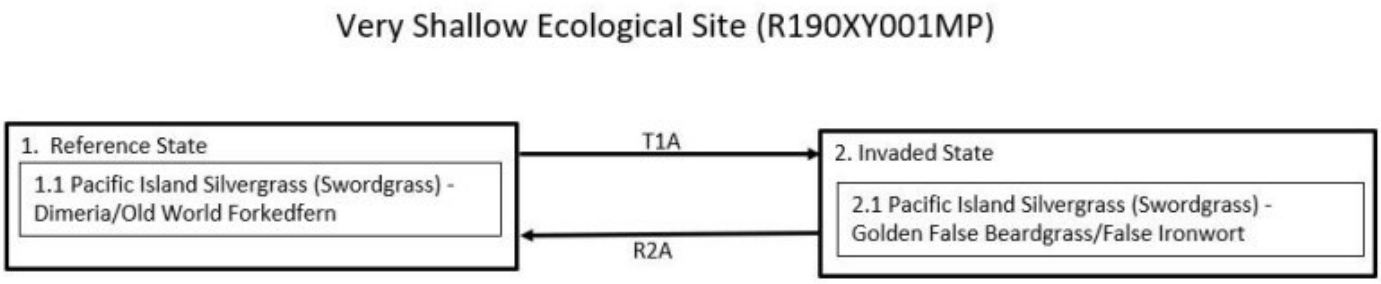

Figure 1. State-and-Transition Model diagram for R190XY001MP (The Very Shallow Ecological Site).

State 1
Reference State

The Reference State (1) has one community phase of medium to tall (to 6.5 feet or 2 meters) grassland. The consensus of most authors indicates that these grasslands are probably the original native vegetation on these soils and that they are not maintained by naturally-caused fires (Amidon et al., 2017; Amidon et al., 2019; Carlisle et al., 2001; Fosberg, 1960; Hunter-Anderson, 2009); Kessler, 2011; Liske-Clark, 2105; Willsey et al., 2019). This state is highly prone to fire, which is caused by humans. The soils are vulnerable to erosion when vegetation cover is low (Amidon et al., 2017; Amidon et al., 2019; Carlisle et al., 2001; Fosberg, 1960; Kessler, 2011; Liske-Clark, 2105; Willsey et al., 2019).

Community 1.1
Pacific Island Silvergrass (Swordgrass) - Dimeria/Old World Forkedfern

Community phase 1.1 is a grassland with a few native grass species and a native fern. The dominant species is Pacific Island silvergrass or swordgrass (*Miscanthus floridulus*). Other species that may occur are mission grass or foxtail (*Pennisetum polystachion*), *Dimeria chloridiformis*, and kodomillet (*Paspalum scrobiculatum*). Old World forkedfern (*Dicranopteris linearis*) may occur as individual plants or as small thickets (Amidon et al., 2017; Amidon et al., 2019; Carlisle et al., 2001; Fosberg, 1960; Kessler, 2011; Liske-Clark, 2105; Willsey et al., 2019).

Dominant plant species

- Pacific Island silvergrass (*Miscanthus floridulus*), grass
- (*Dimeria chloridiformis*), grass
- Old World forkedfern (*Dicranopteris linearis*), other herbaceous

State 2
Invaded State

The Invaded State (2) consists of one community phase. Pacific Island silvergrass or swordgrass (*Miscanthus floridulus*) is the dominant species, but some of the smaller native grasses have been partially displaced by introduced species.

Community 2.1
Pacific Island Silvergrass (Swordgrass) - Golden False Beardgrass/False Ironwort

Pacific Island silvergrass or swordgrass (*Miscanthus floridulus*) is the dominant species. Native *Dimeria chloridiformis*, mission grass (*Pennisetum polystachion*), and kodomillet (*Paspalum scrobiculatum*) have been reduced in vigor and abundance by grazing before they dry out in the dry season. Introduced species are primarily golden false beardgrass (*Chrysopogon aciculatus*) and the forb false ironwort (*Hyptis capitata*) (Amidon et al., 2017; Amidon et al., 2019; Carlisle et al., 2001; Fosberg, 1960; Kessler, 2011; Liske-Clark, 2105; Willsey et al., 2019).

Dominant plant species

- Pacific Island silvergrass (*Miscanthus floridulus*), grass
- golden false beardgrass (*Chrysopogon aciculatus*), grass
- false ironwort (*Hyptis capitata*), other herbaceous

Transition T1A
State 1 to 2

The Reference State (1) transitions to the Invaded State (2) by gradual invasion by introduced plant species. This process is facilitated by large populations of feral ungulates that selectively graze the smaller and more palatable native grass species, which reduces their competitiveness and allows invasion by introduced species.

Restoration pathway R2A
State 2 to 1

The Invaded State (2) is restored to the Reference State (1) by removal of ungulates and selective elimination of introduced species.

Additional community tables

Other references

QX190X01X001 Very Shallow Annotated References

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Contributors

David Clausnitzer PhD
John Proctor
Daniel Bowman
Ann Tan
Amy Koch
Kendra Moseley
Sarah Quistberg
Jill Ficke-Beaton
Daniel Block
Brendan Brazee
Curtis Talbot

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Carolyn Auweloa, NRCS

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	12/21/2025
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):**

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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:**
