Moorea Coral Reef (MCR)

The central goal of the Moorea Coral Reef LTER program is to provide a greater understanding of the physical and biological processes that modulate coral reef ecosystem function, shape local and regional community structure and diversity, and determine the abundance and dynamics of constituent populations. This increased understanding will provide insight into how coral reef ecosystems respond to natural and anthropogenic disturbances that operate across a range of spatial and temporal scales. Coral reefs have immense ecological value. They rival tropical rainforests in annual total gross productivity and support the highest species diversity of any marine habitat. Distressingly, rates of habitat loss in coral reef ecosystems are increasing and typical recovery times following even moderate disturbances can be exceedingly long (~75-100 years). Greater insight into the mechanistic basis of change in coral reef ecosystems will create the capacity to forecast future responses of coral reefs to changing environmental conditions and will provide the information necessary for the development of effective coral reef management strategies.

View of a portion of the coral reef and lagoon complex that make-up the MCR LTER site. Field operations are conducted from the UC Berkeley Richard B. Gump South Pacific Research Station (lower left). Photo by R. Wilder

Site Description and Characteristics:

The MCR LTER site encompasses the complex of coral reefs and lagoons that surround the island of Moorea (17°30'S, 149°50'W). Located in the Society Islands of French Polynesia at the southeastern corner of the Indo-Pacific biodiversity triangle, Moorea is a small (~60 km perimeter), volcanic island 20 km west of Tahiti. The complex system of reefs and narrow (~0.8-1.5 km wide), shallow (~ 5-7 m deep) lagoons that ring the island offers extensive opportunities for studies of coral reef ecosystems. All major coral reef types (e.g., fringing reef, lagoon patch reefs, back reef, barrier reef and fore reef) are present and easily accessible by small boat. The reefs are in excellent condition (~ 70% live coral cover on northern fore reefs) and are dominated by massive *Porites*, *Pocillopora*, *Acropora*, and *Montipora*. Surveys have documented over 600 species of lagoon and fore reef fishes.

The weather in the Society Islands is tropical with two distinct seasons; a cooler (19/25°C low/high), drier winter between May and November and a hotter (21/29°C low/high), more humid summer from December through April. Rainfall (~ 230 cm/month) occurs principally during the summer months although southeasterly winds blowing northward from the Antarctic during the southern winters can give rise to *mara'amu*s; unusually strong winds that bring much cooler temperatures and periods of intense rainfall. Moorea lies outside of the

Southern Pacific cyclone belt, but occasionally does experience the effects of strong cyclones; most recently in the early 1980's.

Research focus: Disentangling cause and effect relationships in coral reef ecosystems requires an interdisciplinary, decadal- and landscape scale program. The MCR LTER research program focuses on improving our understanding of the long-term consequences of disturbance and changing climate regimes in coral reef ecosystems. Our objective is to identify major controls over reef dynamics and quantitatively describe how they are influenced jointly by climate and disturbance. Accordingly, MCR LTER projects are investigating key processes that influence ecosystem function and community structure. Principle scientific goals include:

A MCR LTER investigator photographs reef organisms for quantitative analysis of coral community composition and demography.

Photo by M. Meier.

- Elucidating the mechanistic basis of oceanographic effects on coral reefs
- Evaluating mechanisms and effects of climate forcing
- Examining how species interactions affect growth, survivorship and dynamics of corals and other associated organisms
- Exploring food web relationships and nutrient dynamics
- Understanding the ecological controls and functional significance of biodiversity

All MCR LTER science themes are supported by oceanographic and ecological modeling efforts. Oceanographic models characterize the physical forcing and transport processes in the system, while the ecological models describe critical biological processes. These models will aid in the integration of the individual empirical studies, guide the design of future empirical work, and help relate our findings to other coral reef as well as non-tropical or non-aquatic ecosystems.