

Additionally, native vegetation that grows along river or stream banks also helps to retain sediment. Without vegetation, heavy rains can cause flooding of rivers and wash sediment out to sea, where it can cause damage to seagrass beds and coral reefs.

In many areas of the Pacific, native coastal and riparian vegetation has been removed or lost for various reasons such as 1) purposeful removal for development, 2) grazing by livestock, 3) planting of agriculture near streams, and 4) competition by non-native species. In several coastal communities, younger generations have come to understand the degraded condition of coastal and riparian vegetation as normal and are not aware that different, more natural species complexes once dominated these areas.

Enhancing native vegetation can help to stabilize beaches and reduce beach erosion. It can also help to form a protective barrier to reduce the impact of wave action on the coast. Additionally, native coast vegetation can help to trap sand, thus helping to rebuild beaches and trap sediment originating from upland areas and to reduce the amount of sediment that enters the ocean and ends up on the reef. Similarly, enhancing native riparian vegetation can help to stabilize stream and river banks, keeping the sediment from washing offshore. Sediment on reefs has been shown to be a cause of significant coral mortality. This in turn contributes to further impact on shorelines, as the role that healthy reefs play in mitigating wave action is reduced.

Maintaining or restoring native coastal and riparian vegetation is one of the best and most cost-effective ways to reduce erosion and reduce sedimentation.

Important natural coastal vegetation in the Pacific includes all species of mangroves, species of Spinifex grass, vedever grass, Purple Beach Bean (*Canavaliarosea*), Yellow Beach Bean (*Vigna marina*), Beach Morning Glory (*Ipomoea pes-caprae*), Beach vitex (*Vitexrotundifolia*), naupaka (*Scaevolasericea*), Hau (*Hibiscus tiliaceus*), and several species of salt-tolerant trees and palms that grow on the coast such as califilium (*Calophylluminophyllum*), coconut palms (*Cocos nucifera*), pandanus (*Pandanustectorius*), Iron wood (*Pemphisacidula*), and many others.

**Mangrove Restoration:** Mangrove restoration is a specific category of coastal restoration that requires specific expertise. As a result, we have provided some specific points that should be taken into account when considering mangrove restoration. Mangroves tend to grow well in estuarine habitats including mudflats, tidal lagoons, salt marshes, rivers, and streams. Restoration of mangroves is a way that communities can assist in the recovery of a coastline ecosystem that has been damaged over time. While re-planting mangroves may seem like an easy approach, there are a number of factors that need to be considered to ensure success. Many restoration efforts have failed because they were not well planned and were carried out in a way that was bound to fail (for example, inappropriate species or location was used). It is critical to have technical support to assist in these efforts, as there are several factors that need to be determined for each specific location.

## ACTION DETAILS

There are several important factors that must be taking into consideration when planning an effort to protect or restore native coastal and riparian vegetation.

1. Given the cost effectiveness of restoration of coastal vegetation compared to other options such as hard defenses, restoration and maintenance of coastal vegetation should be thoroughly explored as a primary option before considering hard options, which also have potential negative impacts.
2. In many cases, native coastal and riparian vegetation can restore itself if a sufficient population of the specific species are still intact and the area is protected. For example, mangroves produce thousands of seeds annually. If an area that once had mangroves has a sufficient source of seeds, in many cases the area can restore itself if any further degradation is halted. Allowing for natural recovery is the least costly and most efficient approach to coastal restoration.
3. When an area that may have once naturally included native vegetation, including mangroves, is too degraded for natural recovery to occur, active restoration can be important.
4. There are many examples where concerted action of large groups of volunteers have been able to successfully restore and maintain coastal vegetation.
5. For restoration projects to be successful, it is important to understand the ecology and hydrology of the area as well as the specific needs of the plants being restored. Important information to gather includes:
  - What species naturally occurred in the area, and specifically where were different species located? This information may be available through historical knowledge of community members, as well as through aerial photographs and other records.
  - Why was the natural vegetation degraded or removed?
  - Does the area still have sufficient ecological and hydrological features to allow for restoration of key coastal plans and riparian areas, or can these features be restored? For example, in many areas of Southeast Asia mangroves were removed to build shrimp ponds. In some cases, the changes made to the soil, including height of the substrate, may not be conducive to restoration and the area may need to be actively graded for restoration to be possible.
  - It is extremely important that community members and their partners make a long-term commitment to not only the restoration of coastal and riparian vegetation but to its maintenance. This should include a commitment to tending restored areas until natural processes are able to maintain the vegetation, and ensuring that the vegetation is not further degraded by grazing, trampling, or overexploitation by people.
  - Many communities engage in coastal rehabilitation without expert advice and follow a common sense approach which often includes using local species that are known to already grow well in the area, using local planting methods, combining replanting with conservation areas or rules to protect the plantings, and securing support of materials and finance from government or NGOs. While these approaches can be successful, several community efforts have had poor results that could have been improved with some expert advice. Common causes of low success in restoration efforts include: selecting ecologically incorrect areas or species, utilizing poor-quality seeds or plantings, not maintaining the vegetation after planting with proper watering and fertilizer, not committing sufficient time to long-term care of the plantings, giving up too early before the natural vegetation starts to establish itself, and not sufficiently protecting plantings from trampling or grazing.

