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The 4-Site Pacific transect Collaborative (4-Site)

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ABSTRACT

The vastness of the Pacific Ocean, and the geographic isolation of its island nations, sets the stage for critical disconnects between the drivers and causes of climate change and their local impacts in Pacific Island communities. Pacific Islands, as elsewhere, face persistent local crises at the nexus of natural and human systems that have altered the way we interact with our environments, raising challenging questions about how to sustain the well-being of our communities, and their associated coral reef ecosystems. These ecosystems and communities that rely on them are “canaries in the coal mine” for climate change and biodiversity loss. At the same time, the scientific, technological, indigenous, and social knowledge systems that could contribute to sustainable futures are often siloed in disciplinary as well as political contexts. It is in this arena that the 4-Site Pacific transect Collaborative seeks to work. The big question we ask is, “What knowledge infrastructure is needed to equitably and democratically support Pacific Islands societies in achieving Sustainable Development Goals and promote the resilience of coral reef social-ecological systems”?



FIGURE 1. The 4-Site geographic model.



FIGURE 2. The 4-Site impact ladder.

Vision and Potential Transformative Impact

The 4-site collaborative brings together partners from four well-established, respected research institutions across national borders in the Pacific to enhance adaptive capacity and accelerate action-oriented sciences that will support Pacific Islands societies in achieving Sustainable Development Goals and the resilient well-being of coastal social-ecological systems. The project applies a large-scale, collaborative, transect approach that leverages the islands of Tetiaroa, Moorea, Palmyra, and Oahu as model systems for contributing to the intelligence infrastructure needed for island communities to navigate towards sustainable futures.

The persistent “crisis of the now” in Pacific Island communities has altered the way Islanders interact with their environments and raised challenging questions about governing, managing, and sustaining the well-being of regional communities. coral reefs are especially threatened by a variety of direct and indirect anthropogenic stressors, including increased ocean temperatures and acidification. To combat these existential threats, it is critical to: identify the factors that predict resilient social-ecological systems; integrate and amplify these factors in the design of effective interventions; and implement them through robust management plans and policy frameworks. A place-based model system that integrates local to regional scale dynamics can enable communities to make better conservation decisions quicker and with far less scientific investment or local data gathering.

Realizable, With Connections to Existing U.S. Scientific Infrastructure, technology Development, and Public-Private Partnerships

The collaborative is anchored at research hubs on Oahu (University of Hawai'i), Palmyra (The Nature Conservancy), Moorea (GUMP, CRIOBE-CNRS-EPHE), and Tetiaroa (Tetiaroa Society). We propose a model system approach focused on islands representative of regional diversity, ranging from small private atolls to large heavily populated islands, and spanning a transect across the tropical latitudes currently optimal for coral reefs (Figure 1). 4-site members are already intimately connected to local communities and decision makers that manage coral ecosystems and desire sustainable futures. For example, HIMB partners with six community organizations in managing biocultural restoration of the Heeiea National Estuary Research Reserve; CRIOBE has partnered with local communities on Tahiti to establish a large-scale network of rahui, a traditional form of community-based management; and Tetiaroa Society is partnering with traditional land and sea tenure holders in Arue, Tahiti around sustainable use and marine stewardship issues in the wake of COVID-19.

Scientific/technological Sectors Engaged Outside of Traditional Ocean Sciences

Oceania hosts significant research capacity supported by governments, universities, NGOs, and private foundations, fostering richly situated social and ecological knowledge to support management and policy with an eye on sustainable development goals. Leveraging our collective expertise to critically examine social innovations such as spatial planning and implement culturally-grounded data, knowledge, values, and perspectives is critical to equitably achieve

goals at nested-scales of social-ecological organization. 4-site will focus on community-driven pathways to develop science-based interventions through management plans and policy frameworks that include Indigenous and local knowledge to ensure they are context specific and culturally aligned.

Opportunities for International Participation and Collaboration

- 4-site proposes a series of science-community dialogues and workshops with island nation interested parties to collaboratively:
- characterize functional attributes of nested social-ecological system components, incorporating multidisciplinary data;
 - Model and quantify relationships between functional attributes under historic and current conditions;
 - Map how data and knowledge are utilized in different contexts to conserve and sustainably use natural resources;
 - Predict trajectories of nature's contribution to human well-being under various policy-driven scenarios and environmental conditions using the Island Digital Ecosystem Avatar consortium's predictive modeling approach;
 - Engage and support Indigenous peoples and local communities with templates for island sustainability plans using community-driven data stewardship and equitable dialogues.

Develops Global Capacity and Encourages the Development of the Next Generation of Ocean Scientists, Engineers, and technologists

Addressing foundational questions about resilience in coastal social-ecological systems requires communities to process complex and uncertain dynamics in order to make multi-dimensional decisions. Islands represent efficacious natural laboratories of integral relations between human, environmental, and ecological well-being over millennia. Leveraging place-based scientific model systems, calibrated along a transect, can help local, regional, and coastal communities across the globe build capacity in conservation decision making. By including Pacific Island college students in our synthesis workshops we will extend this impact by providing an opportunity for young scientists to learn through experience and be mentored by community leaders and environmental professionals.

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