Can Florida survive climate change? Here's what the Aspen Ideas: Climate conference had to say

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Some of the most pivotal climate-change questions—and potential solutions—focus on Florida.

The Sunshine State, with its low elevation and 825 miles of shoreline,

make it one of the planet's most vulnerable locations for both sea-level rise and intensified weather events.

So the state took center stage during the second annual Aspen Ideas: Climate conference, calling attention to some of the latest advancements: Wind and wave simulators that help make crucial findings about storms. Concrete hexagonal tubes that cities place off shore to help break up storm surge. A new housing development that withstands hurricanes—without losing power or internet.

The event, which ended Thursday, gathered 300 speakers to the Miami Beach Convention Center and the New World Center along with business leaders, conservationists and journalists.

Here are some of the key takeaways from the conference.

Creating mini hurricanes and super-coral

Imagine a wind tunnel that can create Category-5 wind velocity, then put a 25-yard-long pool inside. The pool is see-through for optimal study, and has a sloping bottom that can be shaped to emulate various shorelines—relatively steep, like Florida's east coast, or gradual, the state's west coast.

That's essentially what professor Brian K. Haus and his team at the University of Miami's SUSTAIN Lab on Virginia Key get to play with every day. The facility, a wind-wave-storm simulator, lets them study the way wind, sea and shorelines interact.

They can create scale models of shoreline and infrastructure and blast it with storm forces to watch surge reactions, or they can blast life-size reef or mangrove structures with storm forces and determine their protective value.

When Haus turned on the wind and waves for Aspen Idea participants visiting the facility, the tank rippled violently with 3-foot waves that would equal 30-foot swells in real life.

He said one of the most crucial findings has to do with water friction.

"Friction from the ocean does not slow down wind as much as previously thought," he said.

The tank revealed that once wind gets over a certain speed, water drag dissipates and stops slowing the storm. The findings have changed hurricane forecast models regarding how quickly hurricanes can build strength and speed—important factors in determining when a storm will hit, and how deadly it might be.

Across the hall at the Coral Reef Futures Lab, senior research associate Liv Williamson walked the attendees into a room full of shallow tanks lined with rows of what could be mistaken for underwater cookies. Each one was a growing live coral, bred to withstand the perils of the planet's hot future.

"We have a 90% loss of Florida's corals," said Williamson as a primer to why she and her colleagues are attempting to toughen up these beautiful marine organisms.

Florida's southeast coast is rimmed by a 350-mile reef that has been damaged by bleaching, a process in which high water temperatures cause the corals to expel the symbiotic algae they rely on for photosynthetic nutrition. Without it they whiten, weaken, and often die.

Coral reefs not only provide vital habitat for hundreds of species of marine life, she explained, many of which are commercially valuable, but the reefs, which tend to grow in shallow water, help shield

civilization from violent hurricane storm surge.

Her program selectively breeds corals to withstand hot water better, and outplants them on nearby reefs to study their success.

It's not just nature buffs who are keen on its success. The Department of Defense is also working with the school with the hopes that can use coral breakwaters around their military installations as a shield against the violent storms of the future.

Can infrastructure innovation save Florida?

To many observers, South Florida is a canary in a coal mine regarding sea-level rise and hurricane intensity. Two panels looked at innovative infrastructure ideas that could help the region and other vulnerable areas, such as New York, brace for the coming century of climate change.

Rodolphe el-Khoury, dean of the University of Miami School of Architecture, started one panel by saying that design is where the action is, particularly in innovations that combine gray infrastructure (human-made water controls structures such as seawalls and breakwaters) and green infrastructure (using ecosystems, or nature as infrastructure).

Landolf Rhode-Barbarigos, assistant professor of architectural engineering at University of Miami, explained the ECoREEF project he's working on that combines the two, to provide quick protection for humans and benefits to nature.

"What if we provided nature with a platform that dissipates wave energy and gives us the fertile ground for corals to grow?" asks Barbarigos.

To give natural reefs a head start, Barbarigos has developed concrete hexagonal tubes, 19 feet long and 6 feet tall, that cities can place off

shore. They break up wave energy and storm surge, but are made of a material and texture where coral can be attached and thrive.

"Let's build a breakwater that's going to become a living breakwater, so we're going to transplant corals and monitor the ecological growth, and the engineering performance." He and his team installed a set of the hexagons off Surfside last Wednesday, and will cover the surfaces with live corals that can grow 4 inches a year. It's essentially a living breakwater that will grow over time, to protect shorelines even more rigorously. They'll also attract food chains of sea life to the shoreline.

