



# BIO-SHIELDS

Take action to defend our coasts from erosion, storm-surge, tsunami, and sea-level rise!



## Introduction

The 2009 tsunami in Samoa reminded us that we need to be prepared for threats from the ocean. While we can not prevent erosion, storm surge, tsunami, and sea-level rise, there are actions we can take to reduce our risks from these threats. Emergency preparedness and an early warning system are the first steps.

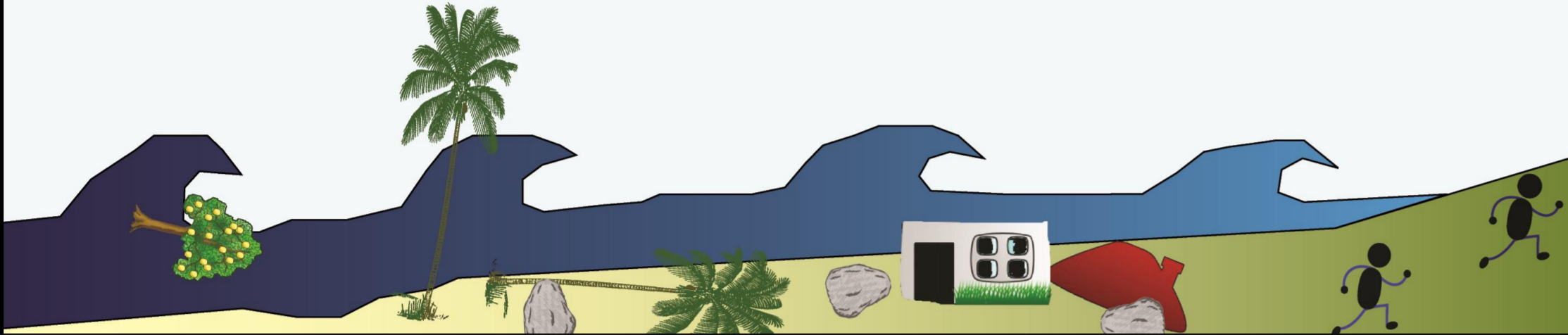
Research from Samoa and elsewhere has shown that a coastal forest (called a bio-shield) can provide protection from waves, wind, and sea spray. In some cases, a Bio-shield can reduce the destructive potential of the waves while providing useful products and services such as habitat for birds, crabs, and other biodiversity.

## What Can A Bio-shield Do?

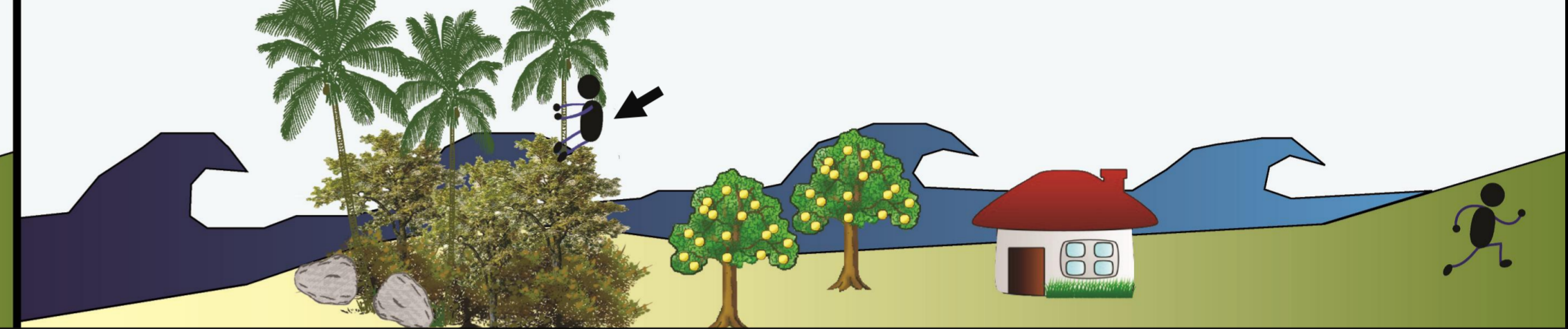
1. Allows people to climb out of the waves
2. Blocks rocks and debris from moving inland
3. Reduces damage to buildings through a reduction in wave energy

4. Protects the reef from debris washed to sea
5. Reduces erosion during large wave events
6. Builds elevation by trapping sand and organic matter

**Without Bio-shield**



**With Bio-shield**



## What Can Be Done

- Avoid cutting down coastal trees and forests!
- Plant a 30 -150 foot wide bio-shield.
- Choose native plants or Polynesian introductions suited to the site's coastal climate zone. Do not plant invasive species.
- Plant hardy coastal plants first. Use these as a wind buffer to plant more species inland.
- Choose plants that are available locally and are easily grown.

