Rhizolith Island: Floating Concrete Breakwater for Mangrove Restoration

JULIE LARSEN
Syracuse University

ROGER HUBELI
Syracuse University

The project was developed in collaboration between Syracuse University Assistant Professors Roger Hubeli and Julie Larsen, and CEMEX GLOBAL R&D. Rhizolith Island is a floating, resilient coastal infrastructure that revitalizes depleting mangrove forests along vulnerable shorelines with ongoing flooding. The modular form of the elements uses advanced concrete technology to strengthen ecological performance of the island as a breakwater and reinforces appreciation of ecologies that surround and protect communities. The project is a collaboration between architects, material scientists, coastal engineers, the local government, and NGOs. Rhizolith Island aims to create a protective barrier for new mangroves to grow and thrive in deep water shorelines. As a breakwater, a collection of islands would attenuate waves through the aggregation of dozens of two-meter concrete elements. Rhizolith Island is designed for failure. The concrete elements are designed to intentionally fail and break apart over time to revert the site back to a more 'natural' state where mangroves become the prominent flood protection once again.

DESIGNING FOR FAILURE

The concrete elements last long enough to protect new mangroves as they grow but are designed to intentionally fail once the mangroves reach maturity. The island is comprised of high strength and lightweight concrete. This ensures that the elements are strong enough to be a breakwater while simultaneously working as a flotation device to keep mangrove seedlings above water until the mangrove roots moor themselves securely into the seabed. The elements are constructed of two pieces; a head and a fin. The fin is comprised of high strength; while the head is made to be light, porous, and buoyant. Together, these elements work to create a strong, buoyant structure that creates stability for mangroves to survive harsh water conditions. To ensure longevity of the mangroves, the inevitable failure of the concrete is designed to break apart naturally once mangrove roots become robust and naturally moor into the newly formed sediment below the modules. As the concrete breaks apart over time, it is trapped in the roots of the mangrove with the natural leaf litter accumulating around the fin.

MORE THAN JUST INFRASTRUCTURE

A key component to making the project viable for the City of Cartagena was to not only engineer a solution but design the forms to ensure high quality public space that people can engage with along the shoreline, above and below the water. While the faceted surfaces derive from the fabrication process, the faceted voids are introduced to encourage fish to swim and create new ecosystems below water. The holes also act as 'rakes' to catch debris and leaf litter that helps to build up sediment for the mangrove roots to moor into.

AGGREGATION INTO ISLAND AND BREAKWATER SYSTEMS

The individual elements can be singular or aggregated into clusters of two to twenty elements. They are connected together with a rope system while the heads are protected with rubber rings around the perimeter to avoid pre-mature cracking. When aggregated into clusters, the floating islands work together as a buoyant field that acts as a soft but very strong breakwater. The islands can reconfigure into varying patterns, depending on the environmental forces, site constraints, and needs of the users.

RHIZOLITH ISLAND

FLOATING CONCRETE BREAKWATER FOR MANGROVE REFORESTATION

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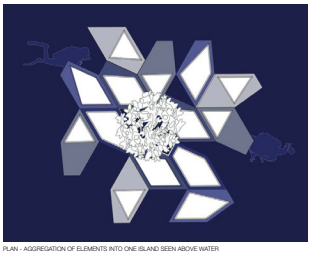
DRAWING SHOWING AN UNDERWATER VIEW OF ELEMENTS BEING CONNECTED BY DIVERS

SECTION 'BEFORE' - INITIAL GROWTH OF PLANTED MANGROVES

SECTION 'AFTER' - MANGROVES FULLY GROWN, ROOTS ENTANGLE BROKEN BREAKWATER

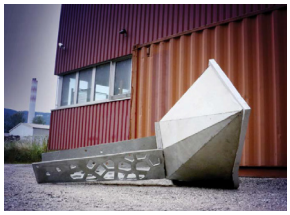
CROSS SECTION OF ISLAND ELEMENTS SHOWING POROUS CONCRETE AS GROWING MEDIUM



PLAN - AGGREGATION OF ELEMENTS INTO ONE ISLAND SEEN ABOVE WATER

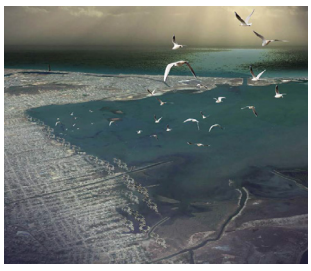
AGGREGATION OF MULTIPLE ISLANDS INTO FLOATING BREAKWATER

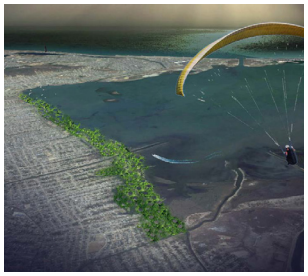
CONCEPTUAL RENDERING OF ISLAND



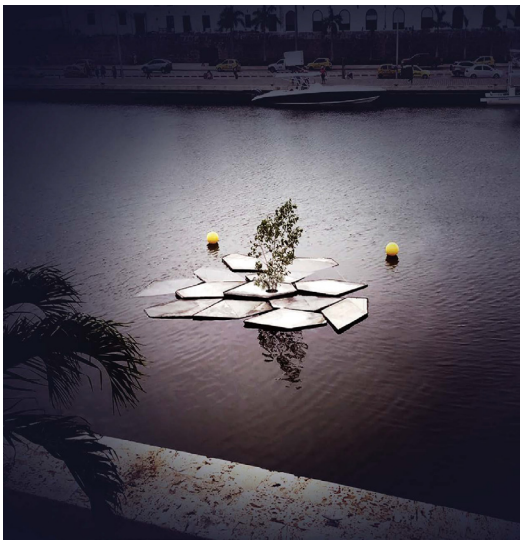
PHOTOGRAPH OF FULL SCALE PROTOTYPE (APPROX. 7'X 5' X 3')

PHOTOGRAPH OF SMALL SCALE PROTOTYPE (APPROX. 1.5'X 1' X .5')





BEFORE / AFTER RENDERINGS OF ISLANDS IMPLEMENTED AS BREAKWATERS ALONG COAST



PHOTOGRAPH OF FULL SCALE ISLAND PROTOTYPE IN THE HARBOR OF CARTAGENA, COLOMBIA