

Algae help save the economy and tourism of Puerto Rico

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Bioluminescent Bays



A bay is a body of water partially surrounded by land; in a bioluminescent bay, the water glows. The glow is better observed at night, with an absence of the moon and with little light pollution.

There are five bioluminescent bays in the world and Puerto Rico has three of them (Mosquito Bio Bay in Vieques; La Parguera in Lajas; and Laguna Grande in Fajardo). The other two are located in Luminous Lagoon in Jamaica and Halong Bay in Vietnam.

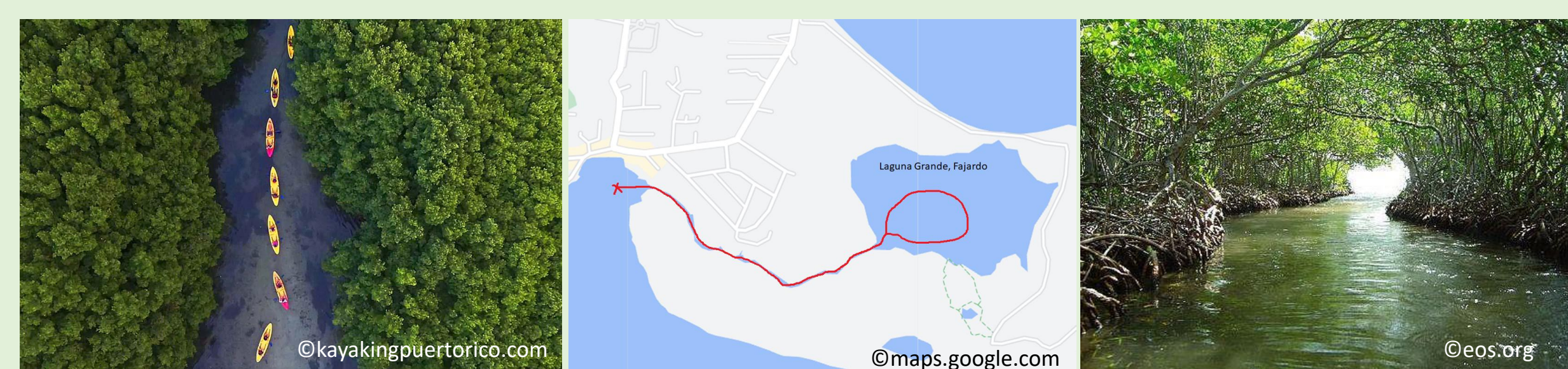
The glow in the bay is produced by the dinoflagellate algae *Pyrodinium bahamense*, which glows when agitated, the glow is produced by energy generated by the algae via photosynthesis; a process that creates the glowing effect and can be better appreciated in the dark. The bays are populated by millions of these microorganisms



The algae is a spherical dinoflagellate (two flagella) and is surrounded by a layer of armored plates (thecals). The two flagella are used for locomotion (one horizontally and the other one vertically). The algae are sensitive to changes in the ecosystem such as salinity, water quality, and climate.

