

18080

Hawai'i Lowland Rainforest

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Vegetation Type

Forest and Woodland

Map Zones

79

Geographic Range

This system occurs from sea level to 1,000m (0-3,280ft) elevation on Kaua'i, O'ahu, Moloka'i, Lana'i, Maui, and Hawai'i. Hawai'i Lowland Rainforest occurs on all the main islands except Ni'ihau and Kaho'olawe.

Biophysical Site Description

Lowland wet forests are thought to have been the predominant original vegetation of the windward lowlands on the larger main islands (Zimmerman, 1948). The system occurs on windward slopes high enough to intercept orographic rainfall resulting from rising moist tradewind air. Soils vary throughout the island chain, from gray acid clays on older islands to thin organic mucks over lava flows and ash beds on Hawai'i.

Vegetation Description

The canopy is dominated by *Metrosideros polymorpha* or, in some forests, by *Acacia koa* where it attains heights of up to 40m. On some islands, this system forms a distinct belt above Acacia-dominated mesic forest. Diversity in the lowland rainforest is high, and *Metrosideros* and *Acacia* at times form an emergent layer over a diverse layer of native trees beneath the *Metrosideros* canopy, and an understory of native ferns, herbs, shrubs and vines, including *Alyxia oliviformis*, *Antidesma platyphyllum*, *Broussaisia arguta*, *Cheirodendron* spp., *Cibotium* spp., *Coprosma* spp., *Cyrtandra* spp., *Dicranopteris linearis*, *Diospyros sandwicensis*, *Freycinetia arborea*, *Hedyotis* spp., *Ilex anomala*, *Korthalsella* spp., *Machaerina* spp., *Melicope* spp., *Myrsine* spp., *Peperomia* spp., *Pittosporum* spp., *Perrottetia sandwicensis*, *Psychotria* spp., *Sadleria* spp., *Smilax melastomifolia*, and in some areas *Pritchardia* spp. Native trees that occur in the understory include kopiko (*Psychotria hawaiiensis*) and hame (*Antidesma platyphyllum*). The endemic liama (*Freycinetia arborea*) is often abundant in these forests. Species that act as epiphytes include *Astelia menziesiana*, *Peperomia* spp., *Adenophorus*, *Huperzia*, and *Elaphoglossum* spp. In the upper reaches of the lowland ohia forest on the island of Hawai'i the understory is dominated by tree ferns or hapu'u (*Cibotium* spp.) which form a distinct closed layer beneath the trees. A more open *Metrosideros* forest with other scattered native trees and a dense ground cover of the indigenous mat-forming uluhe (*Dicranopteris linearis*) and other related ferns (*Diplopterigium pinnatum*, *Sticherus owhyensis*) is seen on steep ridges and valley walls of Kaua'i, O'ahu, Moloka'i, Maui, and the Kohola Mountains of Hawai'i Island (Cuddihy et

al. 1990). *Freycinetia*, *Antidesma platyphyllum*, *Perrottetia*, and *Bobea* are constituents restricted largely to the lowland zone.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
MEPO5	<i>Metrosideros polymorpha</i>	'ohi'a lehua
CHTR2	<i>Cheirodendron trigynum</i>	Olapalapa
BOEL3	<i>Bobea elatior</i>	'ahakea lau nui
ANPL2	<i>Antidesma platyphyllum</i>	Ha'a
BRAR6	<i>Broussaisia arguta</i>	Kanawao
DILI	<i>Dicranopteris linearis</i>	Old world forkedfern
PESA3	<i>Perrottetia sandwicensis</i>	Olomea
CIGL	<i>Cibotium glaucum</i>	Hapu'u

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

Disturbance Description

The lowland wet forest was historically (pre-Polynesian times) more widespread below 1,000m (3,280ft) elevation on the larger islands in windward areas with deep soils before being subjected to cultivation by Hawaiians. Where lands cultivated by Hawaiians were not subsequently used for agriculture, grazing, or urban development, they were invaded by species of Polynesian introduction, particularly kukui (*Aleurites moluccana*) and by later post-European introductions such as strawberry guava (*Psidium cattleianum*). Disturbances in this system include landslides in wet valleys, flood, lava flows, storms, rat predation, and fire. Landslides occur in all seral states except the early development. Landslides are considered to be infrequent events but they have large impacts and will cause later development (seral) stages to transition back to A. Landslides are not currently incorporated into the model.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement				
Moderate (Mixed)	1090	100		
Low (Surface)				
All Fires	1090	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 closely resembles and is often found adjacent to Hawai'i Montane Rainforest (CES412.215) and Hawai'i Uluhe Fern Shrubland (CES412.219).

