

## CLIMATE CHANGE UPDATE

# Innovation may

The coral-growing structure is 'walked' down the beach into position. Below, Arno residents secure the structure.  
Photos: Dr. Thomas Goreau



**A**n innovative shore protection project on Arno Atoll has received an enthusiastic evaluation by a representative of the German government, which funded the work. The "biorock" project, led by the Arno Koba Maron community group and directed by Dr. Thomas Goreau and Eric Hagberg, set out to demonstrate a method to protect an eroding shoreline from sea level rise using a mix of alternative energy.

It integrates use of sustainable energy — wind, solar and wave — with training islanders to construct rebar and chicken wire platforms that are used to grow coral and which are expected — based on the already proven technology used in the Maldives by Goreau — to reduce wave impact and increase beach areas to protect coastal areas.

"We've been looking for something simple and sustainable (to address climate change)," said Carsten Muller, First Secretary of the German Embassy in the Philippines after his visit to Arno. "And we found it (at Arno)."

Carsten, who described Goreau as "one of the leading reef and shoreline protection experts in the world," spent two days reviewing the Arno project late last month, and came away effusive with praise. The German government injected 100,000 Euros (about US\$130,000) into the work, which includes pilot projects at Ine and Jabo islands in Arno and on Enemanet Island in Majuro.

"It's so simple, it's hard to believe it works," Muller said. "Having seen how it works on the ground, I'm thrilled."

Low-lying islands from the Marshalls to the Maldives (in the Indian Ocean) have tried sea walls, gabions (rocks enclosed by chicken wire mesh) and sand bags to protect their shores from erosion, Goreau told the Journal. "They're a disastrous failure," he said.

At a hotel resort on an atoll in the Maldives in the early 2000s, Goreau said "we grew a reef in front of the island" using similar technology as at Arno. The metal structures are con-

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nected to low-voltage electricity, stimulating quick growth of the coral. As the corals grew on the rebar and chicken wire structures, the structures began slowing down the incoming waves.

"The waves still get to shore, but with less force and they deposit sand rather than taking it away," he said.

A side benefit of growing these reef structures is they create a new marine life habitat, drawing in fish and other marine life to the area. "It's an enormous tourist attraction," he said.

At this atoll resort in the Maldives, "now the beach is 50 feet farther out, where before the high tide came right up to the trees on the shore and the bungalows were in danger of falling into the lagoon," Goreau said.

Explaining the technology in use at Arno and Enemanit, Goreau said "we're using the same amount of power as a dim light bulb — about 30 watts."

Power on the two islands in Arno was generated by a windmill (Ine) and a wave generator (Jabo). A power cable is connected to the rebar structures in the lagoon, on which coral has been tied.

A result of the electrical current is it quickly reverses the rust process on the rebar, which turns white as limestone grows on it. With the stimulation of electricity, "corals grow exceptionally quickly," Goreau said.

Nine of these structures were built by Arno residents under Goreau and Hagberg's guidance and installed in the Ine lagoon.

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# save the nation

## Weakening the waves

The principle of shore protection that Dr. Tom Goreau has piloted on Arno and at Enemanit is very different from what he describes as “traditional” shore protection of seawalls.

“A seawall absorbs the energy of the waves and sand disperses,” he said. “The wave energy increases at the base

of the seawall and washes away sand and undermines the structure.”

He also noted how within a few years of installation, gabions (chicken wire baskets filled with rocks) are breaking open from wave damage in the RRE shoreline area and other places in which they are employed.

Goreau’s shoreline protection project is building “open structures,” so the waves go through. “The friction (as the waves move through the coral-filled structures) dissipates the energy of the waves,” he said.

Goreau said these structures are much less expensive than seawalls.



A reef-growing structure off Enemanit Island, Majuro.



Eight more have been built and are ready to be added. “One little windmill is powering the nine structures,” Goreau noted.

The Jabo structures are using what he described as a state of the art wave generator — a box about the size of a large suitcase that is anchored to the lagoon floor and has an “arm” extending downward that moves back and forth with wave motion, generating electricity that is fed into the structures.

Three of these metal structures have been installed on Enemanit by Mike Trevor’s place.

They are using solar power panels that are 40 years old, Goreau said. He noted that while the structures have been in the lagoon for a year, the power was only hooked up about three weeks ago.

When they were connecting the solar power to the structures, “we put some little coral fragments on the structure,” Goreau said. They’ve already shown significant growth, he said.

Muller told the Journal, “this is not just a scientific experiment. It’s a serious practical application.”

Making it all the more impressive is Arno’s “remoteness and the low-level of logistical support available,” Muller said.

While the German funded part of the Marshall Islands project has ended, Muller said he will be submitting a report on this pilot project and hopes that “it can be extended to other locations. Germany is trying to be active in climate change work.”



## Arno’s biorock project

Dr. Thomas Goreau is the President of the Global Coral Reef Alliance. His work has brought him to the Marshall Islands several times, most recently to oversee a pilot project of using “biorock” structures for shoreline protection at Arno Atoll. He works in

islands from the Caribbean to the Indian Ocean.

His organization’s web site contains information on the biorock system, which he Goreau has patented, and on climate change and reef issues. It can be accessed at: [www.globalcoral.org](http://www.globalcoral.org).

## Untapped resources

There are completely untapped energy resources in the Marshall Islands that can be used for a range of sustainable development. That is one message coming out of the Arno shoreline protection “biorock” pilot project.

Power can be produced from the sun, waves, wind and tides, and “only a tiny fraction is needed for shoreline protection,” said Dr. Thomas Goreau, who supervised the work at Arno.

“There has been no development on most outer islands because there is no power,” he said. “But these islands are just as rich as Majuro. If they develop (sustainable power sources) they won’t have to import diesel

**Wind power and wave power are relatively untapped resources.**



fuel. The Marshall Islands is rich in sustainable resources.” The project effectively used wind, wave and solar power.

Other important developments from the pilot project include:

- It was done in a remote location with local residents who had no training and skills for the work. “They were trained to build the structures and tap sustainable energy,” Goreau said. “They had no difficulties in learning techniques needed to save their islands and restore fisheries.”

- Fish stocks in Arno are severely depleted from over-fishing, Goreau noted. The biorock structures help reestablish marine life by creating new habitats for fish.

## Action urgently needed

The Netherlands is about the only nation in the world that has a plan for dealing with sea level rise and climate change, says Dr. Thomas Goreau.

Low-lying areas such as the RMI, Kiribati, Tuvalu, Maldives, and Bangladesh, as well as the United States and other developed nations “have no plan,” he said. But there are adaptive measures that can be implemented in the

meantime to protect these islands, he said.

He believes the “two enemies to action on climate change” are people in complete denial and people who say it is hopeless. “Both prevent action, but action is urgently needed,” he said.

The problem needs “a higher level of seriousness” from policy makers in countries throughout the world, and money to develop

sustainable resources, he said.

The significance of the German-funded pilot project on Arno is that it is the first time to fund this type of project. “Internationally, there have been many promises of money for adaptation, but not much funding,” he said. “The German-funded pilot project doesn’t solve the problem, but it points us in the right direction.”