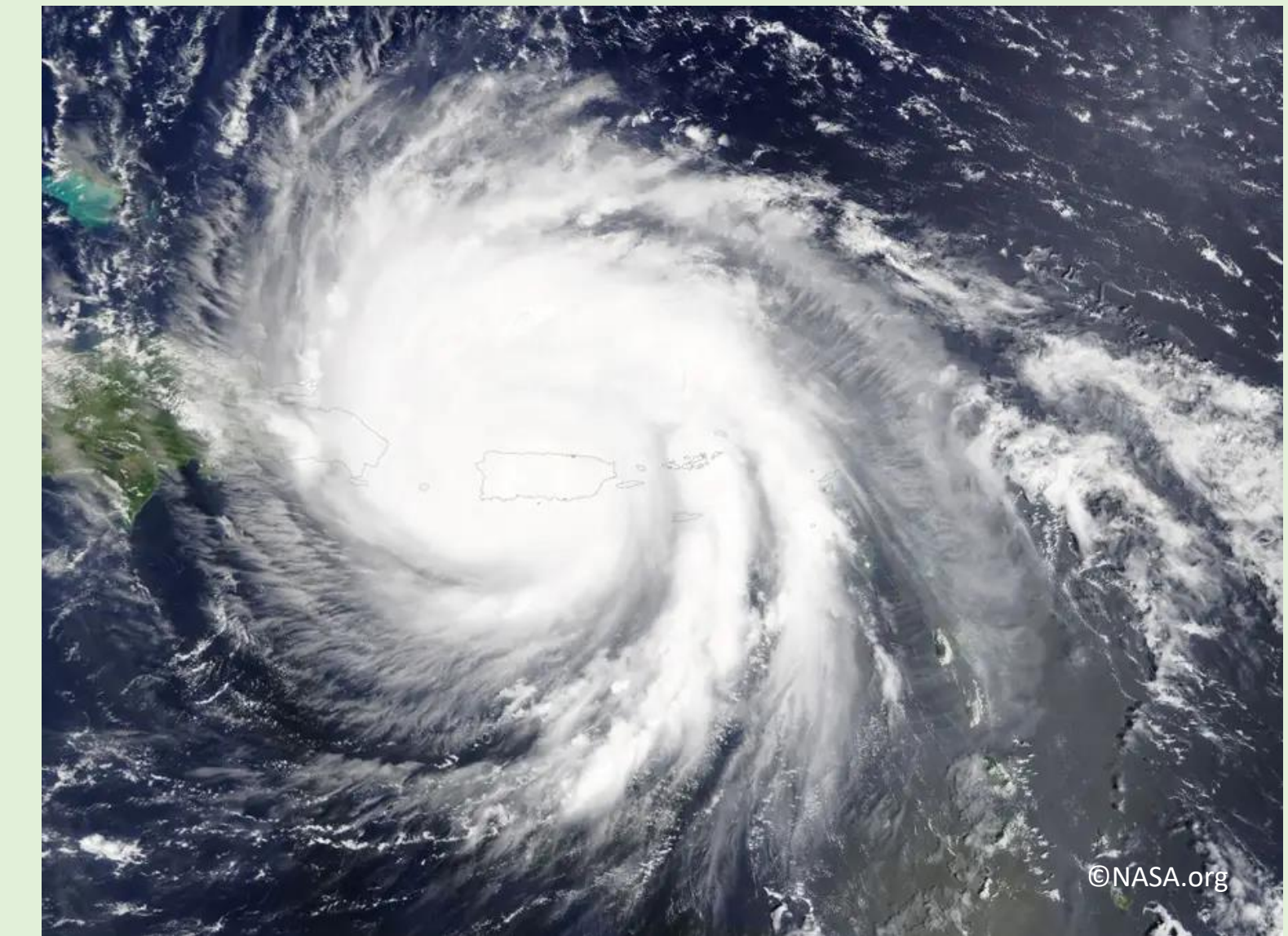
The mangrove roots produce vitamin B12 which is an essential nutrient for the algae. The bioluminescent bay also serves as a nursery for several species of fish.

The only way to access the Laguna Grande in Fajardo, is by swimming, kayaking, or non-motor vehicles. The channel is a narrow mangrove cover.



