



## Rutherford County Schools – Instructional Learning Modules

Grade	Course
High School	Biology I
<b>Unit Focus</b>	
Biological Change and Diversity (LS4)	
Week of 5/4 – 5/8	
Standard(s)	
<p><b>BIOI.LS4.1</b> – Evaluate scientific data collected from analysis of molecular sequences, fossil records, biogeography, and embryology. Identify chronological patterns of change and communicate that biological evolution is supported by multiple lines of empirical evidence that identify similarities inherited from a common ancestor (homologies).</p> <p><b>BIOI.LS4.2</b> – Using a model that demonstrates the change in allele frequencies resulting in evolution of a population over many generations, identify causative agents of change.</p> <p><b>BIOI.LS4.3</b> – Identify ecosystem services and assess the role of biodiversity in support of these services. Analyze the role human activities have on disruption of these services.</p>	
<b>Resources</b>	
<p><b>Evolution/Natural Selection</b></p> <ul style="list-style-type: none"> <li>• (digital) - BioInteractive/ HHMI - Evolution: <a href="https://www.biointeractive.org/classroom-resources?f%5B0%5D=grade_levels%3A98&amp;f%5B1%5D=topics%3A59&amp;f%5B2%5D=topics%3A61">https://www.biointeractive.org/classroom-resources?f%5B0%5D=grade_levels%3A98&amp;f%5B1%5D=topics%3A59&amp;f%5B2%5D=topics%3A61</a></li> <li>• *(digital) – Evolution Lab/PBS: <a href="https://www.pbslearningmedia.org/resource/nvev-sci-mission1/nova-evolution-lab-interactive-lesson-mission-1/">https://www.pbslearningmedia.org/resource/nvev-sci-mission1/nova-evolution-lab-interactive-lesson-mission-1/</a></li> <li>• (textbook) Evaluating Evidence from the K-T Boundary: Pearson, 670-671</li> </ul> <p><b>Biodiversity</b></p> <ul style="list-style-type: none"> <li>• *(textbook) Biodiversity in the Everglades: Pearson. 230-231</li> <li>• *(digital) – BioInteractive/ HHMI – Biodiversity: <a href="https://www.biointeractive.org/classroom-resources?keyword=biodiversity">https://www.biointeractive.org/classroom-resources?keyword=biodiversity</a></li> </ul> <p><b>Overall</b></p> <ul style="list-style-type: none"> <li>• SharePoint Folder from Bootcamp (ideas, video suggestions, additional resources): <a href="https://rcschools.sharepoint.com/sites/bio/EOC%20Bootcamp/Forms/AllItems.aspx">https://rcschools.sharepoint.com/sites/bio/EOC%20Bootcamp/Forms/AllItems.aspx</a></li> </ul>	
* New resource to list	
<b>Task/ Assignment</b>	
<p><b>Scenario 1: Biodiversity in the Everglades</b>  <b>(Source: Tennessee Biology, Miller &amp; Levine, Pearson, pg. 230-231.</b></p> <p>Florida residents once dismissed the value of the Everglades, the marshy wetlands that covered much of the southern half of the state. Ideas began changing in 1947, when Marjory Stoneman Douglas published the book <i>The Everglades: River of Glass</i>. Douglas described the rich biodiversity of the Everglades, as well as the role of the wetlands in providing clean water for the region.</p> <p>The Everglades once covered almost 3 million acres of southern Florida. Now it has shrunk to about a third of that size. Much of the Everglades is part of a national park, where human activities are limited and</p>	

wildlife is protected. However, more than 20 Everglades species are classified as endangered, and many more are threatened. Dense urban areas and commercial farms surround the Everglades on all sides-and they have proven to be disruptive neighbors.

The following bulleted points list some of the ways that human activities have threatened the Everglades environment and its biodiversity. As you read the list, relate each entry to the rapid increase in Florida's human population. One hundred years ago, Florida was home to about 1 million people, most of whom lived far away from the Everglades in the northern part of the state. In 1980, the population shifted south and had grown to 10 million. Today, the population is over 20 million-and still increasing.

