SIGNIFICANCE OF THE EPIPHYTE LAYER TO STEM WATER STORAGE IN NATIVE AND INVADED TROPICAL MONTANE CLOUD FORESTS IN HAWAI'I

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ABSTRACT

Stem water storage was quantified at two mountain cloud forest sites in Hawaiʻi Volcanoes National Park. Water storage elements measured included all epiphytic mosses, leafy liverworts, and filmy ferns. Tree surface area was estimated and a careful survey was taken to account for all epiphytes in the sample area of the forest. Samples were collected and analyzed in the lab for epiphyte water storage capacity (EWSC). Based on the volume of the different kinds of epiphytes and their corresponding EWSC, forest stand water storage at EWSC for the area surveyed was estimated. Evaporation from the epiphyte mass was quantified using artificial reference samples attached to trees that were weighed at intervals to determine changes in stored water on days without significant rain or fog. In addition, a leaf wetness sensor was wrapped in an epiphyte sample and left in the forest for a 6-day period. Epiphyte biomass at the Native Site and Invaded Site were estimated to be 2.89 t ha^{-1} and 1.05 t ha^{-1}, respectively. Average water storage depth at EWSC at the Native Site and Invaded Site were estimated at 1.45 mm and 0.68 mm, respectively. The difference is likely due to the presence of *Psidium cattleianum* at the Invaded Site; *Psidium cattleianum* is an invasive species in Hawaiʻi that requires no disturbance for an invasion, and the smooth surface of the stem supports no epiphytic layer. The evaporation rate from the epiphyte mass near EWSC for the forest stand at the Native Site was measured at 0.38 mm day^{-1}. Evaporation from the epiphyte mass near EWSC represents 10.6 % of the total E_T from the forest canopy at the Native Site.