Hurricanes Irma and Maria

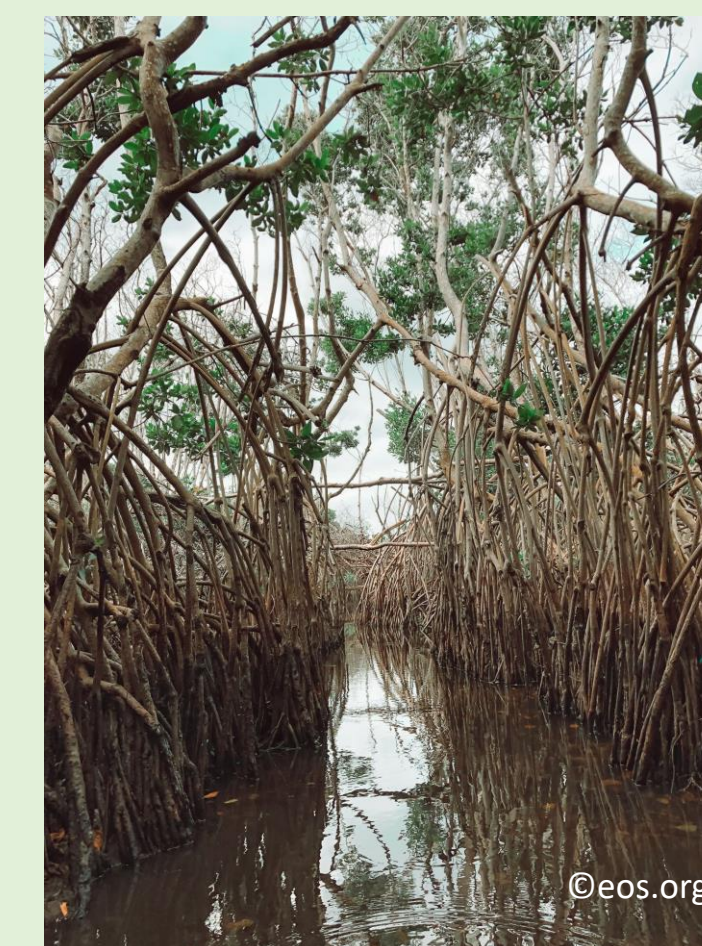
In September 2017, Puerto Rico was struck by two major hurricanes in quick succession. Hurricane Irma passed close to the island on September 7, 2017, the hurricane saturated the ground with heavy rains and winds. On September 20, 2017, Hurricane Maria directly hit the island of Puerto Rico; with winds of 155 miles per hour, this hurricane is the most intense hurricane to make landfall on the island since 1928 (Hurricane Felipe). Maria destroyed buildings, and houses, leaving the island without electricity, water supply, and communication. Road access was difficult, the medical services, food, gas, and drinking water were limited. Approximately 4,000 people died caused by flying debris, flooding, and limited access to medical care. The damage to the island was estimated to be approximately \$80 billion. The island d's tourism industry, which accounts for 7% of GDP (gross domestic product), was one of the hardest-hit sectors in the island's economy.



Economy and Tourism before and after Hurricanes Irma and Maria

The Puerto Rico Tourism Company calculated that 2016 was a peak year in tourism with approximately \$8.5 million in visitor spending. Puerto Rico was going in the right direction increasing the economy through tourism until Hurricanes Irma and Maria destroyed the island.

For months after the passing of the hurricanes, thousands of people, including restaurants and businesses were still without running water, electricity, and with poor phone services. Finding gas to keep the generators running was difficult, and beaches were closed due to possible water contamination. Camuy Caverns and El Yunque Rainforest were closed for safety concerns. Tourism was nonexistent, so tourism-related activities went down along with nearly every other economic indicator on the island.



In March 2017 the government adopts the Act to Promote Puerto Rico as a Destination, creating a team that travels the island taking pictures and information about the island's attractions. The Act will be bringing top-class and famous artists that can promote and help bring tourism to the island with their blogs and programs using the information collected.

The community (kayaking business owners) of the eastern side of the island saw the devastation in the mangrove and asked the government to help them restore the area. Bringing back our own local artist, the dinoflagellate, who did his part, and with people's curiosity and his beautiful glow, helped bring tourism back to the island.

The adventure on a kayak to see the BioBay is a unique experience. Paddling for half an hour through a mangrove-covered channel to get to the bay, waiting for total darkness sitting down in your kayak, once it starts getting dark, the movement of the paddles (and using your own hand to disturb the water) the amazing show of the glow starts giving an incredible and unique experience, not possible to catch on camera without professional equipment.

Ways to protect the ecosystem

It is important to keep the ecosystem clean from vines (non-native plants) and trash left by people visiting the area. Planting mangroves prevent excess sediment from getting into the water., The mangrove protects the bay from strong weather. Regulating the constructions around the mangrove to combat light pollution, will help increase tourism. With less light pollution the bioluminescent bay will glow more.

"It's better to see something once than to hear about it a thousand times"

-Asian Proverb



I would like to thank Eco Adventure Kayaks in Fajardo for the adventure in the Bay. A special thanks to Wanda Crannell, Dr. Shawn and Susan Rowe, and the College of Agricultural Sciences for this amazing opportunity. It was a privilege to be able to show the team my island – Puerto Rico.