18210
Hawai'i Montane-Subalpine Dry Shrubland

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Vegetation Type
Shrubland

Map Zones
79

Geographic Range
This shrubland ecological system is restricted to dryer upper slopes of the higher mountains of Maui (Haleakala) and Hawai‘i (Mauna Kea, Mauna Loa, and Hualalai).

Biophysical Site Description
This ecological system occurs on dry slopes of higher mountains of Maui and Hawai'i, from near 900-3,000m (2,950-9,835ft) elevation. This montane to subalpine ecological system occurs within the very dry and moderately dry zones (zones 2 and 3) of the seven moisture zones developed for the Hawai'ian 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). Stands also occur at lower elevations on leeward sides of islands where there is a strong rain shadow effect. Annual rainfall is generally 400-1,500 mm. Many sites are wind exposed. Substrates include cinder, well-drained, sandy loam soils derived from volcanic ash, and weathered ‘a‘ā or pahoehoe basaltic lava with little soil development.

Vegetation Description
Vegetation is often dominated by an open-to-dense shrub layer dominated by one or more of *Dodonaea viscosa*, *Styphelia tameiameiae*, *Chenopodium oahuense*, shrubby *Metrosideros*, and *Vaccinium* spp. Other shrubs may include *Bidens menziesii*, *Chamaesyce* spp., *Dubautia ciliolata*, *Dubautia linearis*, *Geranium cuneatum*, *Exocarpos*, *Osteomeles anthyllidifolia*, *Gahnia* spp., *Luzula*, *Dianella*, *Silene* spp., *Argyroxiphium* spp., *Lipochaeta* spp., *Sida fallax,* and *Tetramolopium* spp. Scattered *Metrosideros polymorpha*, *Sophora chrysophylla* or *Myoporum sandwicense* trees may be present in some stands. Shrubs extend up to 3m on relatively mesic, protected sites. Native bunchgrasses and forbs (especially rosettes) and ferns are present (e.g., *Sadleria cyatheioides*, *Pellaea ternifolia*, *Asplenium* spp.), but contribute low cover at higher elevation. Grasses can be more abundant at montane elevations, but are generally sparse. Native grasses include *Eragrostis atropioides*, *Deschampsia australis*, and *Eragrastis deflexa*.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
DOVI	*Dodonaea viscosa*	Florida hopbush
STTA	*Styphelia tameiameiae*	Pukiawe
CHOA	*Chenopodium oahuense*	Alaweo
VACCI	*Vaccinium*	Blueberry
BIME	*Bidens menziesii*	Mauna loa beggarticks
CHMU3	*Chamaesyce multiformis*	Variable sandmat
DUCI	*Dubautia ciliolata*	Lava dubautia
GECU	*Geranium cuneatum*	Hinahina

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

Disturbance Description

Lava flow and ash deposition are the primary disturbances. Fire occurs but is not considered to be a significant factor in this type. In areas below upper treeline, these shrublands may exist as a persistent seral stage maintained by disturbance such as periodic fire.

Fire Frequency

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

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

These dry shrublands have broad transition zones with dry woodland dominated by *Metrosideros polymorpha*, *Sophora chrysophylla*, or *Myoporum sandwicense* trees.

Issues or Problems

Fire adapted exotic grasses such as *Pennisetum setaceum* are invasive and threaten these dry shrublands by increasing fire intensity, frequency, and size (Castillo 1997). The exotic rosette forb *Verbascum thapsus* is a common in many stands.

Native Uncharacteristic Conditions

More frequent burning because of presence of fire-adapted exotic grasses such as *Pennisetum setaceum* has converted stands of this dry shrubland to introduced grassland (Castillo 1997).

Comments

Succession Classes

Mapping Rules

		Canopy Cover (%)

Upper Layer Lifeform	Height (m)	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	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	A	A	B	B	C	D	D	D	D	D
Shrub	0.5-1.0	A	A	B	B	C	D	D	D	D	D
Shrub	1.0-3.0	A	A	B	B	C	D	D	D	D	D
Shrub	>3.0	E	E	E	E	E	E	E	E	E	E
Tree	0-5	E	E	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	E	E	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	E	E	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	E	E	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	E	E	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 **8** **Early Development 1 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ASAD	Asplenium adiantum-nigrum	Black spleenwort	Upper
POPE5	Polypodium pellucidum	Dotted polypody	Upper
PELLA	Pellaea	Cliffbrake	Upper
VARE	Vaccinium reticulatum	Ohelo 'ai	Upper

Description

Lava flow, pioneer veg.

Maximum Tree Size Class

None

Class B **2** **Early Development 2 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
RUGI	Rumex giganteus	Pawale	Upper
DUSC	Dubautia scabra	Rough dubautia	Upper
TRGL3	Trisetum glomeratum	Pili uka	Upper

Description

Ash or cinder deposit, pioneer vegetation.

Maximum Tree Size Class
None

Class C 6 Mid Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
STTA	Styphelia tameiameiae	Pukiawe	Upper
DOVI	Dodonaea viscosa	Florida hopbush	Upper
GECU	Geranium cuneatum	Hinahina	Upper

Description
Lava flow with shrubby vegetation.

Maximum Tree Size Class
None

Class D 14 Mid Development 2 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
CHOA	Chenopodium oahuense	Alaweo	Upper
SASA9	Sanicula sandwicensis	Hawai'i blacksnakeroot	Middle
DENU6	Deschampsia nubigena	Alpine hairgrass	Middle
SIHA5	Silene hawaiiensis	Hawai'i catchfly	Middle

Description
Ash deposit with shrubby vegetation.

Maximum Tree Size Class
None

Class E 70 Late Development 1 - Open

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
DULI	Dubautia linearis	Shrubland dubautia	Upper
ARGYR	Argyroxiphium	Silversword	Upper
RAHA2	Ranunculus hawaiensis	Hawai'ian buttercup	Middle
COMO3	Coprosma montana	Alpine mirrorplant	Upper

Description

Late successional stage.

Maximum Tree Size Class
None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:OPN	0	Mid1:OPN	100
Early2:OPN	1	Mid2:OPN	50
Mid2:OPN	51	Late1:OPN	175
Mid1:OPN	101	Late1:OPN	175
Late1:OPN	176	Late1:OPN	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 2	Early2:OPN	Early2:OPN	0.001	1000	No	0
Optional 1	Mid1:OPN	Early1:OPN	0.001	1000	Yes	0
Optional 2	Mid2:OPN	Early2:OPN	0.001	1000	Yes	0
Optional 2	Late1:OPN	Early2:OPN	0.0005	2000	Yes	0
Optional 2	Late1:OPN	Mid2:OPN	0.001	1000	Yes	0
Optional 1	Late1:OPN	Early1:OPN	0.001	1000	Yes	0

Optional Disturbances

Optional 1: Lava Flows
Optional 2: Ash Deposit

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