

A watershed approach to coral reef management at War in the Pacific

By Dwayne Minton

INCREASINGLY, NATIONAL PARK and natural area managers and scientists are recognizing that ecosystem conservation must be conducted with a holistic perspective, looking not at artificially contrived compartments but at ecologically significant units, such as watersheds. Nowhere is this more apparent than in marine resource management, where threats often have an external terrestrial origin and their sources are difficult to identify and isolate. As a result, effective management of our coastal resources must start not at the low tide line but at the top of the mountains. Managers at War in the Pacific National Historical Park are taking this approach to coral reef conservation.

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Located on Guam, War in the Pacific protects more than 1,000 acres (405 ha) of Indo-Pacific coral reef, which is home to more than 3,500 species of marine plants and animals. Park reefs are threatened by numerous land-based environmental problems, including pollution, over-harvest, and poorly regulated land development and recreational activities. One of the most severe impacts to park reefs is nearshore sedimentation. An estimated 27,558 tons (25,000 metric tons) of sediment—the equivalent of 20 dump truck loads per day—are deposited onto park reefs each year.

Sediments directly impact corals through burial, but also harm them by reducing water quality, particularly by diminishing light penetration. Without adequate light, reef-building, or hermatypic, corals will die. Park biologists have estimated that sediment loads on park reefs exceed scientifically quantified mortality thresholds for adult coral and also may be contributing to the low rates of new coral recruitment observed by park staff.

Land erosion is contributing up to 80% of the coastal sediments directly affecting park reefs. Though the problem is straightforward,



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



A large wildfire burns through the savanna of the Asan watershed at War in the Pacific National Historical Park on Guam. The burned savannas, a major source of soil loss that contributes to sedimentation on the park's coral reefs (background), have been a focus of a watershed study of illegal wildland fires, erosion, and coral reef sedimentation.

finding a long-term, economically viable solution is a significant challenge. Erosion is not a simple process on Guam, where extreme environmental conditions, coupled with sociopolitical issues, have created an environmental problem that is destroying Guam's terrestrial and marine ecosystems. Frequent, intense storms can drop as much as 20 inches (50 cm) of rain in 24 hours; steep slopes accelerate the loss of highly erodible clay soils, and poorly planned development and frequent wildland arson along with loss of stabilizing vegetation contribute to accelerated soil loss. Park managers need sufficiently detailed information to better target their management actions to achieve the greatest environmental result.

To gain a better understanding of erosional processes contributing to coastal sedimentation, War in the Pacific undertook a two-year, multidisciplinary assessment of the park's watershed, which concluded in June 2005. With funding from the National Fish and Wildlife Foundation and the National Park Service and with help from cooperating soil scientists, botanists, and wildfire specialists, park coral reef biologists have studied the complex interaction of fire and vegetation structure in upland erosion and coastal sedimentation. The results of this work have been used to develop a strategy for reducing coral reef sedimentation through erosion mitigation.

On Guam, wildfire is not a natural process, and illegal wildland arson contributes significantly to erosion. From June 2003 to June 2005, four wildfires burned approximately 3% of the park watershed, resulting in 3,197 tons (2,900 metric tons) of lost soil. Wildfires were found to

promote invasive grasses, increasing fire frequency and intensity. As fragile topsoils are lost, underlying, inhospitable clays are exposed. These areas, known locally as badlands, are incapable of supporting vegetation, and while they cover only about 5% of the watershed, they account for up to 6,063 tons (5,500 metric tons, or 22% of the total) of soil loss per year.

Elaborate and costly engineering structures such as sediment basins have been proposed to reduce sediment flushing onto park reefs. These structures, though potentially successful, are expensive, do not address the ultimate problem, and require constant and costly maintenance to be effective. The park study suggests that a better long-term management option is to eliminate illegal wildfires and restore badland areas, potentially reducing soil loss and coastal sedimentation by 34% to a level below thresholds of coral mortality.

Recognizing that it has limited resources to achieve these objectives, the park has maintained close partnerships with territorial agencies and nongovernmental organizations. Using these partnerships, park staff hopes to develop a program of culturally sensitive education and community enforcement that will eliminate illegal wildland arson within the park watershed. The park is also working closely with territorial foresters to develop viable badland restoration techniques to restore these problematic areas. ■

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