Benefits of This Action	Challenges of This Action
<ul style="list-style-type: none"> <li>• Low to moderate cost.</li> <li>• Volunteers can carry out most of the labor needed to restore coastal areas.</li> <li>• In many areas, vegetation can restore itself once the causes of its degradation are managed.</li> <li>• Native coastal species retain sand and reduce beach erosion.</li> <li>• Native coastal and riparian species reduce the amount of sediment that runs off from the land to reef areas.</li> <li>• Natural beaches and vegetation provide a buffer from wave action and storm surges.</li> <li>• Long-term coastline protection that requires little to no maintenance over time.</li> <li>• Mangroves provide habitat for important food fish and commercial species.</li> </ul>	<ul style="list-style-type: none"> <li>• Technical knowledge of species requirements and appropriate restoration techniques should be used to avoid approaches that will fail.</li> <li>• Land owners must agree to restoration actions.</li> <li>• Restoration can take several years to provide benefits.</li> <li>• Mangroves are not appropriate for all sites and should only be planted where they historically grew.</li> <li>• Restored vegetation can be quickly degraded if the causes of degradation—such as grazing, harvesting, and competition from alien species—are not managed.</li> </ul>

## TECHNICAL EXPERTISE NEEDED

- Technical expertise should be used to carry out restoration of coastal and riparian vegetation—especially mangroves, which have very specific ecological and hydrological needs. Technical experts can help with:
  - Identifying areas that are suitable for restoration and what species historically grew in the area. Don't try to restore native plants in areas where they never grew, unless the ecological characteristics of the area are determined to be appropriate.
  - Identification of the native species that can be used for re-planting, and access young plants or seeds if needed.
  - For mangroves, review tidal range and water flow of the area to determine the best species to use in the restoration site.
  - Providing advice on how to plant and care for restored vegetation.
  - How to balance restoration with ongoing social and economic needs.
  - Identifying existing stressors (or root causes) that may prevent natural growth of native vegetation. For example, structures that block tidal flow or soil that lacks fresh groundwater or is too salty. These stressors may need to be removed before restoration occurs, as they can limit success.
- If technical expertise is not available, communities can proceed with restoration efforts but should utilize appropriate guides for the restoration efforts and focus on restoration of plants that they knew naturally occurred, as well preventing further degradation. There are numerous guides available for the restoration of mangroves and other native plants.

## COSTS FOR IMPLEMENTATION AND MAINTENANCE: \$\$ - \$\$\$

- Overall, costs for restoring native coastal and riparian vegetation are low to moderate, depending on the situation. Many countries have government agencies or non-governmental organizations focused on forestry or conservation, which can provide technical guidance, provide plantings or seeds, and in some cases provide funding support.

- Expenses for restoration of native coastal-vegetation restoration include:
  - o Cost of technical expertise.
  - o For mangroves, potential costs to restore water flow to the area (man-power, equipment, materials).
  - o Potential cost for seedlings.
  - o Support for volunteer efforts including tools and food and drinks for volunteer events.

## TIME REQUIRED

Restoration efforts can take roughly a year to implement, but may require several years (five plus) to determine if actions are successful and to begin provide benefits of coastal protection.

## RESOURCES

Mangrove Action Project. (2006). *Five Steps To Successful Ecological Restoration of Mangroves* [Brochure]. Yogyakarta, Indonesia: Ben Brown. Found at: [http://www.mangroverestoration.com/pdfs/mangrove\\_restoration.pdf](http://www.mangroverestoration.com/pdfs/mangrove_restoration.pdf)

Spalding, M., McIvor, A., Tonneijck, F.H., To, I.S., and Van Eijk, P. (2014). *Mangroves for Coastal Defence. Guidelines for Coastal Managers & Policy Makers*. Published by Wetlands International and The Nature Conservancy. 42 p. Found at: [http://www.wetlands.org/Portals/0/publications/Book/Mangroves%20for%20Coastal%20Defence\\_A%20Decisionmakers%20Guide\\_Web%20Version.pdf](http://www.wetlands.org/Portals/0/publications/Book/Mangroves%20for%20Coastal%20Defence_A%20Decisionmakers%20Guide_Web%20Version.pdf)

## EXAMPLES FROM THE REGION

### **Restoration of Coastal Beach Vegetation:**

Working together with a common goal, management agencies and caring community members in New Zealand have taken many local beach systems from disaster to restoration. The program partners are now funding 100,000 native dune plants each year with a total over 1,000,000 plants (equivalent to about 140 km of frontdunes), all planted by community volunteers. The restored beaches provide improved protection from tsunami, storm-surge flooding, and coastal erosion, and all of the restored sites are showing a significant trend of accretion, despite climatic conditions favoring erosion. In fact, the measured rates of accretion are an order of magnitude larger than would be required to adapt to even the worst IPCC sea-level rise predictions.

Important lessons can be learned from the New Zealand experience, including:

- The scale of rehabilitation work is immense, and as a result any one group, community, ministry, or agency cannot tackle it alone. Success can be achieved through strong and effective partnerships with passionate members of the affected communities.
- Public knowledge of the scope for restoration is an important first step.
- Many people still believe the poor condition of their beaches is natural or normal, and something that cannot easily be solved. The eroded state of beaches/dunes has been their lifetime experience, and so many people have no reference point to judge the immensity of the change or the losses. “It all happened so long ago...” (de Lange, 2007).

**Restoration of Mangroves** — See **Druadrua Island, Fiji Case Study** on page 39 of *Coastal Change in the Pacific Islands Volume One*.