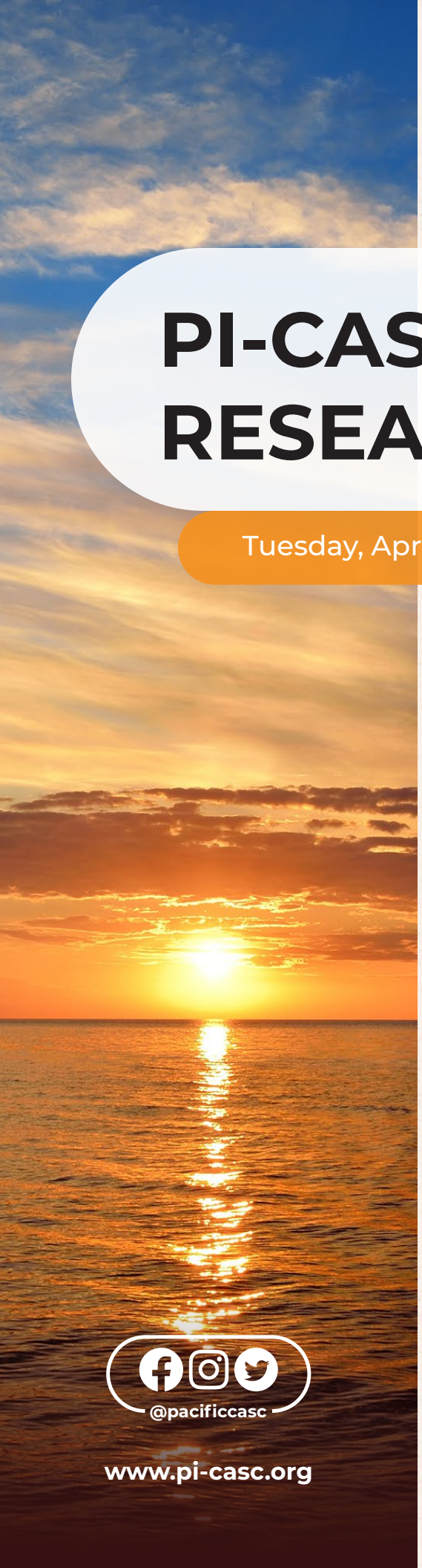

PACIFIC ISLANDS
CLIMATE ADAPTATION SCIENCE CENTER

PI-CASC STUDENT RESEARCH SYMPOSIUM

Tuesday, April 5, 2022 | 8:00AM - 3:00PM | Hyatt Regency Guam

AGENDA

7:30AM	Sign-in
8:00AM	Welcoming remarks and overview
8:30AM	Virtual Block #1: Forest Restoration and Management
9:15AM	Virtual Block #2: Marine and Coastal Effects of Climate Change
10:15AM	Virtual Block #3: Climate change data projections and impacts on wildlife and ecosystems
11:15AM	Lunch
12:15PM	In-person Block #1: University of Hawai‘i at Mānoa
1:00PM	In-person Block #2: University of Hawai‘i at Hilo
1:30PM	In-person Block #3: University of Guam
2:30PM	Closing remarks

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VIRTUAL

Forest Restoration and Management
8:30AM | Virtual Block #1

Enhancing social-ecological resilience and ecosystem services through restoration of coastal agroforestry systems
Gina McGuire

Optimizing forest restoration techniques to increase endangered species habitat and mitigate future drought: Kanakaleonui Bird Corridor
Amberly Pigao

Creating a climate adaptation plan to benefit a community-based subsistence forestry area
David Russell

Marine and Coastal Effects of Climate Change
9:15AM | Virtual Block #2

Sea-level rise viewer for American Samoa: A co-developed visualization and planning tool
Carla Baizeau

Generating a shoreline inventory for Hawai'i Island to increase resilience in the face of rising sea levels
Aloha Kapono

How will mass bleaching events affect the prevalence of ciguatera on Hawaiian reefs?
Nikola Rodriguez

