18160

Hawai'i Montane-Subalpine Mesic Forest

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
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Vegetation Type

Forest and Woodland

Map Zones

79

Geographic Range

This forest ecological system occurs on mesic montane and subalpine slopes of Kaua'i, Maui and Hawai'i.

Biophysical Site Description

This ecological system occurs on mesic montane and subalpine slopes of Kaua'i, Maui and Hawai'i, from 900-2,000m (2,950-6,560ft) elevation. Stands are found in the mesic, seasonal precipitation zone between the dry leeward and wet windward climates. Sites are too dry to support rain forests, but do not experience extended periods of drought like the dry forests (Gagne and Cuddihy 1990). Annual rainfall is generally 1,000-2,500 mm, with some areas experiencing a distinct dry period. Substrates include deep volcanic ash soils and trachyte, rocky mucks, and silty loams derived from weathered ‘a‘ā lava (Gagne and Cuddihy 1990).

Vegetation Description

Vegetation is characterized by an open-to-dense, mostly evergreen tree layer 10-35m tall. There is often diverse subcanopy and tall shrub layers with lianas. *Metrosideros polymorpha*, *Acacia koa*, or *Nestegis sandwicensis* dominate or codominate with other trees (e.g., *Santalum*, *Sapindus*), often present such as *Coprosma* spp., *Ilex anomala*, *Melicope* spp., *Myoporum* *sandwicense*, *Myrsine* spp., *Nothocestrum breviflorum*, *Pipturus albidus*, *Pisonia brunoniana*, *Pittosporum* spp., *Psychotria hawaiiensis*, *Sapindus saponaria*, *Zanthoxylum hawaiiense*, and dryer forest species like *Chamaesyce celastroides*, *Sophora chrysophylla*, and *Myoporum sandwicense*. The understory is variable and may be dominated by sedges and ferns or shrubs. Tree ferns (*Cibotium* spp.) are typically much less prominent than in wet forest. Common shrubs include *Clermontia* spp., *Cyanea* spp., *Dodonaea viscosa*, *Hedyotis* spp., *Rubus hawaiensis*, *Stenogyne* spp., and *Styphelia tameiameiae*. Common ferns and fern allies present include *Dryopteris wallichiana*, *Microlepia strigosa*, *Nephrolepis cordifolia*, *Pelea* spp., *Sadleria* spp., and graminoids *Carex* spp., and *Uncinia uncinata*.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| MEPO5 | *Metrosideros polymorpha* | 'ohi'a lehua |
| ACKO | *Acacia koa* | Koa |
| NESA2 | *Nestegis sandwicensis* | Hawai'i olive |
| COPRO | *Coprosma* | Mirrorplant |
| MYSA | *Myoporum sandwicense* | Naio |
| MYSA2 | *Myrsine sandwicensis* | Kokea lau li'i |
| PTIR | *Pteris irregularis* | Zigzag brake |
| DRWA | *Dryopteris wallichiana* | Alpine woodfern |

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

Disturbance Description

Disturbances are much the same as in lowland mesic forest, except that human activity is much less. Some selective logging, but very little to no agriculture (occasional sweet potato mounds in the forest), so not part of the model. Major disturbances storms, lava flow, lava- or lightning-ignited fire, can use the lowland mesic forest model except take out human disturbances, time frames from lowland mesic probably work. No human ignited fires are thought to have occurred.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement |  |  |  |  |
| Moderate (Mixed) | 503 | 100 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 503 | 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

None

Adjacency or Identification Concerns

Many constituent spp shared with mesic shrubland, dry shrubland, dry forest.

Issues or Problems

Exotic trees *Morella faya*, *Psidium* spp., *Schinus terebinthifolius* are often present in disturbed stands. Fire adapted exotic grasses such as *Holcus lanatus*, *Pennisetum clandestinum,* and *Pennisetum setaceum* are invasive and threaten these forests by increasing fire intensity, frequency and size.

Native Uncharacteristic Conditions

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 | A | A | A | A | A | A | A | A |
| Shrub | 0.5-1.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | 1.0-3.0 | A | A | A | A | A | A | A | A | A | A |
| Shrub | >3.0 | A | A | A | A | A | A | A | A | A | A |
| Tree | 0-5 | B | B | B | B | B | B | C | C | C | C |
| Tree | 5-10 | B | B | B | B | B | B | C | C | C | C |
| Tree | 10-25 | B | B | B | B | B | B | C | C | C | C |
| Tree | 25-50 | D | D | D | D | D | D | E | E | E | E |
| Tree | >50 | D | D | D | D | D | D | E | E | E | E |

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 2 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| DILI | Dicranopteris linearis | Old world forkedfern | Upper |
| MEPO5 | Metrosideros polymorpha | 'ohi'a lehua | Upper |
| VARE | Vaccinium reticulatum | Ohelo 'ai | Middle |
| PTAQ | Pteridium aquilinum | Western brackenfern | Low-Mid |

Description

Disturbances in this class include lava flows.

