

Ecological site VX157X01X001 Torric Naturalized Grassland

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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): 157X–Arid and Semiarid Low Mountain Slopes

4/25/2011 Began editing in ESIS- Megan Baxter

Classification relationships

The Hawaii Agricultural Experiment Station Bulletin 89 (1942) described this area, that includes this rangeland ecological site, as Vegetation Zone A. The Soil Survey of the Island of Hawaii (1973) and the Soil Survey of the Islands of Kauai, Oahu, Molokai, and Lanai (1972) had pasture groups developed to describe rangeland. Pasture Group 1 is very similar to the this rangeland ecological site. In some instances, Pasture Group 2 is very close in nature to this site as well.

Associated sites

VX157X01X003	Rocky Volcanic Ash Savanna Kiawe/buffelgrass (Prosopis pallida/Pennisetum ciliare)
VX157X01X004	Alluvial Woodland (Kiawe/Prosopis pallida)

Table 1. Dominant plant species

Tree	Not specified		
Shrub	Not specified		
Herbaceous	(1) Pennisetum ciliare		

R157XY001HI

Physiographic features

This site occurs on nearly level to gently rolling coastal plains to sometimes moderately steep low mountain slopes. This site, as well as the major land resource area, can be classified as desert.

Landforms	(1) Lava flow (2) Shield volcano (3) Kipuka
Flooding frequency	None
Ponding frequency	None
Elevation	0–1,000 ft
Slope	1–15%
Ponding depth	0 in
Water table depth	0 in
Aspect	S, SW, W

Table 2. Representative physiographic features

Climatic features

Average annual precipitation throughout the entire major land resource area ranges from 5 to 25 inches. Most of the precipitation falls from November to May; with January being the wettest month. Average annual temperatures range from 66 to 88 degrees F. The climate is aridic.

Table 3. Representative climatic features

Frost-free period (average)	365 days
Freeze-free period (average)	365 days
Precipitation total (average)	25 in



Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no water features that influence this site.

Soil features

Typical soils are moderately deep to deep, with some inclusions of very deep, and are well drained to somewhat excessively drained. These soils formed in volcanic as and from materials weathered from basalt. Surface textures range from very fine sandy loam to silty clay loams and silty clays. Surface texture may be cobbly, stony or very stony. Underlying soil textures vary from moderately-coarse (or coarse-loamy) to moderately-fine textured (or fine-loamy). Underlying layers may also be cobbly or stony. Available water capacity is moderate to high. Permeability is moderate to moderately rapid. Runoff ranges from low to medium. Soil colors range from reddish brown and dark brown to yellowish brown. Soil reactions (pH) generally range from neutral to mildly alkaline. The erosion hazard is moderate. Soil temperature regimee is isohyperthermic. Soil moisture regimes may vary from dry ustic to aridic.

MU Symbols & components, HI701 & HI801 Soil Survey Areas (2011):

- 502 Kaalualu
- 503 Kaalualu
- 504 Kaalualu
- 505 Kaalualu
- 506 Pakini
- 507 Pakini
- 510 Kaalualu and Pakini
- 535 Lithic Haplotorrands
- 743 Pakini

Parent material	(1) Basic volcanic ash-volcanic breccia
Surface texture	(1) Cobbly loamy sand(2) Medial loam(3) Very cobbly silt loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Very slow to moderately slow
Soil depth	20–72 in
Surface fragment cover <=3"	1–10%
Surface fragment cover >3"	1–15%
Available water capacity (0-40in)	2–5 in
Calcium carbonate equivalent (0-40in)	0–5%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	1–10%
Subsurface fragment volume >3" (Depth not specified)	15–80%

Ecological dynamics

Throughout most of its location, this site occurs as an open grassland. With continuous grazing, particularly by cattle, palatable perennial grasses such as buffelgrass, green panic, and piligrass decrease. Koa haole (ekoa) will also decrease under heavy grazing pressure.

Pitted beardgrass is the primary increaser under such circumstances with lesser amounts of swollen fingergrass.

