RESET | Nature Based Solutions: Ecosystems (2-3 Weeks)

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Nature Based Solutions: Coral Reefs, Mangroves, and **Dunes**

Authors

Adriana Torres De Perez

Melissa Whitehead

Marsha Riggs

SUBJECT/GRADE LEVEL

Subject Area: STEM/CTE

Grade Level: 5

Materials

- Computers for each student.
- Internet Access for Websites
- Station Lab Slides
- Assessment Rubric
- Trifold Boards
- Craft materials/recyclables for 3D models
- Venn Diagram Models
- Pens, Pencils, Paper

STANDARDS

Next Generation Science Standards

- **ESS2.C: The Roles of Water in Earth's Surface Processes**
  Nearly all of Earth's available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere. (5-ESS2-2)
  5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Writing Standards | Common Core State Standards

- **W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. *(5-ESS2-2)*

English Language Arts Standards | Common Core State

- **CCSS.ELA.SL.5.5** Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. *(5-ESS2-1),(5-ESS2-2)*

LESSON OBJECTIVE(S)

Students will be able to

1. Students will identify essential types of ecosystems.
2. Students will explain the fundamental structure and function of an ecosystem.
3. Students will describe how the interactions among organisms within an ecosystem affect the stability of the ecosystem.
4. Students will identify environmental problems affecting ecosystems such as climate change, pollution, and biodiversity loss.

CAREER CONNECTION(S)

Mentor Background: S. Kyle McKay is a research civil engineer with the U.S. Army Engineer Research and Development Center (ERDC) Environmental Laboratory (EL). He is stationed in New York City to facilitate cooperative research between the ERDC, local U.S. Army Corps of Engineers offices, the City University of New York, and other local partners. His research focuses broadly on examining the ecological effects of water resources infrastructure with applications related to urban ecosystem restoration, ecological models, dam operations and decommissioning, and flood risk management. Integrated water resource management is “a process which promotes the coordinated development and management of water, land, and related resources, to maximize the resultant economic and social welfare equitably without compromising the sustainability of vital ecosystems” (Global Water Partnership).

STEM Careers: Environmental Engineer, Environmental Scientist, Hydrologist, Landscape Architect, Wildlife Biologist, Conservation Scientist, Marine Biologist, Limnologist, Nature Photographer, Tour Guide, Park Ranger, Arborist, Surveyor, Wildlife Biologist, Geologist, Natural Resource Technician.

ENGAGEMENT

Duration: **One to two class periods (45 minutes to 75 minutes)**

Brief Description: Teacher will ask a series of questions about each ecosystem to determine student prior knowledge. Students will view a series of photos of each ecosystem including structures, vegetation, animal species, and activities contributing to ecosystem problems. This is based on a classroom of 30 students divided into 6 groups of 5 students each.

Procedures:

1. The teacher will have a series of 3 to 4 pictures available in each student group. Students may examine these as they are projected on the Promethean/J-touch/Smartboard. The teacher will also display these on the classroom projector system.
2. The teacher will then ask the students to look at each series of pictures. The students in their groups will add features, animal species, or problem notices for each ecosystem onto a graphic organizer or a Venn diagram.
3. While students are viewing each series of pictures, the teacher will walk around each group and ask students guiding questions such as, "What ecosystem is shown in these pictures? What type of animals/plants live there? What may be going on with or wrong with the environment?" Provide feedback to the students as they answer.
4. Have students write a paragraph about their findings based on their observations and Venn diagrams.

EXPLORATION

Duration: **Two to three class periods (90 minutes to 120 minutes)**

Brief Description: Students will explore and create/share a presentation about one of the three focus areas, coral reefs, mangrove swamps, or coastal dunes. Student groups will select from one of the three ecosystems, then choose to create a slide or PowerPoint presentation about the description, locations, and biodiversity found in that ecosystem as well as the importance of the ecosystem and the effects of human activities and/or invasive species on these areas, and what can be done to protect these ecosystems.

EXPLORATION

Procedures:

1. Teacher will place students into six learning groups (5 students based on a class size of 30). Teacher will consider students' prior knowledge and interest level before making group assignments.
2. Student groups will be
    - Mangroves A (What are they, Where are they located, What species lives in this ecosystem.)

