



# WAIMANALO WATERSHED RESTORATION PROJECT

## PLANTS TO CONTROL STREAM BANK EROSION

Is there an erosion problem along your section of the stream? If the erosion problem is not too severe, and your slope is 2:1 or less, planting a combination of shrubs and trees can often help protect stream banks. The Waimanalo Watershed Project has been using native plants with encouraging results on Waimanalo Stream. Check out our plantings next to Weinberg Village (Kahawai Stream) and at the bridge on Saddle City Road (Waimanalo Stream).

### PICK THE RIGHT PLANT

Use the table inside for suggestions for native plants for your stream side project. Take into account the sunlight and water conditions of your site. Purchase healthy container stock from a local nursery.

### PLANTING OUT

- ◆ Make the planting hole twice as wide as the root ball and just as deep. If the soil is clay-like and drains slowly, mix in some coarse red or black cinder, and coarse perlite or compost.
- ◆ Carefully remove the plant from the container and place it in the hole without bending the roots into a “J” shape. Fill the hole back up so the top of the soil is at the same level as the top of the potting mix. Don’t bury the stem or leave roots exposed to air.
- ◆ Water thoroughly after you transplant.

### MULCH

Place a layer of mulch around your plants to conserve water, reduce weed problems and control surface erosion as your planting is filling in. Wood chips, weed mat, and even cardboard can be used for this purpose. Again, don’t bury the stems; it can cause them to rot.

### A WORD ABOUT FERTILIZERS

A heavy hand with the fertilizer has caused a lot of water quality problems in Hawai’i. Fortunately native plants require very low levels of nutrients (which they got at the nursery), so you shouldn’t need to fertilize at all after planting. In general, keep your fertilizers well away from drainage ditches and streams.

### WATERING

Plan to water or irrigate plants when it is dry for up to a year, until the plants are growing well. (NOTE: If you do your planting in the fall from October through November, natural rainfall in the wet season will help you with that chore.)

### SOURCES OF PLANT MATERIALS

**Home Depot**  
**Hui Ku Maoli Ola Native Hawaiian Plant Specialists**  
 phone: 259-6580  
**Native Plant Source**  
 phone: 227-2019

### BOOKS WITH MORE INFO ON NATIVE PLANTS

**Growing Native Hawaiian Plants** by Heidi Bornhorst  
**A Native Hawaiian Garden** by John L. Culliney and Bruce P Koebele



*Native plants at Weinberg Village*

PLANTS TO CONTROL STREAMBANK EROSION

Name <i>Scientific name</i>	Height (ft)	Spread (ft)	Spacing (ft)	Light Requirement	Water Requirement	Elevation (ft)
<b>SEDGES</b> (at waterline) 'Ahu'awa <i>Mariscus javanicus</i>	3'	2'	2-3'	Full to partial sun	Dry to wet	0-600'
<b>GROUNDCOVERS</b> Ilie'e <i>Plumbago zeylanica</i>	1' to 10'	Sprawls	3'	Sun to mostly shady	Dry to wet	0-2000'
Pohinahina <i>Vitex rotundifolia</i>	3'	4'	2-3'	Full sun	Dry to medium	0-500'
<b>SHRUBS</b> 'A'ali'i <i>Dodonaea viscosa</i>	3-10'	8'	3-5'	Full sun	Dry to medium	0-10,000'
'Anapanapa <i>Colubrina asiatica</i>	10-20'	-	5-10'	Full sun to partial shade	Medium to wet	0-300'
Koki'o ke'oke'o <i>Hibiscus anottianus</i>	10-30'	5-10'	5-10'	Full sun to medium shade	Dry to wet	0-2500'
Kulu'i <i>Nototrichium sandwicense</i> <i>Nototrichium humile</i>	3-6'	8'	3-5'	Full sun	Dry to medium	0-2500'
Mamaki <i>Pipturus albidus</i>	6-20'	5-10'	5	Full sun to medium shade	Medium to wet	0-5000'
Ma'o, Hawaiian cotton <i>Gossypium tomentosum</i>	5'	8'	3-5'	Full sun	Dry to medium	0-500'
Naio <i>Myoporum sandwicense</i>	shrub 3-6' tree to 30'	10'	3-5'	Full sun to light shade	Dry to medium	0-7000'
Naupaka, naupaka-kahakai <i>Scaevola sericea</i>	6'	10'	2-5'	Full sun to light shade	Dry to medium	0-500'
Ti* <i>Cordyline fruticosa</i>	4-8'	2'	2-5'	Full sun to light shade	Medium to wet	0-2000'
<b>TREES</b> Hala <i>Pandanus tectorius</i>	35'	25'	10-25'	Full sun	Dry to wet	0-2000'
Kou <i>Cordia subcordata</i>	30'	25'	10-25'	Full sun	Dry to wet	0-1000
Kukui* <i>Aleurites moluccana</i>	50'	30'	10-25'	Full sun to light shade	Medium to wet	0-3000'
Lonomea (Au'ulu) <i>Sapindus oahuensis</i>	30-50'		10-20	Full sun to light shade	Dry to medium	0-2000'
Loulu <i>Pritchardia spp.</i>	25'	15'	3-25	Full sun	Dry to wet	0-1000'
Milo* <i>Thespesia populnea</i>	30'	30'	10-25'	Full sun to light shade	Dry to wet	0-3000'
Ohi'a lehua <i>Metrosideros polymorpha</i>	25' (to 100' in wet areas)	25'	10-25'	Full sun to light shade	Medium to wet	0-7000'
Papala kepau <i>Pisonia umbilifera</i>	10-30'	-	10'	Full sun to partial shade	Medium to wet	300-5000'
Wiliwili <i>Erythrina sandwicensis</i>	20'	20'	10'	Full sun to partial shade	Dry to medium	0-1000'