He ala aukai - The Path Near the Sea: Adapting to Climate Inflictions Upon Intertidal Shoreline
Lauren Kapono

Climate change data and impacts on wildlife and ecosystems
10:15AM | Virtual Block #3

Statistical downscaling for rainfall prediction on Hawaiian Islands
Yusuke Hatanaka

Estimating the timing of high streamflow events in Hawai'i using hourly rainfall and antecedent soil moisture conditions
Maxime Gayte

Life on the edge: Coastal plant resilience under sea-level rise in Hawai'i
Anna McCormick

Cloud water interception in Hawai'i: observations and modeling
Han Tseng

IN PERSON

University of Hawai'i at Mānoa
12:15PM | In-person Block #1

A systematic population assessment and genetic analysis of giant clam stocks in American Sāmoa
Paolo Marra-Biggs

Examining how ridge-to-reef governance in Palau can enhance coastal resources and food security in a changing climate
Michelle Harangody

Marine microbial patterns of resistance and resilience in pre-removal and mid-removal mangrove introductions on leeward Moloka'i and windward O'ahu
Becca Lensing

University of Hawai'i at Hilo
1:00PM | In-person Block #2

Shifts in carbon exports from a Hawaiian watershed under a changing climate
Walter Boger

Pockets and pathways to invasion: Monitoring avian disease-carrying mosquitoes in the face of climate change
Stephanie Mladinich

University of Guam
1:30PM | In-person Block #3

Perceptions of Wildfire and Wildfire Management on Guam
Farron Taijeron

Social Equity in Natural Resource Management: A Case Study from southern Guam
Marybelle Quinata

Investigating the occurence of ectomycorrhizal-mediated community dominance of Intsia Bijuga (Fabaceae) in tropical karst limestone forest
Charles Paulino

Evaluating the effects of biochar on seedling health and survivorship in southern Guam
Patrick Keeler

STUDENT RESEARCH ABSTRACTS

University of Hawai‘i at Mānoa

Sea-level rise viewer for American Samoa: A co-developed visualization and planning tool
Carla Baizeau
Virtual Block #2
American Samoa (AS) is vulnerable to sea-level rise (SLR) because most of the islands' villages and infrastructure are located along thin strips of coastal land. The situation is worsened by ongoing subsidence since the 2009 Samoa earthquake; projections suggest AS will experience roughly twice as much SLR by 2060 as would be expected from climate change alone. We propose to work with the Department of Interior and community stakeholders in AS through a series of workshops to co-develop information and tools, empowering decision makers in coastal management. We will produce a probabilistic projection of SLR in AS that combines the effects of subsidence and climate change, map the spatial extent and frequency of high-tide coastal flooding, and assess the contribution of wave energy to coastal flooding. Project outcomes will be provided to stakeholders via a web application: the American Samoa Sea Level Rise Viewer, directly addressing stakeholder needs.

Estimating the timing of high streamflow events in Hawai‘i using hourly rainfall and antecedent soil moisture conditions
Maxime Gayte
Virtual Block #3
Changes in extreme weather such as heavy precipitations and associated floods draw a lot of attention because of their potential consequences to societies and ecosystems. However, relationships between extreme rainfall and high streamflow events remain unclear in Hawai‘i. To advance our understanding of the linkages and mechanisms of these extreme events, we first compared the timing occurrence of annual maximum hourly rainfall and annual peak discharge. Then we estimated the timing of high streamflow events based on antecedent soil moisture conditions and maximum hourly rainfall for defined extreme rainfall events. We found out that the timing of maximum hourly rainfall was inconsistent with annual peak discharge in its occurrence. Nevertheless, the consistency improved when we included antecedent soil moisture conditions along with rainfall to indicate the expected high streamflow. We successfully estimated the occurrence timing of majority high discharge events at one site on O‘ahu and one site on Maui.