- **Water Control** The Everglades depends on a steady supply of fresh water that flows slowly from north to south. Today, canals and dams divert water for human uses and to prevent flooding. Much of the original Everglades has already been drained for new farms and housing developments.
- **Fertilizer** Runoff from farms has been adding fertilizer to the Everglades water supply. The fertilizer supports the growth of plants such as cattails and duckweed that otherwise would not grow in the Everglades. The fertilizer also supports harmful algal blooms.
- **Invasive Species** Though carelessness or ignorance, human actions have introduced all sorts of new species into the Everglades, some of which have proved invasive. The Burmese python is now competing with the alligator to be the top predator of the Everglades. Invasive plants, such as the Brazilian pepper and Australian pine, are now displacing native species.

Final Product(s): What will you answer? What will you create? What will you communicate?

1. Find out more about the biodiversity of the Everglades ecosystem and the threats to it. Also research how government agencies, private organizations, and individual citizens have been working to protect the Everglades, and the results of these actions.
2. In your own words, define one or more of the problems in the Everglades ecosystem that human activities have caused.
3. Propose ideas for solutions to one or more of the problems that you identified. Your ideas might include new laws to regulate water use, volunteer brigades to combat invasive species, or research into new farming practices that reduce fertilizer in runoff.
4. Choose one of the potential solutions to develop further. Identify criteria for evaluating the solution, such as its potential effectiveness in improving the Everglades and protecting biodiversity. Also identify the costs and other constraints of the solution. Conduct additional research to evaluate the solution according to these criteria and constraints.
5. Based on your research, refine your original proposal. Present your solution in a written or oral report, or as a computer presentation. Your report should include the following information:
  - a change to the Everglades or its biodiversity, and an explanation of the problems that this change could cause or is causing
  - the details of your proposed solution to the problems
  - an evaluation of the benefits and drawbacks of the solution

## **Scenario 2: Restoration of the Everglades and South Florida Rivers: Is it possible?**

**Adapted from TN Electronic Library**

**MARSH MADNESS:** Fishermen have proposed a way to restore the Everglades and South Florida rivers, but will their idea ever become a reality?

Author: Hal Herring Date: Dec. 2017 From: Field & Stream(Vol. 122, Issue 7) Publisher: Bonnier Corporation

**BLACK, TOXIC WATER** was flowing into the Caloosahatchee and St. Lucie Rivers. Following the rains of Hurricane Irma in Sept. 2017, the U.S. Army Corps of Engineers began discharging highly polluted water--billions of gallons of it--from Lake Okeechobee into the South Florida rivers to prevent the flooding of agricultural land to the south, but at the same time poisoning some of the richest game-fish habitat in the world.

This was hardly a first.

In the summer of 2016, the Corps had discharged more than 200 billion gallons of water from Lake Okeechobee, setting off a chain of catastrophes. A 239-square-mile bloom of toxic algae had been spreading across the lake all summer, and when that water was released, the Caloosahatchee and St. Lucie were flooded with it. Beaches were closed. People fell ill. Fish died. Officials advised people to stay away from the very waters that had made this part of Florida one of the nation's most famous fishing destinations. It was the worst the pollution had ever been, but the discharges happen every rainy year in South Florida. So when the black water poured into the rivers again this past September, people knew what to expect.

"It's economic free fall," a St. Lucie fishing guide told me on a recent trip to Florida. Water dumped from Lake Okeechobee had devastated the local fishing and tourism industries and killed the St. Lucie's seagrass beds--nurseries for grouper, snapper, seatrout, redfish, and more. The damming of Lake Okeechobee necessitates these discharges and cuts off the Everglades and Florida Bay, one of the world's greatest saltwater fisheries, from a fresh flow of water.

