Section 319
NONPOINT SOURCE PROGRAM SUCCESS STORY
Hawaii

Restoring Native Vegetation Reduces Sediment Entering Coastal Waters

Waterbody Improved

Dry environmental conditions combined with a long history of human land use have resulted in severe erosion on Kaho`olawe. Much of the island has been reduced to barren hardpan, and sediment-laden runoff affects nearshore water quality and threatens the coral reef ecosystem. Efforts to minimize erosion and restore native vegetation in two watersheds on Kaho`olawe (Hakioawa and Kaulana) have reduced the amount of sediment entering the stream/gulch systems and coastal waters and have improved the quality of coastal waters, coral reef ecosystems and native wildlife habitat.

Problem

The island of Kaho`olawe, the smallest of the eight main Hawaiian Islands, is approximately 7 miles southwest of Maui. Kaho`olawe lies within the rain shadow of the volcanic summit of Maui.

The island has a unique history. Evidence suggests that Hawaiians arrived as early as 1000 A.D. Kaho`olawe served as a navigational center for voyaging, an agricultural center, the site of an adze quarry, and a site for religious and cultural ceremonies. More recently, Kaho`olawe was used as a penal colony, a ranch (1858–1941), and a bombing range by the U.S. Navy (1938–1990). The island was also home to as many as 50,000 goats during a 200-year period (1793–1993). Throughout the ranching period, uncontrolled cattle and sheep grazing caused a substantial loss of soil through accelerated erosion.

An estimated 1.9 million tons of soil per year is eroded from Kaho`olawe (Figure 1). This erosion results in extremely high ocean turbidity following rainfall events, affecting coral health and reproduction (although this seems to be improving as a result of long-term revegetation efforts). In 1990 litigation ended the U.S. Navy's use of the island as a bombing range and resulted in transfer of the island to the Kaho`olawe Island Reserve Commission (KIRC). A cleanup project conducted from 1993 to 2004 set the stage for restoration.

Project Highlights

The Hawaii Department of Health, Polluted Runoff Control Program (PRCP), has provided Clean Water Act (CWA) section 319 funding to KIRC to initiate erosion control, reestablish native plant communities, and improve water quality affected by excessive sedimentation. KIRC is managing the island and its resources until the island can be transferred to a sovereign Native Hawaiian entity. The CWA section 319 funds have been matched by more than 80,000 labor hours contributed by volunteers that helped implement best management practices (BMPs) and plant native vegetation. Native Pili grass hay bales (Figure 2) and native seed have been purchased from the U.S. Department of Agriculture's Plant Materials Center on the island of Moloka`i, while other native plants have been acquired from private nurseries on Maui.

Figure 1. A lack of vegetation leads to excessive erosion on Kaho'olawe, which in turn causes sediment loading into adjacent marine waters.

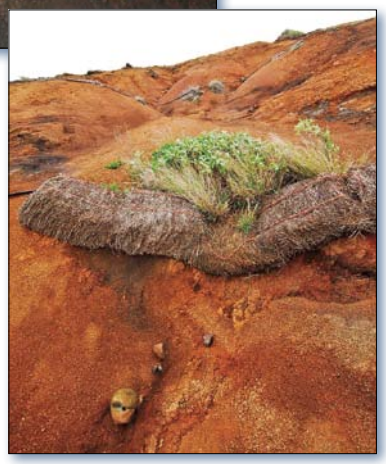

Figure 2. Pili grass hay bales planted with native shrubs create areas of accretion for highly erodible topsoil.

Because the island's average annual rainfall ranges between 10 and 25 inches (due to its location in the rain shadow of Maui), irrigating newly planted vegetation is critical. Project partners use water from a 1-acre roof catchment system that collects and stores about 450,000 gallons of precipitation

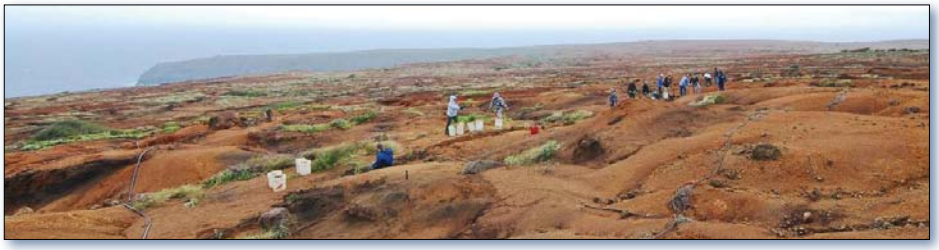

Figure 3. Volunteers plant native shrubs and grasses for Hakioawa's revegetation.

annually. Specific activities undertaken by the project include developing erosion control BMPs, removing and controlling alien animal and plant species, and refining revegetation techniques (Figure 3).