*Maximum Tree Size Class*  
None

Class B 14 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| RUHA | Rubus hawaiensis | Hawai'i blackberry | Middle |
| LYVE2 | Lycopodium venustulum | Hairtip clubmoss | Lower |
| MIST4 | Microlepia strigosa | Palapalai | Lower |
| BRAR6 | Broussaisia arguta | Kanawao | Middle |

Description

Disturbances in this class include lava flows. Other disturbances that effect this seral stage include mixed severity fire and storms.

*Maximum Tree Size Class*  
None

Class C 12 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ILAN | Ilex anomala | Hawai'i holly | Upper |
| MYSA2 | Myrsine sandwicensis | Kokea lau li'i | Mid-Upper |
| CORH | Coprosma rhynchocarpa | Woodland mirrorplant | Mid-Upper |
| DISA3 | Diplazium sandwichianum | Hawai'i twinsorus fern | Low-Mid |

Description

Disturbances in this class include lava flows. Other disturbances that effect this seral stage include mixed severity fire and storms.

*Maximum Tree Size Class*  
None

Class D 12 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| EMPA | Embelia pacifica | Kilioe | Lower |
| DRWA | Dryopteris wallichiana | Alpine woodfern | Lower |
| PIBR3 | Pisonia brunoniana | Australasian catchbirdtree | Mid-Upper |
| VIME | Vicia menziesii | Hawai'i vetch | Mid-Upper |

Description

Disturbances in this class include lava flows. Other disturbances that effect this seral stage include mixed severity fire and storms.

*Maximum Tree Size Class*  
None

Class E 60 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| CLPY2 | Clermontia pyrularia | Hamakua clermontia | Middle |
| MEVO | Melicope volcanica | Volcanic melicope | Mid-Upper |
| CYLE5 | Cyanea leptostegia | Giant kokee cyanea | Mid-Upper |
| OCHA | Ochrosia haleakalae | Island yellowwood | Mid-Upper |

Description

Disturbances in this class include lava flows. Other disturbances that effect this seral stage include mixed severity fire and storms.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 20 |
| Mid1:OPN | 21 | Mid1:CLS | 100 |
| Mid1:CLS | 101 | Late1:CLS | 200 |
| Late1:OPN | 201 | Late1:CLS | 230 |
| Late1:CLS | 201 | 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:ALL | Early1:ALL | 0.001 | 1000 | No | 0 |
| Optional 1 | Mid1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.002 | 500 | No | 0 |
| Wind or Weather or Stress | Mid1:OPN | Mid1:OPN | 0.005 | 200 | No | 0 |
| Optional 1 | Mid1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:OPN | 0.002 | 500 | Yes | 0 |
| Wind or Weather or Stress | Mid1:CLS | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Optional 1 | Late1:OPN | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.002 | 500 | No | 0 |
| Wind or Weather or Stress | Late1:OPN | Late1:OPN | 0.005 | 200 | No | 0 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.001 | 1000 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:OPN | 0.002 | 500 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:OPN | 0.005 | 200 | Yes | 0 |

Optional Disturbances

Optional 1: lava flows

References

Gagne, W.C., and L.W. Cuddihy. 1990. Vegetation. Pages 45-114 in: W.L. Wagner, D.R. Herbst, and S.H. Sohmer, editors. Manual of the Flowering Plants of Hawaii. 2 Volumes. University of Hawaii Press, Honolulu.

Mueller-Dombois, D., and F.R. Fosberg. 1998. Vegetation of the tropical Pacific islands. Springer-Verlag, New York. 733 pp.

NatureServe. 2008. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.0. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: September 3, 2008 ).

Price, J.P., S.M. Gon III, J.D. Jacobi, and D. Matsuwaki. 2007. Mapping plant species ranges in the Hawaiian Islands: Developing a methodology and associated GIS layers. Hawai'i Cooperative Studies Unit. Technical Report HCSU-008. Pacific Aquaculture and Coastal Resources Center (PACRC), University of Hawai'i, Hilo. 58 pp., includes 16 figures and 6 tables.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1999. Manual of the flowering plants of Hawaii. Revised edition. Volumes 1 and 2. University of Hawaii Press and Bishop Museum Press, Honolulu. 1919 pp.

Western Ecology Working Group of NatureServe. No date. International Ecological Classification Standard: International Vegetation Classification. Terrestrial Vegetation. NatureServe, Boulder, CO.