Designer Kate Orff, founding principal and partner at SCAPE, a landscape architecture and urban design practice, is the woman who was tasked with protecting New York City with a living breakwater after the destruction of 2012′s Hurricane Sandy.

She and her team created the Living Breakwaters, a 1.5-mile necklace of living breakwaters off the coast of Staten Island. The breakwaters reduce risk, help rebuild the shoreline, and stop a collapse of marine life by creating pockets, such as tidal pools, and graduated water depths, to enhance biodiversity. At the time of her project, the oyster population in the New York area was about 1% of its historic range.

The breakwaters, designed for sea life, are seeded with oysters, which filter the water.

Oyster populations blossomed on Orff's project and others around the city, making water clearer. Other regulations have brought baitfish, and the predatory fish and dolphins that eat them, back to New York Harbor. Even whales have shown up.

"The most resilience will come from a robust, living, thick, three-dimensional landscape," she said, "and if we invest in those landscapes,

we will be better."

Orff warns that a vertical bulkhead seawall is easy and fast, but what happens when you have sea-level rise against it? "We've lost intertidal habitat, we've lost fish nurseries, we've lost seagrass, we've lost reefs, we've lost this rich three-dimensional mosaic of shorelines that actually create life in the marine world. It's quite easy to do the wrong thing," she said. Her efforts are a way to build a bridge so life on earth can sustain itself, and so we can hold on, too.

Projects like this alone are insufficient, she said. "I feel like the very difficult things to do are truly behavioral and policy changes on a federal, state and local level. She mentioned the seagrass die-off in Biscayne Bay, and said that until we reduce nutrient load that prompts die-offs, we can't succeed. "We need to have incredibly difficult conversions about what we need to stop doing."

"Everybody's watching what's going on in Miami," she said, based on her projects in the Caribbean.

Another panel discussed the recent proposal by the Army Corps of Engineers to build a monolithic seawall that cuts through both Biscayne Bay and nearshore neighborhoods to protect Miami from an eventual massive hurricane. The community rejected the project in favor of something that would incorporate a combination of gray and green infrastructure. The coming months will determine just what happens with the project.

How a solar-powered development survived Hurricane Ian

On Sept. 23, the eastern eyewall of Hurricane Ian sat on top of Babcock

Ranch, a new housing development just east of Fort Myers, for eight hours, with sustained winds of 100 mph and gusts to up to 150 mph. "I was sitting in my house and it was like a perpetual freight train running right through us," said Sydney Kitson, Babcock Ranch resident and CEO Kitson & Partners, the firm that planned the development.

After the storm passed, Kitson and others emerged to discover that the development never lost power, water or internet.

Babcock Ranch, which is powered entirely by solar, was designed for resilience, said Kitson as he spoke to the crowd on the final day of the conference. The 150-megawatt solar facility has 700,000 panels, and weathered the hurricane well.

Kitson took a rare approach to developing land. The firm bought the 91,000-acre ranch in 2006, and sold 73,000 acres of it to Florida—the largest land purchase in states history. That land became part of the Florida Wildlife Corridor, a swath of wilderness running up the state and connecting national parks, state parks and private ranches. The corridor allows crucial wildlife such as Florida panthers, black bear and deer to travel and avoid inbreeding due to isolation.

The development, or "town" as Kitson calls it, will eventually have 20,000 homes and 55,000 people on 18,000 acres, half of which is preserved, meaning 90% of the original land is protected in some way.

"Our goal was to prove that a new town and the environment can work hand-in-hand," he said. Storm safety was also paramount, he said.

Babcock's ability to withstand Hurricane Ian began with location choice. Kitson said Babcock is 30 feet above storm surge level—a very intentional choice. "We decided to work with nature rather than against it," he said of the master plan.

Architects studied historic water flow in the area and built drainage to mimic it, and allowed space for wetlands throughout the community.

They built roads and homes around nature's pre-existing fingerprint.

The result is "a massive amount of surface water storage that was incredibly helpful (during the hurricane)," he said.

They've also got a wastewater facility hardened for high wind, and underground power lines. All buildings meet Florida Green Building Coalition standards. Kitson also praised Florida's strong building codes, which evolved after the destruction of Hurricane Andrew in 1992.

"Does this cost more? Yes it does," he said. "And it's a great investment. The cost is nominal in comparison with the loss of property, the loss of productivity and the loss of life. New technology is going to make this a safer world," he said. "That's good news for our kids and grandkids."

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