COLLABORATIVE PROPOSAL: MSB-ENSA: COMBINING GRADIENTS OF SPACE AND TIME TO UNDERSTAND BIODIVERSITY DYNAMICS IN THE HAWAIIAN ISLANDS

Biological diversity is fundamentally important to the functioning of all natural and human-engineered ecosystems. Yet we still have only a very rudimentary understanding of biodiversity as a dynamic process – *how has it been shaped in the past, and what are the expectations as we move into the future? How will associated ecosystems adapt to global change?* A grand challenge in understanding the origins of biodiversity is to disentangle the influence of evolutionary and historical processes operating at larger spatiotemporal scales from ecological processes operating at smaller scales. One underexploited system that provides an opportunity to integrate ecological and evolutionary processes is that of remote island archipelagoes, in particular when the component islands are arranged chronologically, as is found in "hotspot" islands with multiple discrete volcanoes each providing elevational gradients with contrasting physiological barriers (temperature and rainfall) across the gradient, and that have incurred radically different anthropogenic impacts. Our proposed research aims to use the Hawaiian Island chronosequence as a natural laboratory for understanding community interactions that underlie biodiversity dynamics and environmental change by incorporating new technologies and theoretical approaches, coupled with standardized sampling protocols, thus providing temporal replicates of the same ecological and evolutionary processes across gradients of elevation. The primary goals of the project are two-fold: (1) Characterizing the biotic community using metabarcoding and related approaches to look at soils &/or atmospheric attributes; microbial diversity; and arthropod and plant diversity. (2) Look at how entire communities are changing (especially in the context of invasions and disease) across the elevation gradients and over the chronosequence using approaches including ecological interaction networks; assessing the predictability of patterns of community assembly and diversification/ extinction; effect of trophic level on diversification; and the effect of interactions on diversification. We will make use of a National Ecological Observatory Network (NEON) site on the Big Island of Hawaii, and integrate the data generated with data currently being generated as part of a NSF Dimensions in Biodiversity project. The data will be integrated into a statistical and Bayesian framework in order to determine signatures of change from ecological processes to evolutionary processes over gradients of elevation, precipitation, and time.