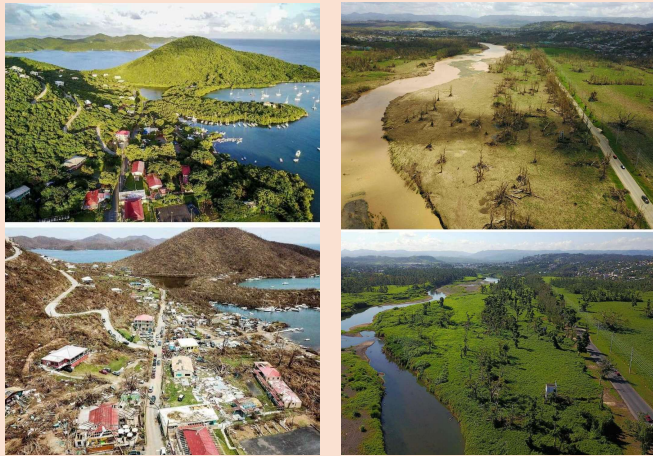


Environment, Economy, and Natural Disasters: How Puerto Rico's Resilience Led to Recovery

Hurricanes: Storms of Mass Destruction

In the Fall of 2017, Puerto Rico's ecosystems, economy, infrastructure, and livelihoods were turned upside down by Hurricanes Irma and Maria. Hurricane Irma reached Puerto Rico first, leaving 66% of the entire island without electricity, and at least 33% without access to clean water¹. 10 days later, Hurricane Maria struck. A category 5 storm with 175 mph winds and 20 inches of rain demolished homes, uprooted trees, caused mass flooding, and destroyed cell towers and the electrical grid, leaving the entire island without power or communication². The balance of the island's entire ecosystem was disrupted, exacerbating the humanitarian crisis. 5 years later, Puerto Rico is still recovering. The mangroves are just beginning to come back, soil and water chemistry is different, and cropland hasn't been revitalized. Hope, however, is not gone. Communities across the island have united to rebuild, restore, and conserve what was once taken from them.



Right: The small town of La Pargana and surrounding area (DGAO). Left: The La Plata River in Fajardo (Ricardo Arduengo)

Environment & Economy: One in the Same

Two contributors to Puerto Rico's economy are agriculture and tourism, both of which took serious hits after the tropical storms. According to the USDA PR, 80% of the crop value was lost after the storms, and 2 billion dollars' worth of damage occurred³. Visiting the coconut farm in Sabanetas showed just how long it takes a farm to get back up and running after a disaster. Revitalizing the cropland takes more than financial aid and resources; it takes time. In addition to cropland destruction, forests and mangroves were uprooted from the intense winds and flooding. Many coastal mangroves like the one we visited in the wetlands of Isabella died off after the storm from changes in water salinity. The mangroves in Fajardo survived, allowing us to go on a nighttime kayak tour to see bioluminescent algae. There are many businesses in Fajardo giving these tours that directly depend on the health of the mangroves to provide the environment the bioluminescent algae need. Without the mangroves, there is no algae, and without the algae, the businesses lose customers. The people depend on nature for income, demonstrating the close ties between the economy and the environment.



Conservation Efforts: Mangrove Restoration

One of the most impactful projects we worked on was planting baby mangrove trees in the wetlands of Isabella. The hurricanes brought intense rainfall that trapped fresh water in the wetlands, changing the delicate balance of salinity the mangroves require to grow. As seen in the photos above, the wetlands are now a collection of dry, brittle branches and roots. Vida Marina, the Center for Conservation and Ecological Restoration through UPR Aguadilla, is a team reintroducing red (*Rhizophora mangle*) and black (*Avicennia germinans*) mangrove trees. They access and monitor water levels and salinity variation in the wetlands in addition to planting trees. After the storms, many organizations like this were started to mitigate and reverse the damage. Our group split into two teams, one planting trees along a path through the wetlands and another planting in propagation centers. The artificial structures seen above shade the young trees and allows them to acclimate to rising water levels. It was rewarding to work alongside other conservationists and contribute to a lasting project. We were able to see the resiliency of the community up close.



Planting Wetland Saplings (Credit: Daphne Adamson in Remote Blog)

The wetlands and the mangroves that live in them are vital not only for the ecosystem but for Puerto Rico's economy. Our group had the privilege of taking a nighttime kayak paddle through a different, live mangrove in Laguna Grande, Fajardo, to see the bioluminescent algae in the water. There are numerous businesses offering kayaking, snorkeling, and boating tours to see the bioluminescence that largely depend on tourism. The businesses are locally owned, making the health of the mangroves very important for the livelihoods of the people. If the mangroves are damaged in any way, the aquatic ecosystem wouldn't be suitable for the algae and the businesses would lose attention from tourists, thus affecting the local economy and in turn, the island's economy. These mangroves weren't decimated like the ones in the Isabella wetlands were, but if they had been, almost an entire town would have faced an economic crisis.

Agricultural Recovery: Coconut Farm

A generous coconut farmer in Sabanetas gave us a tour of his coconut farm, letting us try fresh coconut meat and teaching us about the logistics of farming in Puerto Rico. We learned just how significant the impact of the hurricanes was on agriculture. Coconut farms across the island were uprooted and topped, and the floods damaged the soil composition. Farmers whose sole income is their production suffered tremendously and had to find new forms of income and food sources. The coconut trees can take anywhere between 4 to 10 ten years to reach maturity and begin fruiting. The trees seen in the image on the bottom right show 3 years' worth of growth. Despite the difficult timeline for getting back up and running, the resilient farmers have found alternative ways to speed up the process. Our trip here made me realize that restoring the land and communities after a disaster or crisis isn't only a matter of getting access to financial support and labor, but a matter of time and nature's natural process.



Looking back...

Visiting the island changed me and my professional trajectory. I was immersed in a new culture that I quickly fell in love with and learned how kind and united people can be. The importance of working with others rather than individuals became clear to me in a way it never has before. Prior to the trip, I wanted to pursue lab-based research with my botany degree, but I now want to follow the path of conservation and fieldwork. I'm inspired to return to Puerto Rico this coming winter on a trip through Worldwide Opportunities on Organic Farms to learn more about sustainable farming and participate in a volunteer program that teaches local farmers better farming practices.



Individuals across Puerto Rico and Oregon came together to invest their time and money into teaching our group. Thank you to everyone at Vida Marina, SurfRider, Eco Adventure Kayaks, The Coconut Route, and the University of Puerto Rico. I appreciate the leadership of Wanda Crannell and Shawn and Susan Rowe, as well as the investments of Prof. Estefania De Thomas, Prof. Jose Reyes, Dr. Ricardo J. Colon-Rivera, Edgardo Gonzalez, Dr. Eugenio Santiago Valentin, Dr. Edly Santiago, and Dr. Griselle Gonzalez. Thank you to ER Jackmen and the CAS Global Experience Fund for providing the financial means for me to participate on this trip.



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