With severe deterioration, shrubby species can increase to dominate such as lantana and sweet acacia. Weedy annual and perennial forbs such lion's ear mint, golden crownbeard and fireweed will invade this site. Warm season rhizomatous grasses such as bermudagrass and crabgrass also invade the site with severe deterioration.

Kiawe tends to be tall and scattered, reaching almost tree-like stature in most instances when it is present.

Natural fire may be important to the development of this naturalized plant community. Some plant species associated with this site developed in other parts of the world where natural fire is part of the ecosystem. In areas where low shrubs and half-shrubs dominate, the potential production of perennial grass can be greater than the present production of low shrubs and half-shrubs once they are removed from the plant community by fire or brush management.

This site has a history of destructive wildfires as many areas have a high understory fine fuel build-up due to the exclusion of livestock grazing. Because this site can border the ocean, the grass should be managed to control the movement of sediment from water erosion to meet current and future objectives of coastal zone management.

Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but at this time they are the most prevalent and repeatable plant communities expressed on this ecological site. The plant composition table shown above has been developed from the best available knowledge at the time of this revision. As more data are collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as "Desired Plant Communities". According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities will be determined by the decision-makers and will meet minimum resource quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge, observation and experience at the time of this revision.

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1 Reference; Naturalized Mid-Grassland

Community 1.1

Desert Mid-Grass



Figure 2. 1.1 Desert Mid-Grass

The interpretive plant community for this site is a naturalized plant community. This plant community evolved in recent history. The aspect is open grassland composed principally of a continuous cover of buffelgrass. Most of the plants in this community evolved in ecosystems where there was a presence of herbivores or wildfire was a natural force. Total annual, average, air-dry vegetation production can range from 800 to 3,500 pounds per acre, and averages about 2,000 pounds per acre during an average or normal rainfall year. The major plant growth period is from mid-fall to late winter.

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	680	1700	2975
Shrub/Vine	160	400	700
Forb	40	100	175
Total	880	2200	3850

Table 5. Annual production by plant type

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	1-5%
Forb foliar cover	1-3%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	5-10%

Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	5-10%
Bedrock	0%
Water	0%
Bare ground	1-5%

Table 7. Soil surface cover

Tree basal cover	0-3%
Shrub/vine/liana basal cover	1-10%
Grass/grasslike basal cover	85-90%
Forb basal cover	5-15%
Non-vascular plants	0%
Biological crusts	0%
Litter	20-25%
Litter Surface fragments >0.25" and <=3"	20-25% 0-5%
Litter Surface fragments >0.25" and <=3" Surface fragments >3"	20-25% 0-5% 5-10%
Litter Surface fragments >0.25" and <=3" Surface fragments >3" Bedrock	20-25% 0-5% 5-10% 0%
Litter Surface fragments >0.25" and <=3" Surface fragments >3" Bedrock Water	20-25% 0-5% 5-10% 0% 0%



Figure 4. Plant community growth curve (percent production by month). HI1571, Naturalized Desert Mid-Grass. Warm season grasses.

State 2 Naturalized Grass & Shrubland

Community 2.1 Mid-Seral Mixed



Figure 5. 2.1 Mid Seral Mixed

This plant community occurs with continuous grazing pressure. Recognition of this plant community will enable the land user to implement key management decisions before a significant economic/ecological threshold is crossed. Key grass species such as buffelgrass and piligrass have been reduced to remnant amounts. Pitted beardgrass, with lesser amounts of swollen fingergrass, and Japanese tea have increased in abundance and dominate the community. This community provides significantly less forage amounts than the interpretive community.



Figure 6. Plant community growth curve (percent production by month). HI1571, Naturalized Desert Mid-Grass. Warm season grasses.

