Stand level water-use in forests of contrasting rainfall regimes: assessing the impacts of future drying on native Hawaiian ecosystems

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Summary of Accomplishments: Without baseline information of how Hawai‘i’s dominant native trees take up and transpire water, we cannot quantify values that are of relevance to managers: the true economic and biological values of maintaining native vegetation, nor can we predict how climate change and invasion will affect the hydrological functioning of Hawai‘i’s watersheds. Our project objectives are to determine the extent, timing and longevity of moisture effects on water use, water-use efficiency and plant growth in a strongly water limited and non-limited forest. The results of this study will facilitate better management decisions by providing: 1) stand-level estimates for dry and wet sites, scaled up from sap flux measurements using 5 years of plot census data on tree size (basal area and biomass) and growth, and 2) using the sap flux and water-use observations to estimate tree photosynthesis and gross primary productivity, detailing information relevant to tree growth and mortality. We are examining stand water use, growth and mortality in an established pair of forest inventory and dynamics research plots located in the Hawai‘i Experimental Tropical Forest (HETF). These plots are part of the HIPPPNET plot network (www.hippnet.hawaii.edu), established by Hawai‘i EPSCoR (http://www.epscor.hawaii.edu/). The Environmental Dynamics and Ecosystem Response (ENDER) Climate team established a coupled climate/vegetation observatory that contains sites across gradients in leeward and windward Hawai‘i Island. This proposal takes advantage of the two sites at which we have detailed vegetation data and above-canopy height towers (30-32 m): Laupâhoehoe Natural Area Reserve and the Forest Bird Sanctuary at Pu‘u Wa‘awa‘a.

Progress to date: We are in the beginning stages of our project and have just hired a full-time technician to coordinate sap flux sensors and climate measurements and maintenance. Adam Sibley will start in early November 2013. In July 2013, collaborator Yoshiyuki Miyazawa visited Hawaii for three weeks and constructed the sap flux probes. Installation in the field was not done because we were awaiting permits (now received). With Adam’s hire, installation should be able to occur in the next month and then there will be major troubleshooting required probably until the end of the year.

Outreach to managers and community: We will be attending the Hawai‘i Island Conservation Forum on November 12, 2013 organized by Three Mountain Alliance, Big Island Invasive Species Committee, Mauna Kea Watershed Alliance, and the Kohala Watershed Partnership, and we are providing some funds to defray meeting costs.

Staff on project: Adam Sibley, technician

Figure 1. Sap flux probes will be established in canopy trees near the tower areas at both Pu‘u Wa‘a Wa‘a (pictured) and Laupāhoehoe.

Figure 2. Dr. Yoshiyuki Miyazawa installing sap flux probe at a previous site.