An altitudinal transect analysis of the windward vegetation on Haleakala, a Hawaiian island mountain: (2) vegetation zonation

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with 5 figures and 3 tables

Abstract. Floristic composition, structure, and distributional patterns of plant communities were studied along a transect between 350 m and the summit (3055 m) on a windward slope of Mt. Haleakala, Maui, Hawaii. A working hypothesis tested was that plant communities would be altitudinally excessively wide ranging in distribution due to lessened interspecific competition, a putative consequence expected from the island’s isolation. The plant communities, classified by Braun-Blanquet’s synthesis table technique, were closely correlated with altitude; thus, they characterized discrete vegetation zones. At the top of the classification hierarchy, the rain forest and the treeless high altitude vegetation were differentiated. The rain forest was dominated by a single endemic tree species, *Metrosideros polymorpha*, with one broad-ranging and two zonally discrete morpho-varieties. The rain forest vegetation was subdivided into two units, corresponding to the lowland and montane zones. These units and the high altitude vegetation were further partitioned into seven plant communities which indicated the following zones: dieback forest belt (450-600 m asl), lowland intact forest (c. 350 and 600-1000 m), lower (1200-1700 m) and upper (1750-1950 m) montane forest, forest line (1900-1950 m), subalpine scrub (1950-2700 m), and alpine desert (above 2700 m). The upper boundaries of the lowland, montane, and subalpine zones coincided with the lifting condensation level (c. 1000 m), the base of the frequent trade wind inversion (c. 1900 m), and the frequent ground-frost line (2700 m), respectively. The species turnover rate along the transect, based on similarity values of stands, also showed distinct vegetation boundaries at these altitudes. The strong hierarchical arrangement of the vegetation zones seems to be a characteristic unique to this island mountain. The presence of a large number of associated species over more than one climatic zone, as well as others with more restricted ranges, was responsible for this strong hierarchy.

1. Introduction

Vegetation on isolated oceanic islands shows some divergent ecological phenomena. For instance, certain substituted plant communities which are dominated by alien species, spatially monopolize the landscape over more than one habitat type in Hawaii (Egl er 1939, Mueller-Dombois 1992). The same characteristic can be found in the native dominant canopy species of the Hawaiian rain forest, *Metrosideros polymorpha*. This species has an extremely wide ecological amplitude ranging from newly created lava flows to old growth forest (Mueller-Dombois 1987). In terms of dynamics, monodominant fo-