Issues or Problems

The boundary between the lowland and montane wet forests in Hawai'i is not generally agreed upon by all botanists and ecologists, and it may be variable on different islands. A clear picture of pre-human vegetation is complicated by the extreme disturbance the lowlands have suffered. Nonetheless, roughly 1,000m elevation marks the transition between the warmer lowlands and the cooler montane zone.

Native Uncharacteristic Conditions

Comments

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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	E	E	E	E	E	E	D	D	D	D
Tree	25-50	E	E	E	E	E	E	D	D	D	D
Tree	>50	E	E	E	E	E	E	D	D	D	D

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 5 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
MEPO5	Metrosideros polymorpha	'ohi'a lehua	Upper
DILI	Dicranopteris linearis	Old world forkedfern	Upper
VARE	Vaccinium reticulatum	Ohelo 'ai	Upper
POPE5	Polypodium pellucidum	Dotted polypody	Upper

Description

Maximum Tree Size Class
None

Maximum Tree Size Class
Large 21-33" DBH

Class D	60	Late Development 1 - Closed
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Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
MEPO5	<i>Metrosideros polymorpha</i>	'ohi'a lehua	Upper
CHTR2	<i>Cheirodendron trigynum</i>	Olapalapa	Upper
PSHA3	<i>Psychotria hawaiiensis</i>	Kopiko 'ula	Lower
ANPL2	<i>Antidesma platyphyllum</i>	Ha'a	Lower

Description

Metrosideros is the tallest forest canopy former among many other native Hawaiian tree species found in this mature forest type. Other common trees in this rich climax stage include *Ilex*, *Bobea*, *Melicope*, *Diospyros*, *Pritchardia*, *Myrsine*, *Tetraplasandra*, *Pandanus*, *Perrottetia*, *Syzygium*, *Acacia*, and *Claoxylon*. Shrubs include *Toucharida*, *Hedyotis*, *Broussaisia*, *Cyrtandra*, *Clermontia*, *Cyanea*, *Coprosma*, and *Vaccinium*. Lianas and vines include *Freycinetia*, *Alyxia*, and *Smilax*. Many ferns and herbs in groundcover.

Maximum Tree Size Class

Very Large >33" DBH

Class E	9	Late Development 1 - Open
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Upper Layer Lifeform: Tree

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
MEPO5	<i>Metrosideros polymorpha</i>	'ohi'a lehua	Upper
CHTR2	<i>Cheirodendron trigynum</i>	Olapalapa	Upper
PSHA3	<i>Psychotria hawaiiensis</i>	Kopiko 'ula	Lower
ANPL2	<i>Antidesma platyphyllum</i>	Ha'a	Lower

Description

This is a storm-disturbance and/or canopy dieback variant in which canopy has been opened, but constituent species remain largely the same (rich in several layers).

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	50
Mid1:OPN	51	Mid2:CLS	90
Mid2:CLS	91	Late1:CLS	180
Late1:CLS	181	Late1:CLS	999
Late1:OPN	181	Late1:CLS	205

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 2	Early1:ALL	Early1:ALL	0.0025	400	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.001	1000	No	0
Optional 1	Mid1:OPN	Early1:ALL	0.001	1000	Yes	0
Wind or Weather or Stress	Mid1:OPN	Mid1:OPN	0.005	200	No	0
Mixed Fire	Mid2:CLS	Mid1:OPN	0.001	1000	Yes	0
Optional 1	Mid2:CLS	Early1:ALL	0.001	1000	Yes	0
Wind or Weather or Stress	Mid2:CLS	Mid1:OPN	0.005	200	Yes	0
Mixed Fire	Late1:OPN	Late1:OPN	0.0005	2000	No	0
Optional 1	Late1:OPN	Early1:ALL	0.001	1000	Yes	0
Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.005	200	No	0
Mixed Fire	Late1:CLS	Mid1:OPN	0.001	1000	Yes	0
Optional 1	Late1:CLS	Early1:ALL	0.001	1000	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.0066	152	Yes	0

Optional Disturbances

Optional 1: lava flow

Optional 2: Hawaiian agriculture

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