Examining how ridge-to-reef governance in Palau can enhance coastal resources and food security in a changing climate
Michelle Harangody
In-person Block #1
Coastal resources are fundamental to food security, livelihoods, culture, social fabric, and general wellbeing throughout the Pacific. In Palau, fish are an important source of protein and income, and they support complex social networks and cultural identity. Traditional agriculture enhances food security while sustaining crops that are culturally significant. These resources face increasing stressors from climate change and expanding development, but ridge-to-reef governance can reduce environmental pressures while promoting integrated, adaptive management. This project combines existing data with qualitative field research to 1) characterize residents' reliance on coastal resources for food and income, and 2) examine the Palau Protected Area Network (PAN) as a case study to determine if, where, and how different institutions are integrating to protect ecological structure and function. Preliminary results identify how ridge-to-reef governance can be enhanced within the PAN system as well as in broader food security and livelihood contexts.

Statistical downscaling for rainfall prediction on Hawaiian Islands
Yusuke Hatanaka
Virtual Block #3
Due to its isolation from the continents and the size of the land, water resource is limited and susceptible to weather surrounding the islands. On top of that, Hawai‘i's rainfall gradient is steep, making the rainfall drastically change across the islands and local areas. Being able to make fine resolution forecasts on the islands, therefore, is crucial to maintaining such resource. This project focuses on making rainfall predictions at high resolution using reanalysis data of 16 environmental variables in coarse grids. All of those variables become input to a statistical downscaling model. At this stage, we focus on the difference in performance between linear models and nonlinear models.

Generating a shoreline inventory for Hawai‘i Island to increase resilience in the face of rising sea levels
Aloha Kapono
Virtual Block #2
Globally, coastal shorelines play a vital role as a defense system against extreme weather, erosion, and storm runoff, and are treasured as a valuable public and cultural resource. Within Hawai‘i, coastal erosion has been documented on the islands of O‘ahu, Maui, and Kaua‘i, proving a critical concern to planners as they envision the future of our coastlines. The lack of a comprehensive shoreline assessment for the Island of Hawai‘i has prevented accurate decision-making due to limited availability of coastline data. In an effort to address this gap, and set precedence for future projects to build upon, this study aimed to create a shoreline inventory by collecting high-resolution imagery of several coastlines, including areas around Ali‘i Drive and Hilo, on the west and east side of Hawai‘i Island.

Marine microbial patterns of resistance and resilience in pre-removal and mid-removal mangrove introductions on leeward Moloka‘i and windward O‘ahu
Becca Lensing
In-Person Block #1
Microbial communities underpin essential estuarine ecosystem services. Yet, we have a poor understanding of how large-scale perturbations, like invasive species and increased weather events, facilitate shifts in community structure and interactions, especially in tropical and sub-tropical estuaries. Here, we identify the short-term water quality and the long-term resilience of planktonic and microbenthos microbial communities in previous

STUDENT RESEARCH ABSTRACTS

and ongoing monitoring projects in Hawaiian invasive mangrove forests subjected to strong weather events. These studies were realized from the co-production of knowledge with Indigenous fishpond stewards Paepae o Heʻeia (Oʻahu) and local Molokaʻi community members and seek to empower communities to understand and protect their natural and cultural resources. These partnerships continue to provide novel and critical insights into how distinct changes, ranging from storms and climate change to biocultural restoration, impact tropical island estuaries, especially traditional Hawaiian fishponds, in the modern world.

A systematic population assessment and genetic analysis of giant clam stocks in American Sāmoa
Paolo Marra-Biggs
In-person Block #1
All species of giant clam are of conservation concern and are listed on both CITES and IUCN as species vulnerable to extinction. However, molecular work has revealed that morphological identification of giant clams is more difficult than previously realized, and existing assessments of population size and extinction risk are confounded by misidentified and cryptic species. Further, the most recent studies conducted on Tridacnid clams in the Samoan Archipelago were published nearly 20 years ago, prior to recognition of *T. noae* and without molecular corroboration of visual identifications. We confirm species boundaries reported in a recent mitogenome study (Tan et al. 2020), and investigate the currently accepted taxonomy of giant clams found in US jurisdictions through phylogenomic analyses. We find that the species list for American Sāmoa is incorrect, and detect *Tridacna noea*, a frequently misidentified cryptic congener to *T. maxima*, as present.

