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Hawai'i Montane-Subalpine Dry Grassland

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Vegetation Type

Herbaceous

Map Zones

79

Geographic Range

This grassland ecological system is found in the drier saddle and upper slopes of Mauna Kea, Mauna Loa, Hualalai, Hawai'i, and Haleakalā on Maui.

Biophysical Site Description

This ecological system occurs on dry montane to subalpine areas, from near 1,615-2,300m (5,295-7,540ft) elevation. This montane to subalpine ecological system occurs within the arid, very dry, and moderately dry zones (zones 1, 2 and 3) of the seven moisture zones developed for the Hawaiian Islands by Price et al. (2007). An inversion layer of warmer air forms 50-70% of the time between 1,600-3,000 that dramatically reduces precipitation at higher elevations (Gagne and Cuddihy 1990). This is because the wet trade winds generally do not rise above 1,900m (6,230ft), and are deflected around the mountains leaving upper slopes too dry to support rain forests (Mueller-Dombois and Fosberg 1998). Annual rainfall is generally 400-500mm. Substrates include well-drained, sandy loam soils derived from volcanic ash or cinder and weathered basaltic lava with little soil development. Edaphic properties tend to suppress woody life forms.

Vegetation Description

Vegetation is characterized by moderate to dense bunchgrass layer (<1m tall) dominated by *Eragrostis atropioides* and sometimes codominated by *Panicum tenuifolium* (Gagne and Cuddihy 1990), and *Deschampsia nubigena*. Other herbaceous species include *Eragrostis deflexa*, *E. leptophylla*, *Trisetum glomerata*, and *Agrostis sandwicensis*. Scattered shrubs may be present (<10% cover) such as by *Bidens menziesii*, *Chenopodium oahuense*, *Dodonaea viscosa*, *Dubautia linearis*, *Gnaphalium sandwichensium*, *Osteomeles anthyllidifolia*, *Myoporum sandwicense*, and *Sophora chrysophylla*.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
ERAT	<i>Eragrostis atropioides</i>	Hardstem lovegrass
PATE6	<i>Panicum tenuifolium</i>	Parkland panicgrass
ERDE	<i>Eragrostis deflexa</i>	Pacific lovegrass
TRGL3	<i>Trisetum glomeratum</i>	Pili uka

DENU6	<i>Deschampsia nubigena</i>	Alpine hairgrass
AGSA3	<i>Agrostis sandwicensis</i>	Hawai'i bentgrass
ERLE3	<i>Eragrostis leptophylla</i>	Mountain lovegrass
PTAQ	<i>Pteridium aquilinum</i>	Western brackenfern

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

Natural (e.g., lava ignited) fires very infrequent (ca 2,000yrs), Anthropogenic fires in pre-contact Hawaii also would have been very rare, grazing by non-native ungulates unimportant until post contact, conversion to pasture post 1800, Today, anthropogenic fire is much more frequent, but fire adapted exotic grass *Pennisetum setaceum* has not significantly invaded and is only occasionally present. Weedy exotic forbs are common, including *Heterotheca grandiflora*, *Verbescum thapsus*, and *Verbesina encelioides* common in disturbed stands (Shaw and Castillo 1997). *Senecio madagascariensis* also a problem. Displacement by alien grasses can change fire regime.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement				
Moderate (Mixed)				
Low (Surface)	103	100		
All Fires	103	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Adjacency or Identification Concerns

This system is similar to Hawai'i Montane-Subalpine Dry Shrubland and Hawai'i Montane-Subalpine Mesic Grassland.

Issues or Problems

Native Uncharacteristic Conditions

Shrubs in this system seldom if ever achieve more than 10% canopy closure.

Comments

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	B	B	B	B	B	B	B	B
Herb	0.5-1.0	A	A	B	B	B	B	B	B	B	B
Herb	>1.0	A	A	B	B	B	B	B	B	B	B

Shrub	0-0.5	B	B	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	0.5-1.0	B	B	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	1.0-3.0	B	B	UN	UN	UN	UN	UN	UN	UN	UN
Shrub	>3.0	B	B	UN	UN	UN	UN	UN	UN	UN	UN
Tree	0-5	B	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	B	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	B	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	B	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	B	UN	UN	UN	UN	UN	UN	UN	UN	UN

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A 3 Early Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PTAQ	<i>Pteridium aquilinum</i>	Western brackenfern	Upper
DENU6	<i>Deschampsia nubigena</i>	Alpine hairgrass	Upper

Description

Bare cinder field, whether freshly laid by volcanic activity, alluvial deposit or aeolian processes, or de-vegetated by major fire. Rapidly colonized by *Pteridium aquilinum* and *Deschampsia nubigena*.

Maximum Tree Size Class

None

Class B 97 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ERAT	<i>Eragrostis atropioides</i>	Hardstem lovegrass	Upper
PTAQ	<i>Pteridium aquilinum</i>	Western brackenfern	Upper
DENU6	<i>Deschampsia nubigena</i>	Alpine hairgrass	Upper
TRGL3	<i>Trisetum glomeratum</i>	Pili uka	Upper

Description

Within 25-50yrs, the major constituents colonize and dominate, forming a closed grassland.

Maximum Tree Size Class

None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:OPN	0	Late1:CLS	30
Late1:CLS	31	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Optional 1	Early1:OPN	Early1:OPN	0.001	1000	No	0
Optional 1	Late1:CLS	Early1:OPN	0.001	1000	Yes	0
Surface Fire	Late1:CLS	Late1:CLS	0.01	100	No	0

Optional Disturbances

Optional 1: Ash Deposit

References

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