Note: Plants which show an asterisk are Polynesian introductions and not native plants.

Note: Lower elevations reported on the chart are those established horticulturally, which may be lower than that reported as the lower range. Upper elevations are from Wagner and Herbst, Manual of the Flowering Plants of Hawai'i and from horticultural sources, although many of these plants have not yet been used in upper elevation stream bank plantings.

## PLANTS WITH POTENTIAL

Suggested by botanists and plant propagators, these plants have not yet been evaluated for stream bank planting.

Ferns/Ground covers: Palapalai (*Microlepia strigosa*), Kupukupu (*Nephrolepis cordifolia*), Awapuhi\* (*Zingiber zerumbet*), Ma'oli'oli (*Schiedea kealiae*), Ko'oko'olau (*Bidens amplexans* and *Bidens asymmetrica*).

Sedge: *Carex wahuensis*

Shrubs: Ma'o hau hele, Hau hele wai

Trees: *Charpentiera* spp., *Pouteria sandwicensis*

\* *Polynesian Introduction*

## WEED CONTROL

Waimanalo is full of weeds like ivy gourd, California grass, wild cane and Job's tears. At first you'll need to keep an eye on your new planting to be sure weeds don't crowd out your native plants.

There are several approaches to controlling weeds.

**STALE SEED BED:** Most environmental professionals prefer to deal with weed seeds before planting. The best way to knock back the "weed seed bank" in the soil is to water your planting area, allow the weeds to grow some and then kill them off (by smothering them with black plastic or by very carefully applying AquaMaster™ herbicide). If you do this cycle twice before planting, most of the weed seeds will be killed off. This will save you a lot of time and labor in the future.

**HERBICIDE:** At this time, the only herbicide which is safe to use next to streams is AquaMaster™. You must follow the instructions very carefully or you risk poisoning yourself as well as harming stream life.

**HAND WEEDING:** You'll need to do some hand weeding to keep areas right next to your plant weed-free. Be sure to pull out the weed's roots and to dispose of the weeds in the trash (so they don't regrow elsewhere).

**WEED MATS:** New biodegradable weed control mat products are now available on the market. Well-anchored polypropylene weed mat can be used where it isn't in danger of washing downstream in a flood. Cardboard and wood chips are readily available alternatives. Visit our Saddle City planting to evaluate the materials for yourself.

## INVASIVE ALIENS: BEAUTIFUL BUT DANGEROUS

Most of the problem plants that we hunt down now in Hawai'i were brought in by Botanical Gardens or by the landscaping industry because they were considered attractive. Now they have crowded out Hawaii's native plants and make it difficult for native birds and insects to survive. Be careful not to grow plants which are invasive! If you're in any doubt about your plant, check first with the Hawaii Ecosystems at Risk Project (HEAR) website before planting it out into our environment.

## RIPARIAN RESTORATION PLANT INTERACTIVE KEY

The **Bishop Museum** is developing an interactive plant key for riparian restoration with native Hawaiian species. In the initial phase comprehensive data on 20+ native Hawaiian plants will be available. When completed each of the species in the database will have photographs and a detailed description, favored habitat attributes, names and synonyms, and trials with success and failure information from the field.

