Project Summary

Miconia (*Miconia calvescens*) is dubiously recognized among "*100 of the World's Worst Invaders*"[1]. Hawaii has designated 237,292 ha as critical habitat for 358 endangered species. Threats by these plant invasions to our endemic assets must be addressed through sustained research/management partnerships[2]. Herbicide Ballistic Technology (HBT) is a novel application system developed by the University of Hawaii and registered as a FIFRA 24c Special Local Need (SLN) pesticide to treat Miconia in Hawaii's natural areas. Through sustained partnerships with the MISC, KISC, and OISC, we have eliminated over 23,000 incipient Miconia targets. A new 5-year 24c registration was just extended to 2022.

Miconia is not feasibly eradicable from Hawaii. Major efforts are now focused on developing long-term biological control strategies of the larger infested areas. In our FY16 report, we predict that current statewide investments in miconia containment are only 40% of levels calculated to be successful. Short of this level should trigger decisions to localize protection strategies on prioritized assets[8]. Effective management, regardless of strategy, is achieved when target mortality outpaces biological recruitment. Models interpreting the spatial and temporal dynamics of an invasion are critical to developing cost-effective counter tactics integrating with the larger biocontrol effort to produce complementary outcomes[6]. We have a strong understanding of miconia invasiveness driven by fecundity, dispersal, seed bank longevity and recruitment. It would be beneficial to also understand where this species can invade, as likely limits of suitable habitat exist. This information, could improve efficiencies in management as it will prioritize areas to control as this invasion advances into new locations of the East Maui Watershed.

Project Objective and Approach

The objective of this project is to develop spatially explicit bioeconomic map layers depicting optimal management strategies with a custom database application. Bioeconomic modeling originates from fisheries research looking at dynamic population trends dictated by management (harvest) intensity, in concert with the biological constraints of the species and habitat. In the context of invasive species management, it is essential to predict how populations migrate over space and time to determine preemptive control strategies[16]. This project will customize bioeconomic models for miconia informed by: (i) species biology as described above, (ii) empirically-derived operational (cost) metrics and (iii) habitat suitability models (HSM) correlating presence/absence data to climate layers. These models will present probability density functions of an invasion impact radiating from known target locations, with management imposing measurable reduction. Environmental correlations of suitability will also determine likelihood of impact relative to optimal, where, e.g., higher elevations present less suitable habitat. These model parameters will also interpret impact probability density functions on critical habitat boundaries, where, i.e., impact would be greatest inside critical habitat and have no immediate impact beyond the dispersal kernel (e.g., 1980 m for miconia) or unsuitable habitat. The HSMs will be created from an ensemble of computer modeling techniques and vetted by ground-truth QA/QC with a one-week exploration of randomly selected points in the East Maui Watershed to validate model relevance and utility to actual conditions.