Life on the edge: Coastal plant resilience under sea-level rise in Hawaiʻi
Anna McCormick
Virtual Block #3
Coastal dune ecosystems support biodiversity and human well-being, but their health depends on dune plants stabilizing these critical habitats. Climate change is altering coastal conditions, including increasing salinity via sea-level rise, increased storm surges, and decreasing precipitation. But it is unclear whether these changes are driving salinity exposure beyond dune plant adaptation thresholds. With the National Tropical Botanical Garden and the Maui Nui Botanical Garden, we examine salinity tolerance of dune seedlings to project climate change effects on population regeneration in coastal dune plant communities. We are testing seedling responses in photosynthesis, growth, and survival to three-week salinity treatments that mimic sea-level rise salinity increases. Across 18 diverse species, we detect significant salinity tolerance variation, from full tolerance through halophytic strategies to nearly 100% reduction in growth and survival. This suggests some species may thrive under climate change, while others may experience no seedling recruitment, leading to population declines and extirpation, results that may inform efforts towards restoration and conservation of vulnerable species.

Enhancing social-ecological resilience and ecosystem services through restoration of coastal agroforestry systems
Gina McGuire
Virtual Block #1
Indigenous agroforestry systems were prominent food production systems in pre-European contact Hawaiʻi, and there is great interest in their restoration today for potential as multi-benefit landscapes which contribute to climate mitigation. To help envision potential areas for restoration across the Hawaiian Islands, we draw on interviews with agroforestry practitioners in Hawaiʻi and spatial data on climate, land use history and tenure, and environmental conditions. We use spatial ecosystem service modeling to assess how restoration of various types of agroforestry may influence carbon storage and groundwater recharge. We focus on these two ecosystem services due to their policy relevance, as well as the critical importance of considering carbon-water synergies and tradeoffs in landscape planning. Results firmly place agroforestry restoration as having potential to contribute to carbon sequestration initiatives across the state, ensuring the greatest co-benefits and minimizing tradeoffs in regards to local goals and contexts.

Cloud water interception in Hawaiʻi: observations and modeling
Han Tseng
Virtual Block #3
Cloud water interception, the passive capturing of liquid water droplets in clouds by plants, is a unique ecohydrological process in fog-affected ecosystems such as tropical montane cloud forests and can serve as an extra water source on top of rainfall. However, cloud water interception is highly heterogeneous, and quantifying cloud water interception at scales large enough to answer hydrological questions is difficult. In this study, we examined cloud water interception variations by comparing observations made at five sites with diverse climates and vegetation types across three Hawaiian Islands. We then developed a process-based model to predict cloud water interception by four atmospheric and canopy structural variables. The model performed well given its simplicity, and its relatively low data requirements make it especially suitable for data-scarce areas.

University of Hawaiʻi at Hilo

Shifts in carbon exports from a Hawaiian watershed under a changing climate
Walter Boger
In-person Block #2
Rivers are important pathways that connect ridges to reefs, exporting carbon (organic, inorganic, particulate) that supports coastal productivity. In Hawaiʻi, river discharge is flashy in its timing and magnitude. Storms are expected to increase in frequency and intensity due to climate change. This study's goal is to assess how different discharge affects forms and quantities of carbon transported by the Wailuku River, the largest watershed in the state. We collected samples starting in August 2021 and analyzed them

STUDENT RESEARCH ABSTRACTS

for different carbon forms. Dissolved organic carbon (DOC) increased with discharge. Seeds comprised 20% of baseflow particulate matter (PM) and comprised 25% of stormflow PM. Leaves comprised 27% of baseflow (<3800 L/ s) PM and comprised 32% of stormflow (>3800 L/ s) PM. With predicted changes to discharge from climate change, export of DOC, seed, and leaf matter exports to Hilo Bay could increase in the future, disrupting marine life.