- Plant in areas out of reach of normal waves.
- Protect young plants from wind and sea spray.
- Keep animals and people from trampling on young plants.
- Plant dense vegetation in vertical layers: big trees, small trees, shrubs, herbs, ferns, and vines.
- Avoid straight-line paths through the trees. This can channel waves, increasing damage.

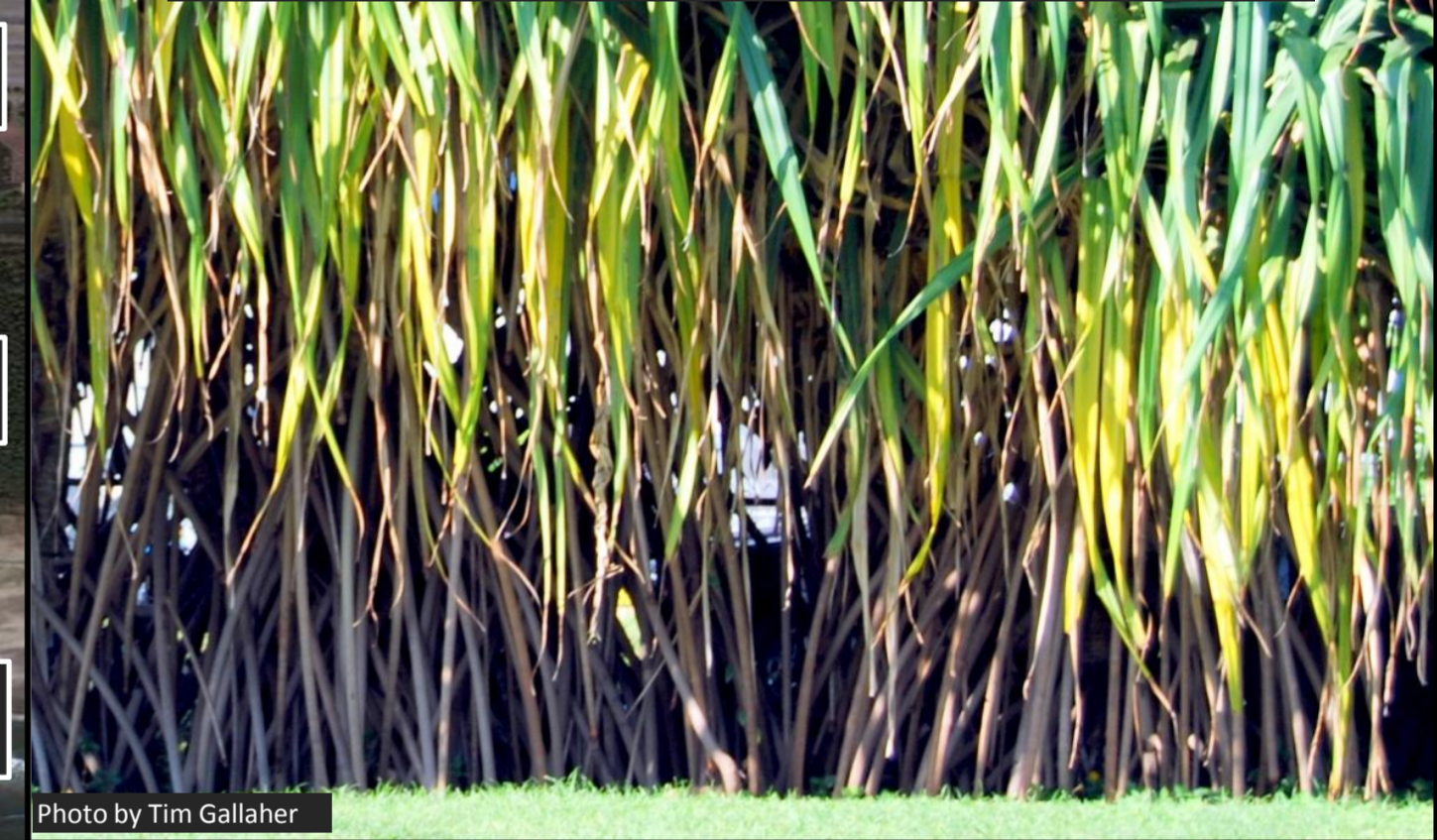
**Coastal Ecosystems Can Support Surprising diversity.**