Fishermen, conservationists, and guides are now working double time to save the St. Lucie and other South Florida rivers. Their goal is to find a way to send water south out of Lake Okeechobee, rather than discharge it through its canals and estuaries. This would not only help restore the rivers but would also revive the Everglades and Florida Bay. But the mammoth Florida sugar industry, which in many ways holds the key to solving the pollution problems, has shown little interest in helping. Meanwhile, the losses in Florida are reaching a breaking point.

### **WATER WOES**

This disaster is intertwined with the history of Florida. For millennia, the Kissimmee River twisted through central Florida before flowing into the 730-square-mile Lake Okeechobee to the south. In rainy seasons, Lake O, as locals now call it, overflowed its southern brim, and the waters continued down into the Everglades. This sheet of water, 60 miles wide in places and as shallow as 6 inches, moved across 11,000 square miles of trackless wilderness until it reached Florida Bay, just 100 miles south. This is the river that made the Everglades. This is the river that fed the Biscayne Aquifer, which supplies 8 million people with drinking water. But this river is now pretty much gone.

After a devastating hurricane in 1928, the U.S. Army Corps of Engineers built the Herbert Hoover Dike to control Lake O, and set about draining and opening lands to the south for farming. In 1948, 470,000 acres of these newly drained lands were established as the Everglades Agricultural Area (EAA). That same year, the Corps began channelizing the Kissimmee River to the north of Lake O, opening tens of thousands of acres for farming, ranching, and development. Over the decades, runoff from these new communities and farms found its way into the stagnating Lake O, creating the algae blooms we see today. All the while, south of the lake, the EAA kept growing and now totals some 700,000 acres, nearly 500,000 of which are devoted to sugar production, and whose existence depends on the Herbert Hoover Dike.

Sugar is a fickle crop. Too little water dries it. Too much drowns it. So, during rainy years, Lake O must be drained to prevent flooding in the EAA, and to protect the towns within it. Rather than run that risk, in the 1930s, the Corps began sending large discharges of polluted Lake O water west down the Caloosahatchee River to the Gulf, and east down the St. Lucie Canal to the Indian River Lagoon, on the Atlantic coast. There's no water-pollution event in all the U.S. that comes close to the magnitude of this one, and it is perfectly legal.

"The discharges have been killing us off every rainy year, for over 30 years now," Rufus Wakeman, a veteran St. Lucie fishing guide, told me, as we sat outside the River Palm Fish Camp. "This was one of the most vibrant fisheries I've ever been a part of, and the degradation we've seen is just incomprehensible." The 2016 discharges he witnessed in the St. Lucie eclipsed those of previous years, and the ones this September wreaked further havoc. But as bad as the pollution has been, the key concern, Wakeman said, is Florida Bay and the Keys.

Ever since the construction of the Herbert Hoover Dike, the Everglades National Park has been drying out from a lack of water from Lake Okeechobee; by some estimates, nearly half of South Florida wetlands are already gone. Similarly, the Biscayne Aquifer, deprived of any recharge, is dropping fast, with saltwater intrusion increasing. Florida Bay has lost more than 50,000 acres of sea-grass, and with it the bonefish, seatrout, tarpon, and reef and offshore fish that were born and had sheltered there. "Nobody can believe that we've let the problem go this far, when we know exactly how to fix it," Wakeman said.

#### THE FIX IS IN ... LIMBO

People have known the solution to South Florida's water problems for nearly as long as they've been suffering from them. The scientific consensus is that there's only one feasible solution: Construct a flow way from Lake O through the EAA to the south. The flow way will curb future discharges but will need to be planted with enough wetlands vegetation to clean the waters of pollutants. As the cleaned water flows south, it'll restore the Everglades, recharge the Biscayne Aquifer, and bring a balance of fresh and saltwater to Florida Bay. This solution has been around since the 1990s, but no solid plan has been put into action. Over the past decade, the sugar industry has taken a hard stand and refused to sell land to create the flow way. How has the sugar industry managed to block every major restoration effort? According to the Miami Herald, from 1994 to 2016, the two major sugar companies in the EAA contributed nearly \$58 million to state and local political campaigns, which may help explain it.