He ala aukai - The Path Near the Sea: Adapting to Climate Inflictions Upon Intertidal Shoreline
Lauren Kapono
Virtual Block #2
Over the past decade of collaborative intertidal monitoring in Hawai'i, locally-led research teams on the shores of Kalaemanō, have identified significant shortcomings in the current research being conducted on Hawai'i Island's unique wave-dominated, rocky intertidal shoreline. This data can influence a more robust and sophisticated understanding of intertidal ecology and sustainable fisheries management. We draw new hypotheses that focus on the effects of seasonal changes in habitat on patterns of reproductive cycles, recruitment, and productivity of rocky intertidal communities. Our project aims to suggest adaptive management strategies for our dynamic rocky intertidal fishery based on the natural carrying capacity of 'opihi (*Cellana spp.*) habitat, and to develop a model of the Kalemanō shoreline to predict long-term impacts of sea-level rise upon the intertidal habitat. Through shoreline mapping and identification of 'opihi habitats, coastal communities can better understand future sea-level rise impacts upon the rocky intertidal.

Pockets and pathways to invasion: Monitoring avian disease-carrying mosquitoes in the face of climate change
Stephanie Mladinich
In-person Block #2
Hawai'i's native forest birds are threatened by avian malaria, a disease vectored by the invasive mosquito, *Culex quinquefasciatus*. With climate change and predicted increases in mosquito abundance at higher elevations, the threat of disease is encroaching on the forest birds' last refugia. In collaboration with Hakalau Forest National Wildlife Refuge, we monitored adult mosquito populations, local climate conditions, and larval habitat across a 300-meter elevational gradient in the lower reaches of the refuge over two field seasons. Our study revealed little evidence of invasion by *Culex quinquefasciatus*, with minimal mosquito captures and larval habitat occupancy, providing an indication of low densities of mosquitoes across the refuge. However, detection efficiency experiments demonstrate the need for increasing trap efficacy, and provide an impetus for the development of innovative detection methods to improve early detection of mosquito invasion.

Optimizing forest restoration techniques to increase endangered species habitat and mitigate future drought: Kanakaleonui Bird Corridor
Amberly Pigao
Virtual Block #1
As avian malaria threatens current habitats, corridors for native birds to move upslope are important for restoration, but climate change in Hawai'i stands to alter forest succession. Areas with abundant daily fog are vital to forest self-regeneration, but many have become resilient, degraded grasslands. Kanakaleonui Bird Corridor (KBC) is a unique sub-alpine forest with fog characteristics, like a montane cloud forest, connecting the lower Hakalau Forest to the eastern upper slopes of Mauna Kea and offering a refuge for native birds. Synthetic fog structures built along existing fence lines capture fog-generated moisture, which then drips down to water seedlings planted below. *Acacia koa* and *Sophora chrysopylla* have also been selected as nurse trees to facilitate growth of seedlings planted under each tree's natural drip line. ZENTRA soil moisture probes and HOBBS temperature gauges capture daily readings at KBC, and seedlings will be monitored for survival and vigor through 2022.

How will mass bleaching events affect the prevalence of ciguatera on Hawaiian reefs?
Nikola Rodriguez
Virtual Block #2
Ciguatera fish poisoning (CFP) is caused by consumption of reef fishes containing toxins produced by dinoflagellates in the genus *Gambierdiscus*. However, it is not clear how the climate-driven changes to reef ecosystems may influence the probability of ciguatoxic fishes and thus the risk of CFP on local communities dependent upon these fisheries. Therefore, the objectives of this study are to evaluate the relationship between coral cover loss, herbivorous fish biomass, and the probability of the high-level predator, Roi (*Cephalopholis argus*), and an herbivore commonly targeted by anglers, Kole (*Ctenochaetus strigosus*), of being ciguatoxic using a commercially available fluorescent receptor binding assay. Fishes were sampled along west Hawai'i Island across a gradient of coral cover loss. The results of the study will allow state agencies to better warn the public about the risk of CFP.

