18060
Hawai'i Bog

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Modelers		Reviewers	
Darren Johnson	darren_johnson@tnc.org		
Jim Jacobi	jim_jacobi@usgs.gov		
Sam Gon III	sgon@tnc.org		

Vegetation Type
Herbaceous Wetland

Map Zones
79

Geographic Range
This system is found in very wet, poorly drained places near mountain summits on Kaua'i, O'ahu, Moloka'i, and West Maui (Selling 1948; Carlquist 1980); on high rainfall windward slopes of East Maui and on windward slopes of the Kohala Mountains, Mauna Kea, and Mauna Loa on Hawai'i Island.

Biophysical Site Description
Hawai'i Upland Bog occurs primarily between 1,067-1,670m (3,500-5,500ft) elevation as isolated small patches on flat or gently sloping topography in high rainfall areas in cloud forests and other wet forests on all the high islands. They are also known to occur at a subalpine bog at 2,270m (7,446ft) elevation on Maui, and a low elevation bog at 646m (2,120ft) on Kaua'i.

Soils remain saturated on a shallow to deep layer of peat (0.01-5m), underlain by an impervious basal clay layer that impedes drainage. A few bogs occur on steeper terrain were precipitation is extremely high, such as in North Bog in the Wai'ale'ale summit region of Kaua'i, where soils remain saturated despite adequate drainage. Two bogs are believed to have formed in former small lakes, one along the Wailuku River, Hawai'i (Treeless bog), the other the subalpine bog on East Maui (Flat Top bog). The low-elevation bog on Kaua'i occurs on shallow, poorly drained acidic peat.

Clay formation in Hawai'ian bogs is typically a result of basaltic weathering under cool, wet conditions that permits an accumulation of humus. Climate is generally very wet (zones 7) of the seven moisture zones developed for the Hawai'ian Islands by Price et al. (2007). Annual precipitation typically is over 4500mm. On flat and gently sloping terrain, the clay formation impedes drainage resulting in perched water on top of the clay. In addition, it has now been established that eolian clay mineral deposits accumulated on broad summits and ridges within high rainfall and cloud areas over a 200,000-500,000yr time span have also contributed to the formation of clay substrates that support Hawai'ian bogs. Clay formation in Hawai'ian bogs is typically a result of basaltic weathering under cool, wet conditions that permits an accumulation of humus. On flat and gently sloping terrain, the clay formation impedes drainage resulting in perched water on top of the clay. In addition, it has now been established that eolian clay mineral

deposits accumulated on broad summits and ridges within high rainfall and cloud areas over a 200,000-500,000yr time span have also contributed to the formation of clay substrates that support Hawai'ian bogs.

Vegetation Description

Bogs are characterized by an uneven hummocky matrix of sedges and grasses (*Oreobolus furcatus*, *Carex* spp., *Rhynchospora* spp., *Dicanthelium* spp.) and stunted woody plants including 'ohi'a, pilo (*Coprosma ochracea*), and na'ena'e (*Dubautia* spp.) Dwarfed or stunted woody plants can occur as scattered individuals, in clumps, or as a continuous layer. Associated ferns and herbs include *Sadleria* spp., *Polypodium* spp., *Hymenophyllum* spp., *Elaphoglossum* spp., *Athyrium* spp., *Schizaea robusta*, *Selaginella deflexa*, *Plantago* spp., *Astelia* spp., *Viola* spp., *Machaerina* spp., *Lysimachia* spp., and on Kaua'i, the boreal catchfly *Drosera anglica*.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
LOGL4	*Lobelia gloria-montis*	Bog lobelia
ORFU2	*Oreobolus furcatus*	Hawai'i island sedge
MEPOP4	*Metrosideros polymorpha var. pumila*	'ohi'a lehua
PLPA4	*Plantago pachyphylla*	Maui plantain
SEDE4	*Selaginella deflexa*	Deflexed spikemoss
DRAN	*Drosera anglica*	English sundew
DIHI2	*Dichanthelium hillebrandianum*	Bog rosette grass
ARGR5	*Argyroxiphium grayanum*	Hana forest silversword

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

Disturbance Description

Primary disturbances include landslides and erosion that drain these areas resulting in drier substrate conditions that favor shrubland and forest development. Landslides will cause this system to transition to a late successional stage of wet forested systems such as Hawaii Lowland Rainforest, Montane Rainforest, and Cloud Forest.

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

Issues or Problems

This system is in fact a seral stage of many wet forested systems found in the Hawaiian archipelago, but we were unable to model that without violating the LANDFIRE modeling rule limiting models to five seral stages. This also prevented us from modeling the primary

disturbance, landslides (resulting in drainage), which cause this type to transition back to an early successional forest type. As such it has been modeled as a late stage closed one box model.

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	A	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	A	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	A	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	A	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	A	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 100 Late Development 1 - Closed

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ORFU2	Oreobolus furcatus	Hawai'i island sedge	Upper
MEPOP4	Metrosideros polymorpha var. pumila	'ohi'a lehua	Upper
DIHI2	Dichanthelium hillebrandianum	Bog rosette grass	Upper
PLPA4	Plantago pachyphylla	Maui plantain	Upper

Description

This state persists for thousands of year (climax seral state). Experts agree that this is a seral state of wet forested systems found in Hawai'i when poor drainage creates continually saturated, low oxygen, high acid substrate.

Maximum Tree Size Class
None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Late1:CLS	0	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

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