### FOR MORE INFO:

Dr. Christopher F. Puttock  
(808) 848-4177  
cputtock@bishopmuseum.org



*Ivy gourd*

### FOR MORE INFO ON INVASIVE PLANTS:

**Hawaii Ecosystems at Risk Project (HEAR):**

<http://www.hear.org/index.html>

**Oahu Invasive Species**

**Committee:** <http://www.hear.org/oisc/>



*Coir rolls at Saddle City stream restoration site*

## BIOENGINEERING TRIALS FOR WAIMANALO

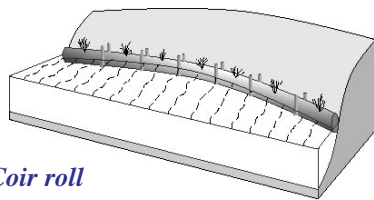
Biotechnical stream bank protection uses living plant materials to reinforce soil and stabilize slopes. Plants can be used as the primary structural component or in combination with inert materials like rock, concrete and steel to help stabilize stream banks. These methods are being tried at Saddle City Bridge:

## EROSION CONTROL FABRICS

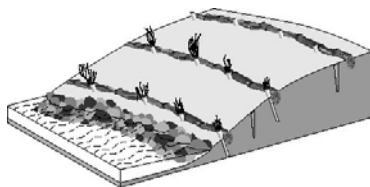
Erosion control fabrics are commercially-available products that can be used to prevent erosion on slopes until vegetation establishes and has a chance to stabilize the slope. The fabrics are constructed of a variety of materials from coconut fiber or jute to straw mulch encased in biodegradable plastic netting. For stream applications, a tightly woven coconut fiber blanket is a durable option. Woody cuttings and herbaceous plants can be planted into the fabric and seed can be placed underneath the fabric. By the time the blanket decomposes, vegetation will have significantly stabilized the stream bank.

## COCONUT FIBER ROLLS

This technique uses a coconut-fiber (called “coir”) roll product to protect the stream bank by stabilizing the toe of the slope and by trapping sediment from the failing stream bank. Riparian plants are transplanted into the coconut fiber roll and behind it. By the time the roll decomposes, stream vegetation will have stabilized the stream bank.



*Coir roll*



*Fascines (bundles of plant cuttings)*

## FASCINES (BUNDLES OF CUTTINGS)

This technique uses bundles of plant cuttings in buried trenches along the slope of an eroding stream bank. This “terrace” is used to reduce the length of slope of the stream bank. The cuttings will sprout and take root, stabilizing the stream bank with a dense cluster of roots. Some toe protection (rocks or other hard armor at the base of the slope) may be necessary with this technique. Some plants that may work include naupaka, wauke, hala, ti and ko.



## FOR MORE INFO ON BIOTECHNICAL SLOPE STABILIZATION

**The Practical Streambank Bioengineering Guide: User’s Guide for Natural Streambank Stabilization Techniques in the Arid and Semi-Arid Great Basin and Intermountain West.** USDA-NRCS. <http://www.nm.nrcs.usda.gov/technical/fotg/section-1/references/streambank.html>

**A Soil Bioengineering Guide for Streambank and Lakeshore Stabilization.** USDA Forest Service <http://www.fs.fed.us/eng/index.htm> Check under: Engineering > Publications



## PREVENTATIVE MAINTENANCE TO AVOID EROSION PROBLEMS

- Do not fill land adjacent to streams (i.e., the stream flood plain). Filling constricts the stream flow area and can put pressure on stream banks causing them to fail in a flood. You may also be subject to prosecution and fines.

- Do not locate infrastructure adjacent to streams (i.e., leave a buffer of 25-100 feet). Watch streams for changes. One way to do this is to take pictures from the same location and with the same orientation at regular intervals. Streams naturally will meander, and these meanders shift over time. Downcutting of streams is serious and will lead to bank stabilization problems.

- Take action before problems are serious. Watch areas where concentrated flows occur. Removing debris in streams and tending vegetation can help. More serious problems may require an engineer's advice.

- Putting brush, fallen trees or trash on the banks in an attempt to protect them can cause harm to your streambank. Putting this material on the bank makes it difficult to monitor the condition of the bank. The material takes up flow area in the stream. Storms can wash the debris downstream where it may clog a bridge or culvert, causing flooding. Use of tires, construction waste and other unapproved materials may result in fines.