Creating a climate adaptation plan to benefit a community-based subsistence forestry area
David Russell
Virtual Block #1
A collaborative effort is underway involving affiliates from government agencies, universities, non-profit organizations, and members of the community to restore an 84-acre parcel on the Pu'uwa'awa'a cone in North Kona, Hawai'i. Pu'uwa'awa'a cone is an old geologic feature on the Hualālai volcano with a deep, rich soil, making it an excellent site for restoration of dry and mesic plant species. This project has three main components: 1) a literature review of various historic and contemporary sources to identify past plant species that inhabited the Pu'uwa'awa'a cone; 2) ground surveys to identify remnant native species and their locations across the cone; 3) using GIS software to evaluate data on these past and present species in future climate change scenarios, to help identify the most resilient species under predicted climate conditions.

STUDENT RESEARCH ABSTRACTS

Results will be compiled into a climate adaptation plan that can be utilized to inform restoration of Puʻuʻwaʻawaʻa.

University of Guam

Evaluating the effects of biochar on seedling health and survivorship in southern Guam
Patrick Keeler
In-person Block #3
Southern Guam is comprised of hilly savannah grassland and interspersed ravine forests that burn on an annual basis during Guam's dry season. These anthropogenic fires make revegetating southern Guam difficult for natural resource managers by burning acres of viable land. Regular acts of arson have contributed to the formation and sustainment of large swaths of grassland throughout southern Guam. This project will test the effects biochar has on seedling health and survivorship. Biochar has been shown to increase water retention, reduce nutrient leaching, increase cation exchange capacity, and even mitigate soil acidity. By adding biochar, the carbon-rich product created when biomass is heated in a closed container with little to no available air (Lehmann & Joseph 2009), I expect to see an overall decrease in mortality, as well as an increase in stem diameter and height of two outplanted tree species: *Acacia auriculiformis* and *Pterocarpus indicus*.

Investigating the occurence of ectomycorrhizal-mediated community dominance of Intsia Bijuga (Fabaceae) in tropical karst limestone forest
Charles Paulino
In-person Block #3
Tropical forests are known for hosting a high diversty of woody plant taxa, which is believed to be governed by high pest and pathogen pressure that controls species abundances in a community. However, there are some low-diversity communities dominated by one or two species which are believed to be influenced by a symbiosis with a rare type of mycorrhizal fungi, the ectomycorrhizal (ECM) fungi. This has been extensively documented in both the Neotropics and Paleotropics, but not on tropical Pacific islands. For this project, I aim to investigate if ECM-mediated dominance occurs in *Intsia bijuga*, a culturally and ecologically important species indigenous to the western Pacific Ocean.

Social Equity in Natural Resource Management: A Case Study from southern Guam
Marybelle Quinata
In-person Block #3
Our environment is inseparably linked to cultural values, traditions, and identity, which make natural resource management issues more complex to solve. However, effective natural resource management is necessary to build our resilience to climate change and to protect the livelihoods of our island communities. This case study will examine the impacts of community involvement in natural resource management efforts in the Manell-Geus watershed over the last ten years. Volunteer programs are one tool natural resource managers use to educate and involve community members in natural resource management interventions. This project will examine the historical context of natural resource management in southern Guam, explore the value and impact of volunteering for natural resource management, and discuss potential community development opportunities to increase equitable, meaningful involvement in natural resource management on Guam.

Perceptions of Wildfire and Wildfire Management on Guam
Farron Taijeron
In-person Block #3
Though wildfire is an understood phenomenon on Guam, public perception of wildfire and wildfire management have not been studied. For resource managers to effectively work with communities, it is important to understand what communities think about wildfire. Through this project, I conducted a survey which generated 189 responses that showed only 30% of residents of Guam believed that wildfire on Guam is 100% human caused.

ABOUT PI-CASC

The Pacific Islands Climate Adaptation Science Center (PI-CASC) is a collaborative partnership between the U.S. Geological Survey and a university consortium hosted by the University of Hawai'i at Mānoa, with the University of Hawai'i at Hilo and the University of Guam, designed to support sustainability and climate adaptation in communities across the Pacific Islands.