State 3 Naturalized Low-Seral Weedy Grass & Shrubland

Community 3.1

Low-Seral Mixed



Figure 7. 3.1 Low Seral Mixed

This plant community occurs with continuous grazing pressure. Recognition of this plant community will enable the land user to implement key management decisions before a significant economic/ecological threshold is crossed. Key grass species such as pitted beardgrass and swollen fingergrass have been reduced to remnant amounts. Sod patches of Bermudagrass, with lesser amounts of uhaloa and ilima have increased in abundance and dominate the community. Sweet acacia and lantana can also have begun to invade this site. This community provides significantly less forage amounts than the interpretive community.



HI1571, Naturalized Desert Mid-Grass. Warm season grasses.

Transition T1 State 1 to 2

With continuous livestock grazing and/or human-induced fire, this site moves toward the 2.1 Mid-Seral Mixed Community and eventually the 3.1 Low Seral Mixed Community.

Restoration pathway R2 State 2 to 1

With prescribed grazing and control/removal of fire, this plant community can be shifted to the 1.0 Reference State.

Conservation practices

Land Reclamation, Fire Control Prescribed Grazing

Transition T2 State 2 to 3

With continued heavy grazing pressure, this site will move toward the 3.1 Low Seral Mixed Community.

Restoration pathway R3a State 3 to 1

The pathway back to the 1.0 Reference community is with prescribed grazing.

Conservation practices

Prescribed Grazing

Restoration pathway R3b State 3 to 2

The pathway back to the 2.1 Mid-Seral Mixed Community is with prescribed grazing.

Conservation practices

Prescribed Grazing

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)	
Grass/Grasslike						
1	Naturalized Wa	arm Seaso	n Mid Bunch Grasses	1700–1800		
	buffelgrass	PECI	Pennisetum ciliare	1600–1800	_	

-		-			
	crimson fountaingrass	PESE3	Pennisetum setaceum	1–20	_
	guineagrass	URMA3	Urochloa maxima	1–20	_
2	Naturalized Wa	arm Seaso	1–100		
	pitted beardgrass	BOPE2	Bothriochloa pertusa	1–20	_
	swollen fingergrass	CHBA10	Chloris barbata	1–20	_
3	Naturalized Wa	arm Seaso	n Stoloniferous Short Grasse	1–20	
	Bermudagrass	CYDA	Cynodon dactylon	1–20	_
	stargrass	CYPL2	Cynodon plectostachyus	1–20	_
4	Naturalized Wa	arm Seaso	n Annual Grasses	1–20	
	hooked bristlegrass	SEVE3	Setaria verticillata	1–20	_
5	Native Warm S	eason Mic	Bunch Grasses	1–100	
	tanglehead	HECO10	Heteropogon contortus	1–100	_
	hardstem lovegrass	ERAT	Eragrostis atropioides	1–20	_
6	Native Warm S	eason An	nual Grasses	1–20	
	Maui panicgrass	PAPE3	Panicum pellitum	1–20	_
	torrid panicgrass	ΡΑΤΟ	Panicum torridum	1–20	_
	kakonakona	PAXE	Panicum xerophilum	1–20	_
Forb		·			
7	Naturalized Fo	rbs		20–100	
	uhaloa	WAIN	Waltheria indica	1–100	_
	Cuban jute	SIRH	Sida rhombifolia	1–40	_
	golden crownbeard	VEEN	Verbesina encelioides	1–20	_
	Australian saltbush	ATSE	Atriplex semibaccata	1–20	_
	sensitive partridge pea	CHNIG	Chamaecrista nictitans ssp. patellaria var. glabrata	1–20	_
	purple bushbean	MAAT80	Macroptilium atropurpureum	1–20	_
	Madagascar ragwort	SEMA15	Senecio madagascariensis	1–20	_
Chrub	Mino				

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8	Naturalized Shrubs, Half-Shrubs, and Trees			20–100			
	kiawe	PRPA4	Prosopis pallida	20–100	-		
	ʻilima	SICO	Sida cordifolia	1–20	-		
	sweet acacia	ACFA	Acacia farnesiana	1–20			
	anil de pasto	INSU	Indigofera suffruticosa	1–20			
	lantana	LACA2	Lantana camara	1–20	_		
	white leadtree	LELE10	Leucaena leucocephala	1–20	_		

Animal community

Animal Community - Wildlife Interpretations

This site provides habitat to a variety of small and medium-sized birds such as doves, the Northern cardinal, the chestnut-bellied sand grouse, and the gray francolin. The introduced axis deer may also use this site. Importantly, the site provides habitat and hunting grounds for the native Hawaiian hawk (I`o) and the Hawaiian owl (Pueo).