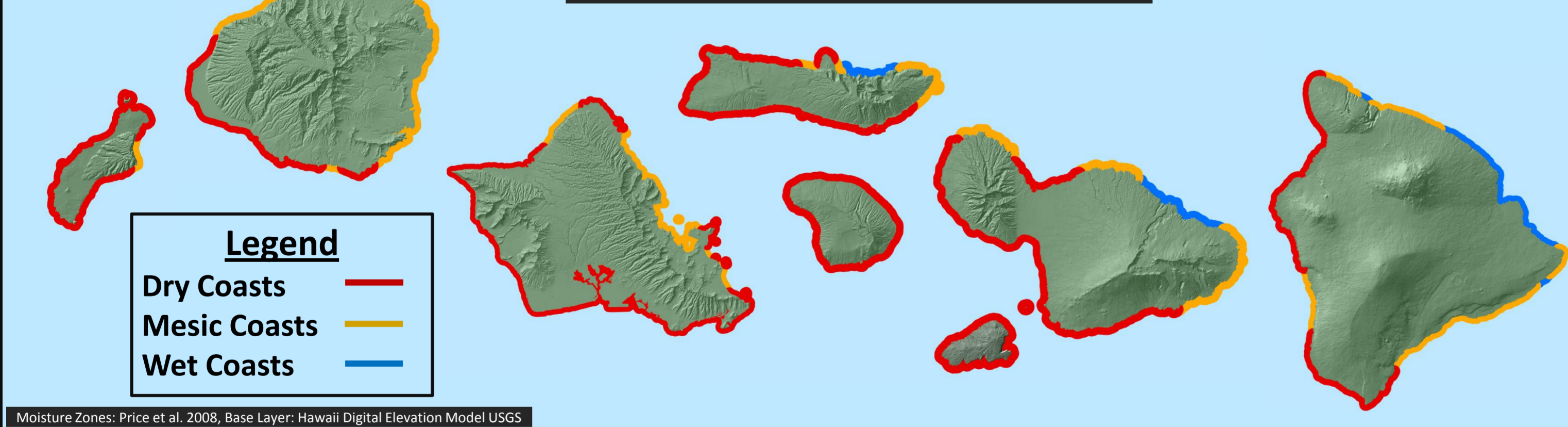
**A Coastal Bio-shield Protecting a Community in Japan**



**Stems, Leaves, and Roots of Plants such as Hala Can Provide an Affective Wave Barrier**



**Coastal Climate Zones of Hawaii**



**A Successful Coastal Reforestation Project in Tonga**



## What to Plant

	<b>Dry Coast Species</b>	<b>Mesic Coast Species</b>	<b>Wet Coast Species</b>
<b>Buffer species</b> first 30 feet from the top of the beach	Naupaka ( <i>Scaevola taccada</i> ) Milo ( <i>Thespesia populnea</i> ) Naio ( <i>Myoporum sandwicense</i> ) Pōhinahina ( <i>Vitex rotundifolia</i> ) Maiapilo ( <i>Capparis sandwiciana</i> )	Hala ( <i>Pandanus tectorius</i> ) Kou ( <i>Cordia subcordata</i> ) Niu ( <i>Cocos nucifera</i> ) Kamani ( <i>Callophylum inophyllum</i> )	Hau ( <i>Hibiscus tiliaceus</i> ) Noni ( <i>Morinda citrifolia</i> ) Kamani ( <i>Callophylum inophyllum</i> ) Hala ( <i>Pandanus tectorius</i> )
<b>Behind the buffer</b> 30-150 feet from the top of the beach	Ma`o ( <i>Gossypium tomentosum</i> ) `a`alii ( <i>Dodonaea viscosa</i> ) `iliahi ( <i>Santalum ellipticum</i> ) `aweoweo ( <i>Chenopodium oahuensis</i> ) `akoko ( <i>Chamaesyce celastroides</i> )	Loulu ( <i>Pritchardia sp.</i> ) `ulu ( <i>Artocarpus altilis</i> ) `ohia lehua ( <i>Metrosideros polymorpha</i> ) `ulei ( <i>Osteomeles anthyllidifolia</i> ) `akia ( <i>Wikstroemia spp.</i> )	Numerous wet lowland species  For more information and a complete list of species visit: <a href="http://www.....">www.....</a>



Information from the University of Hawaii Tropical Plant and Human Interaction Lab with funding from the Kaulunani Urban and Community Forestry Program, USDA Forest Service, and the DLNR Division of Forestry and Wildlife

