Sea-Level Rise Modeling as a Catalyst for Effective Ecological Management in West Hawai‘i, The Nature Conservancy, PI: Charles Wiggins (L. Marrack and E. Conklin, Co-PIs)
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ABSTRACT

Global mean sea level is projected to rise between 1 and 2 meters by 2100. The distribution and structure of coastal and marine ecosystems are expected to change due to flooding, erosion, saltwater intrusion, or a combination of these phenomena. Coastal ecosystems may shift inland if open space is available and conditions are suitable. These shifts may benefit ecosystem integrity due to habitat expansion or impair it by changing hydrology or facilitating the spread of invasive species. Ideally, potential habitat sites can be protected and incorporated into restoration efforts so that vulnerable ecosystems and species will persist into the future and long-term integrity of conservation and restoration efforts can be supported.

Unique groundwater-fed anchialine pools, wetlands, and fishponds occur throughout the west Hawai‘i Sentinel Site coastal corridor and support numerous endemic species as well as provide key ecosystem services to natural and human communities. Predicting the effect of sea-level rise (SLR) on these ecosystems requires models that incorporate groundwater levels which are elevated above sea levels and will exacerbate flooding in the porous basalt aquifer.

This project will generate information to guide management and policy decisions based on the following four questions: (1) what are the potential ecological impacts of changes in sea level on coastal and marine conservation priorities within groundwater-fed wetlands, fishponds, and anchialine pools?; (2) what are the potential impacts of changes in sea level on ecosystem services within the focal coastal corridor?; (3) what priority management and policy actions can be implemented to reduce the vulnerability of coastal and marine habitats and communities?; and (4) who will implement priority management and policy actions to reduce vulnerability?

Sea-level rise models have recently been developed for west Hawai‘i and incorporate the current location of priority ecosystems, high resolution LiDAR data, extreme water levels from local tide gauges, and future SLR scenarios. Methods for incorporating groundwater levels have been developed for this coastline, but data on groundwater levels do not exist for the west Hawai‘i Sentinel Site. Refined SLR models for the west Hawai‘i Sentinel Site will be developed by collecting and incorporating high resolution groundwater data collected across a network of wells and groundwater habitats. These models will then be used to predict the response of coastal ecosystems such as anchialine pools, wetlands, and fishponds to rising seas. Maps will be produced using various SLR scenarios that show inundation of existing habitat, creation of new habitat inland, and dispersal of introduced species. These products will be used to along with other qualitative and quantitative data to identify the impacts SLR may have on key ecosystem services provided by the priority ecosystems within the west Hawai‘i Sentinel Site.

These results will be used to update the South Kohala Conservation Action Plan (CAP) from 2011, which included input from more than 90 individuals representing government, non-profits, businesses, and private land-owners. Due to the lack of climate change data, the group decided that the 2011 CAP would focus on non-climate impacts on conservation targets. It is essential to revise the existing CAP to take climate change impacts into account so that ecosystem management actions and conservation planning is successful over the long term. This project will coordinate a series of workshops to evaluate and update the CAP. High resolution data on SLR effects on local habitats and processes will be a key part of this effort. The Nature Conservancy has been a leader in this planning process and will continue this role.