Animal Community - Grazing Interpretations

The naturalized plant community on this site is suitable for grazing by all kinds and classes of livestock, at any season, particularly cattle. However, this site is best utilized for mid-fall to late winter grazing as this is the major plant growth period. This site is suited for grazing by both cow-calf operations and stocker operations. However, sheep can be grazed on this site as well. This site is poorly suited to continuous year-long use if the interpretive naturalized plant community is to be maintained. Herbaceous forage can be deficient in protein during the drier summer months.

Hydrological functions

This site is dominated by soils in hydrologic groups B and C. Infiltration and runoff potential for this site varies from low to moderate depending on soil hydrologic group and ground cover. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook (NEH-4) for runoff quantities and hydrologic curves).

Recreational uses

Because of the climate of the major land resource area, and the open grassland nature of this site, it composes a significant portion of the open vistas that are an important part of the charm and character of South and West Hawaii, as well as portions of Maui. The naturalized shrub and grass species makes this site pleasing to view. Its open aspect makes it an excellent location for horseback riding, hiking, bird watching, and hunting. The open space nature of this site is currently being threatened, is some areas, due to the development of subdivisions.

Wood products

No appreciable wood products are present on the interpretive plant community for this site.

Other products

None

Other information

None

Type locality

Location 1: Hawaii County, HI				
Latitude	18° 55′ 35″			
Longitude	155° 41′ 6″			
General legal description	Hawaii County, Island of Hawaii, Ka'u District			

Contributors

Joseph A. May Loretta J. Metz

Approval

Kendra Moseley, 5/08/2025

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)	Loretta J. Metz, Earl W. Spence; David Clausnitzer
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Date	01/29/2009
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills: None.
- 2. Presence of water flow patterns: None.
- 3. Number and height of erosional pedestals or terracettes: No erosional pedestals or terracettes are present on this site, regardless of wet or dry season.
- Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground): Bare ground should never exceed 5% in any season.
- 5. Number of gullies and erosion associated with gullies: No gullies or erosion associated with gullies are be present on this site.
- 6. Extent of wind scoured, blowouts and/or depositional areas: None.
- 7. Amount of litter movement (describe size and distance expected to travel): No litter movement is expected, regardless of the season.
- 8. Soil surface (top few mm) resistance to erosion (stability values are averages most sites will show a range of values): Values ranging from 2 to 4 are common.

- 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: Warm season perennial midheight bunchgrass changes to invasive shrubs (lantana and haole-koa). This change will reduce the infiltration and increase the runoff.
- 11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site): None.
- 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: Naturalized, warm season, mid-height perennial bunchgrasses >>

Sub-dominant: Naturalized, warm season, non-leguminous forbs =

Other: Naturalized, leguminous shrubs/trees.

Additional:

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

Decadence of herbaceous plants is common due to drought, high evapotranspiration rates, ocean salt-spray, and prolific winds that are common on the site.

14. Average percent litter cover (%) and depth (in): Litter cover above 25% can maintain site stability and function, provided that plant gap does not exceed an average of 1.5-feet and annual production remains in the expected range.

- 15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production): 2000 pounds per acre.
- 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: Prosopis pallida (kiawe); Leucaena leucocephala (haole-koa); Acacia farnesiana (klu); Lantana camara (lantana); Waltheria indica (uhaloa); Chamaecrista nictitans (Japanese tea).
- 17. **Perennial plant reproductive capability:** Capacity to reproduce should not be reduced or impaired in the reference state.