

## **A SOCIOSCIENTIFIC ISSUE FOR THE CLASSROOM: NOT ALL THAT BLOOMS IS PRETTY IN THE INDIAN RIVER LAGOON**

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*Man-made activities such as human urbanization and agriculture have altered the Indian River Lagoon, as well as, other marine ecosystems in the state of Florida. These impacts have brought environmental, financial, and social repercussions affecting the quality of life of residents and leading to loss of habitat for many native species. Though a long-term remediation plan is in place, some believe this may not be enough to save such a vast ecosystem. This case compares the conflict between human development and natural preservation and raises the question, what should be prioritized.*

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### **INTRODUCTION**

Science teachers have the daunting task of instructing future generations into becoming responsible citizens able to prosper and make sound decisions. Unfortunately, time-constraints, inconsistent curricula or educational frameworks between states, and content-based standardized assessments/evaluations restrict teachers' creativity and flexibility to steer away from the traditional teacher-centered classroom. Many students find science unappealing as they do not find it relevant.

After teaching elementary and middle grades science for over a decade, Judith moved to Florida to complete a doctoral degree in STEM Education. This science teacher wanted to find ways to bring context-relevant content hoping to spark interest for science back in students. Through research and her advisor's guidance, Judith learned about how socioscientific issues (SSI) could fulfill that goal. Socioscientific issues are complex, open-ended societal issues with applicable connections to science ideas and principles which are subject to multiple perspectives and solutions (Zeidler, 2014; Sadler & Zeidler, 2005). As with case studies, these relate to real-world scenarios and can be customized to different subjects. However, the cool thing about SSI is that students not only learn the

scientific background and content, but also consider the financial, social, political, and environmental ramifications on the featured issue. Now, if only she could find the perfect issue that would encompass all this!

Florida is well-known for its, almost year-round, summers. This great climate attracts, not only tourists, but people looking to enjoy the sun and the variety of aquatic environments this state provides resulting in an exponential increase in population size. Due to this, an increase in urbanization, and agricultural development have impacted the health of these ecosystems one of them being the Indian River Lagoon (IRL) located in Melbourne, Florida. Every year, this state spends nearly \$20 million of taxpayer funds on the effects of toxic algae blooms that affect the population and deprive the water of much needed oxygen levels killing millions of fish and other wildlife. Tourism, fishing, and other Florida industries experience millions of dollars in losses. The situation exacerbates during the summer due to excessive rainfall and water discharges that end up in the IRL and eventually reach the ocean covering it in green goop and stench. Though long-term restoration plans are in place, some are skeptical about their effectiveness due to the continuous population increase and climate change conditions. An issue this controversial was worthy of becoming an SSI!

FIGURE 1 & 2: Visual of green algae blooms. Dead fish as a result of the blooms.

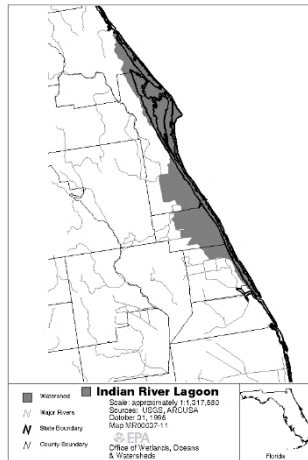


### **THE INDIAN RIVER LAGOON SSI**

The Indian River Lagoon (IRL) is one of the most biologically diverse estuaries in North America as it contains over four thousand species of plants and animals ([https://www.fws.gov/refuge/pelican\\_island/wildlife\\_and\\_habitat/indian\\_river\\_lagoon.html](https://www.fws.gov/refuge/pelican_island/wildlife_and_habitat/indian_river_lagoon.html)). It covers around 30% of the eastern coast of Florida and stretches approximately 156 miles. The northern section of the IRL is comprised of three bodies of water: Mosquito Lagoon, Banana River, and Indian River. The central and southern sections of this system are fed by freshwater sources such as the San Sebastian River, and the St. Lucie Canal which is connected to the largest freshwater lake in Florida, Lake Okeechobee.

As Florida's population has exponentially increased in the past decades, concern around the health of one of the most important natural resources has been on the rise as well. Being an essential part of Florida's economic engine, this estuary, separated from the ocean by barrier islands, has always been an attractive area for recreating and living due to its wealth of resources and mild climate.

**FIGURE 3: The Indian River Lagoon system and its watershed.**



### **THREAT TO THE ECOSYSTEM**

While hosting thirty-five threatened or endangered species, climate change and anthropogenic activities are to blame for the declining state of the IRL. Excessive rainfall causes periodic freshwater releases from Lake Okeechobee through the St. Lucie Canal into the IRL; this happens because the historic flow of surface waters in the Greater Everglades Watershed was changed to address flood control, water supply, and agricultural needs. Droughts, on the other hand, set a limit on freshwater releases. Both cause an imbalance in the salinity and nutrients in IRL waters, which can have other negative consequences for aquatic life in the IRL.

Development, alteration of surface water drainage, alteration of shoreline vegetation, fertilizer use, and septic tank discharges are factors that have led to the accumulation of muck at the bottom of the IRL and/or the influx of high levels of phosphorus and nitrogen that trigger toxic algae blooms. These factors can induce a phenomenon known as eutrophication or excessive richness of nutrients which may trigger "blooms". Most blooms in the IRL are due to microscopic algal cells populating the water column to such a degree as to discolor the water, in extreme circumstances rendering it opaque. Some blooms, such as those associated with Okeechobee waterway releases, can form a tangible sludge or skin on the surface of the water. Some of its negative consequences include death of marine plants due

to the lack of light for photosynthesis and anoxic conditions which lead to fish kills. Some blooms also emit toxins which are a health threat.

### **CONSERVATION EFFORTS**

Scientists and environmental groups have been monitoring conditions in different sections of the lagoon for years and many conservation efforts are starting to be put into practice. For example, with the help of universities and grants from federal authorities, programs to restore the shoreline through the renewal of the mangrove population and the introduction of oysters to filter the water and reduce the erosion hope to spark awareness and motivate others to learn about the importance of this natural resource. Much more needs to be done to educate and involve the public in restoration efforts such as these. Authorities have recognized this need when, in March 2016, Brevard County voters approved a sales tax to raise money for cleanup efforts which include upgrading wastewater treatment plants, removing old septic tanks from old infrastructures along the shoreline, and restoring the natural flow of freshwater from Lake Okeechobee. Should agriculture and water supply be risked in restoring the natural flow of the freshwater? Will the Indian River Lagoon ever be saved or is it too late?

### **REFERENCES**

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