Partners developed a watershed-based plan as a companion document to KIRC's Strategic Plan. It focuses on activities in the Kaulana and Hakioawa watersheds. The U.S. Geological Survey (USGS) has established various monitoring efforts, including: (1) installing stream gauge stations on Kaulana and Hakioawa streams to determine discharge, as well as suspended sediment loading; (2) establishing soil erosion pin transects to determine erosion rates, plant survival, plant cover and plant growth; and (3) monitoring water quality in the nearshore area (primarily for turbidity). The monitoring portion of the project will enable the partners to evaluate restoration techniques and determine the water quality benefits associated with the restoration.

Results

More than 2,000 volunteers have assisted with the restoration efforts. While on the island, the volunteers also benefit from exposure to historical and cultural information. Project partners and volunteers have planted approximately 60,000 plants covering more than 60 acres as part of the revegetation effort. Cover measurements of planted `A`ali`i, a native shrub, have increased 50 percent in one year. Plant survival rates have increased from 10 to 80 percent when irrigated with water from the rain catchment for three months following planting.

Although USGS is still collecting baseline data for the stream gauges and turbidity monitors, it has already documented several interesting results. Soil erosion pin transects installed and monitored by USGS are used to document sediment erosion and accretion in areas restored with vegetation, as well as those that have not yet been restored. USGS recorded five sets of measurements between January 2007 and May 2009. In the Hakioawa watershed, measurements associated with areas planted with native vegetation indicate an average soil accretion of 1.12 millimeters (mm), whereas those associated with areas not planted indicate an average soil erosion of 5.68 mm. In the Kaulana watershed, measurements associated with areas planted with native vegetation indicate an average soil erosion of 0.21 mm, whereas those associated with areas not planted indicate an average soil erosion of 4.50 mm.

Although the data represent conditions over a relatively short time frame and might oversimplify the complex and dynamic processes of erosion and accretion on Kaho`olawe, it appears that restoring native vegetation is reducing the amount of sediment moving over the island, into to the stream gulches and eventually to the ocean. It should be noted that these data have been collected very early in the restoration process and further monitoring data (erosion pin transect data along with stream gauge and sediment sampling and coastal water monitoring) will help to better define the reduction in sediment loading and improvements in water quality and habitat.

Partners and Funding

The KIRC, the Hawaii Department of Health, USGS (Pacific Islands Water Science Center in Honolulu, Hawaii, and Pacific Science Center in Santa Cruz, California), the U.S. Department of Agriculture's Plant Materials Center (Moloka`i), and the efforts of more than 2,000 volunteers have contributed to restoring the Hakioawa and Kaulana watersheds on Kaho`olawe. Since 2004 the Hawaii Department of Health's PRCP has provided nearly $1.9 million in CWA section 319 funding; these funds were supplemented by nearly $1.9 million in matching funds from volunteer restoration activities. It should also be noted that KIRC has supported two restoration program staff positions as part of this effort. Collectively, these funds have allowed KIRC to make considerable progress in its effort to begin restoring the two targeted watersheds by implementing innovative methods to minimize erosion and reduce sediment loads moving from the land into the waters on and around the island.

U.S. Environmental Protection Agency
Office of Water
Washington, DC

EPA 841-F-09-001FF
October 2009

For additional information contact:

Lyman L. Abbott, Natural Resources Specialist III
Kaho`olawe Island Reserve Commission
808-243-5884 • labbott@kirc.hawaii.gov

Hudson Slay
U.S. Environmental Protection Agency
Pacific Islands Contact Office
808-541-2717 • slay.hudson@epa.gov