- Large trees close to stream banks can be good or bad. Tree roots hold and protect the bank and the tree canopy cools the water temperatures for aquatic organisms. However the weight of larger trees, especially during high winds and hurricanes, can topple a tree and cause a bank failure. Consider taking down diseased trees and trimming back trees to reduce weight and wind resistance.

## SEVERE EROSION PROBLEMS

Severe erosion problems on streams involving deep gullies with very steep slopes will require some form of structural measure to protect the banks. Structural measures such as armoring or training structures must be designed by a professional and will require permits.

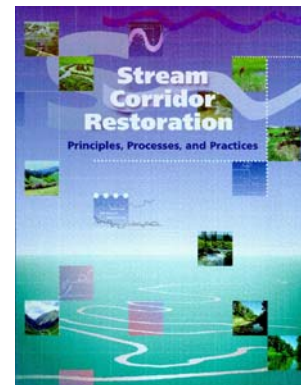
- Contact an engineer or geologist who has done stream bank work to develop a plan of action. Permits may be required from US Army Corps of Engineers, Honolulu C&C, the State Commission on Water Resources Management, and the Dept. of Land and Natural Resources.

- Since stream bank problems often affect more than one property, contact your neighbors to discuss the project. You should plan to discuss the effect of the proposed project on neighboring and downstream properties, equipment access issues, maintenance responsibilities, and opportunities for cost sharing.

- Once you have a design and permits, be sure to hire a contractor with stream bank work experience.

## FOR MORE INFO ON STREAM RESTORATION

Consult the on-line manual "Stream Corridor Restoration: Principles, Processes and Practices" at [http://www.usda.gov/stream\\_restoration/](http://www.usda.gov/stream_restoration/).



## FOR MORE INFO ON SEVERE EROSION PROBLEMS

Basic information and technical assistance may be available from the USDA Natural Resources Conservation Service, the governmental leader for soil conservation and erosion control.

### USDA NRCS

Aiea Service Center  
99-193 Aiea Heights Drive  
Suite #207  
Aiea, HI 96701  
phone: 483-8600

## 9 GUIDELINES TO HELP WAIMANALO STREAMS



**DON'T DUMP RUBBISH, YARD WASTES OR GRASS CLIPPINGS INTO THE DITCH OR STREAM CORRIDOR.** They smother existing plants, causing erosion and spreading invasive, non-native plants. Their decomposition robs the water of valuable oxygen, affecting fish and other aquatic organisms. Rubbish ends up as litter on the beach and trash in the ocean. It's also illegal.



**NEVER USE FERTILIZERS OR PESTICIDES IN THE RIPARIAN OR AQUATIC ZONE.** The runoff can kill insects, fish, birds, and other wildlife.



**KEEP DOMESTIC ANIMALS AWAY FROM THE STREAM BANKS.** Dogs and cats kill stream wildlife. Livestock trample or eat plants, leading to erosion and destruction of wildlife habitat.

**PROTECT EXISTING TREES.** Construction, compaction, tilling, and changes to soil grade or drainage patterns should not occur under the tree drip-line (from the trunk to the edge of vegetation canopy).

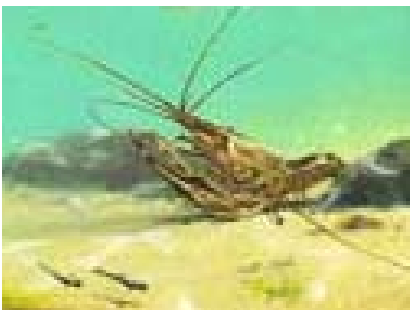
**DON'T RAKE UP LEAF LITTER AND FALLEN BRANCHES OF NATIVE PLANTS.** This material provides food and shelter for beneficial insects, a crucial part of the food chain. It also protects the ground from erosion and helps keep weeds from sprouting.



**CONTROL EROSION BY PROTECTING AREAS WHERE FLOWING WATER MEETS BARE SOIL,** such as on dirt roads, trails, driveways, earthen drainage ditches, or patches of bare or sparsely vegetated earth. Mulch, grasses and groundcovers can slow down the water.

**FOR CONSTRUCTION IN RIPARIAN AREAS, WORK BY HAND.** Avoid machinery.

**MAINTAIN TRAILS TO CORRECT EROSION PROBLEMS.**



**GROW NATIVE PLANTS.** Hawaii's native plants have evolved and are adapted to this environment. They provide food and shelter for endangered native birds and fish, plus have many traditional uses within the Hawaiian culture.

