



## Erosion and Sedimentation — Scourge of the reef

**Background & Description:** Upland erosion and associated coastal sedimentation are significant threats to the terrestrial and aquatic resources of many Pacific Island Network (PACN) parks. This is particularly true at War in the Pacific National Historical Park (WAPA), Kalaupapa National Historical Park (KALA), and Pu'uhonua o Hōnaunau National Historical Park (PUHO). Tropical soils are thin and generally of poor quality. When vegetation is removed for farming or development, there remains little natural protection for the land as rain and wind remove topsoil, which in turn can alter the overlying plant community. Lost soil is transported down the watershed and can clog streams, altering streambed quality and adversely affecting aquatic organisms, including many rare or endemic species of fish and snails. Stream sediments can also impact human health, especially on islands that rely on streams for drinking water. Soil eventually is flushed from streams onto coastal coral reefs, where it buries corals and degrades water quality. Several international conservation agencies have identified sedimentation as a primary threat to Pacific coral reefs.

Erosion and sedimentation are, however, natural processes on Pacific islands. Coral reef distributions reflect naturally high sediment loads near river mouths, where reef flats are “cut”, or in some cases, do not exist. However, human activity has altered this process. Poorly regulated human development, poor land management practices (particularly associated with



A sediment plume washes onto the Reef at War in the Pacific NHP following a storm in August 2004.

agriculture and wetlands preservation), and wildland fire all contribute to increased erosion and coastal sedimentation.

### Occurrence in Pacific Island Network:

Erosion and sedimentation are a significant problem in several PACN parks. The worst case is at War in the Pacific NHP where the link between wildfire arson, vegetation changes, erosion, and sedimentation have been studied since 2002. At WAPA, declining soil quantity and quality have been attributed to changes in tropical savanna vegetation communities, including the development of “badlands” or areas where all top soil has been entirely lost leaving exposed acidic clays that erode at a rate in excess of 370 tons/acre/year (and possibly as high as 2,500 tons/acre/year). In the waters at WAPA, sedimentation rates are among the highest in the world for a coastal coral reef ecosystem. At the park, coral recruitment, or the settlement and survival of juvenile corals, is among the lowest in the world, and appears to be part of a trend of declining coral recruitment observed across Guam over the last thirty years. During this time period coastal sedimentation has doubled. While the cause of these low recruitment rates has not been established, they may be linked to elevated sediment levels.

Erosion and sedimentation are also known to be a significant problem at KALA (and on Moloka'i in general) and at PUHO on Hawai'i Island, where eroded sediments are impacting both natural and cultural resources.

**Management Considerations:** Reducing the impacts of erosion and coastal sedimentation is not a simple endeavor. Standard methods such as catchment basins are often expensive, technically challenging, and sel-

dom address the ultimate cause. Detailed studies are needed to pinpoint the cause and source of soil loss, so that lasting, long-term

solutions can be achieved. In most cases this will require changes in the way people conduct business in the islands. Many human sources of upland erosion occur outside park boundaries, requiring the NPS to work cooperatively with adjacent land owners and local governments to elicit change.



An NPS diver collects marine benthic data at War in the Pacific NHP as part of an on-going sedimentation study.

On Guam, human activities contributing to soil loss include poor land management, inadequate construction practices, and arson. Finding environmentally friendly yet economically viable alternatives to current practices is a challenge, but successfully addressing these human sources could substantially reduce soil loss and sedimentation on Guam. Similar results may be achievable on other islands where erosion and sedimentation threaten natural resources.

The PACN I&M program will be monitoring erosion and deposition as one of its network Vital Signs. This information will be critical to determine the success of erosion and sediment mitigation efforts, and will provide important information to park managers when working with adjacent landowners.

— D. Minton



An NPS diver (right) fans a coral reef in War in the Pacific NHP to show the sediments that have settled on and killed the corals at this site in the park. In the picture on the left, the corals in the lower left corner are dead; those in the upper right are partially dead.