After the summer of 2016, Florida Senate President Joe Negron decided something had to be done. He supported a proposal to create water storage reservoirs on existing state lands and on some leased lands south of Lake O, to avoid future discharges. But no exact acreage for the new water-storage reservoirs has been established. "We are still trying to determine what we will get," Dawn Shirreffs, of the Everglades Foundation, told me. Will the reservoirs stop the discharges? "It can help," she said. "It won't eliminate the discharges, but it can help."

It's a baby step in the right direction. The Army Corps of Engineers is putting bends back in the Kissimmee River, trying to reconnect the river to its floodplain, to let some of the pollution settle before it gets to Lake O, another positive step. But the question remains whether Florida will have the political will to fix the systemic problems plaguing its waters. Grassroots groups like Bullsugar are trying to drum up support from anglers to pressure legislators to act. For Wakeman, the goal is simple. He remembers watching tarpon roll through the St. Lucie and snook bust the surface--sights no one now could imagine. "I'm like everybody else from here, working on this year after year," he said. "I just want to see clean water in my lifetime."

#### LAY OF THE LAND

##### DIRTY WORK

A quick look at South Florida's water problems: First, agricultural runoff flows into the Kissimmee, then travels south into Lake Okeechobee, where it builds up. During rainy years, rather than let excess Lake O water replenish the Everglades Water Conservation Area and the Everglades, the water is discharged west down the Caloosahatchee and east down the St. Lucie, to protect the farms within the Everglades

Agricultural Area from flooding, a total disruption of its natural course. The proposed flow way will help clean the water as it runs south out of Lake O and makes its way to Florida Bay.--JR Sullivan

Please Note: Illustration(s) are not available due to copyright restrictions.

Caption: Hit the Poles A flats guide gets his angler into position on Florida Bay.

Copyright: COPYRIGHT 2017 Bonnier Corporation <http://www.fieldandstream.com/> Source Citation (MLA 8th Edition) Herring, Hal. "MARSH MADNESS: Fishermen have proposed a way to restore the Everglades and South Florida rivers, but will their idea ever become a reality?" *Field & Stream*, vol. 122, no. 7, Dec. 2017, p. 24+. Gale In Context: High School, [https://link.gale.com/apps/doc/A518437438/GPS?u=tel\\_main&sid=GPS&xid=104026f8](https://link.gale.com/apps/doc/A518437438/GPS?u=tel_main&sid=GPS&xid=104026f8). Accessed 26 Apr. 2020. Gale Document Number: GALE|A518437438

**Final Product:**

1. According to the article what are some of the major water problems in South Florida. What are some of the proposed solutions and what are some of the challenges facing their implementation? Use evidence from the text.
  
2. Choose one of the following ecosystem services and write a paragraph describing how they influence the biodiversity and health of Southern Florida. (List obtained from [healingearth.ijep.net](http://healingearth.ijep.net))
  - PROVISION SERVICES
    - Food Production
    - Water
    - Wood and Fiber
    - Fuel
  
  - SUPPORTING SERVICES
    - Nutrient Cycling
    - Soil Formation
    - Primary Production
    - Habitat Provision
  
  - CULTURAL SERVICES
    - Spiritual
    - Aesthetic
    - Educational
    - Recreational
  
  - REGULATING SERVICES
    - Climate Regulation
    - Flood Regulation
    - Water Purification

**Week Review/ Remediation/ Enrichment Options**

Everglades Documentary: <https://www.youtube.com/watch?v=D72m2LIAu7A>

Python: Invasive Species in the Everglades: <https://www.youtube.com/watch?v=412x2hvM31Y>