18210

Hawai'i Montane-Subalpine Dry Shrubland

BpS Model/Description Version: Aug. 2020

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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**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | 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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