- Mangroves B (Why are mangroves important to the environment, What are the human/invasive species threats facing mangroves, What steps are being taken to save mangroves.)
- Coral Reefs A (What are they, Where are they located, What species live in this ecosystem.)
- Coral Reefs B (Why are coral reefs important to the environment, What are the human/invasive species threats facing coral reefs, What steps are being taken to save coral reefs.)
- Coastal Dunes A (What are they, Where are they located, What species lives in this ecosystem.
- Coastal Dunes B (Why are coastal dunes important to the environment, What are the human/invasive species threats facing coastal dunes, What steps are being taken to save coastal dunes.)

3. Students will work together to create a PowerPoint or a Google slide presentation to illustrate the answers to these questions. Each student will be responsible for creating at least two slides in the presentation.
4. Students will present their findings to the class.
5. The teacher will assist groups as needed and ask guiding questions for each student group; specific to their topic. Teacher will informally assess student progress with a parking lot tool or exit tickets asking for specific information such as What species lives in your ecosystems or Why is your ecosystem important to our world.

EXPLANATION

Coral Reefs/Mangroves and Nature Based Solutions

Duration: **Approximately 180-225 min (4-5 class periods)**

Brief Description: Students will complete a station lab activity where they visit various stations to learn about coral reefs, mangroves, and dunes.

Procedures:
These slides can be sent to students so that they fill out the Station Lab Sheet on their device in Google Slides and work independently with all videos and materials on their device, or the slides can be printed so that each station is set up at a different table with a device pulled up to the corresponding task. In the second method, teachers can print the Station Lab Sheet for students to write on or send a copy of the slides to each student for them to type their answers on the Station Lab Sheets.

Watch It: Answer questions after watching the following videos.

Coral Reefs 101
Inside the Mangrove Forest
What's Killing Coral Reefs?
Can Protecting Mangroves Save the Planet?

Read It: Answer questions after reading the article about an unexpected phenomenon with coral reefs and mangroves.

Caribbean Mangrove Forests May Serve as Coral Shelters | Smithsonian Voices | Smithsonian Tropical Research Institute Smithsonian Magazine

Explore It: Identify parts of marine ecosystems using google and other resources on the slide from reefreleif.org & Complete Venn Diagram comparing the two: reefs vs mangroves.

Marine Ecosystems worksheet (reefrelief.org)

Coral Reef vs. Mangrove Ecosystems- Worksheet (reefrelief.org)

Research It:

What are nature-based solutions and how can they help us address the climate crisis? | Stories | WWF (worldwildlife.org)
Nature-based solutions: Mangroves - Climate Champions (unfccc.int)
What are nature-based solutions and why do they matter? (climatechangenews.com)

Teacher will review the information that students have discovered by doing the station labs over the course of 3-4 class periods once they are complete with discussion and PowerPoint added information to elaborate.

ELABORATION

Duration: Approximately 180-220 minutes (5 class periods).

Brief Description: Students will watch videos, complete activities, play games, and use Google Earth to investigate facts related to coral reefs, mangrove forests, and dunes.
Procedures: Teacher will introduce and present the videos to the entire class. After, students will be instructed to get a laptop. Teacher will provide links to the videos, activities, games, and Google Earth. Teacher will model procedures for each one of the activities. Teacher will instruct students to complete tasks.

Coral Reefs: After watching *Coral Reefs 101*, students will complete the "Reef or Wrong" jamboard. The class will be divided into three groups of ten students to play the "Coral Reef Race for Survival" game. Teacher will review the game's rules, guidelines, and expectations with students.

Day 1: Video: Coral Reefs 101

Complete the Reef or Wrong Jamboard (make a copy for your use)

Day 2: Reef or Wrong Game

Mangrove Forests: After watching *Inside the Mangrove Forest*, students will complete the "Mangrove Forests" jamboard. Then, students will play the Make a Mangrove Game. Teacher will review activities, rules, guidelines, and expectations with students.

Day 3

Video: Inside the Mangrove Forest

Complete the Mangrove Forests Jamboard (make a copy for your use)

Day 4: Make a Mangrove Game

Coastal Dunes: After watching *Sand Dune Formation and the Rock Cycle*, students will complete a chart by retrieving information from "Dune." The chart will be used as a guide to visit places around the globe using Google Earth.

Day 5

Videos: Sand Dune Formation and the Rock Cycle , National Geographic: Dune

Complete the Sand Dune Chart

Google Earth

EVALUATION

Brief Description: Using Canvas, trifolds, assistive technology, or 3D models, students will create a presentation to explain coral reefs, mangroves, and dunes and develop a nature-based solution that will best serve to help restore these ecosystems.

Procedures: At the conclusion of the unit, students will be expected to choose an ecological service/nature- based solution that they felt would best serve to help coral reefs, mangroves, and dunes. Students will explain how we can actively play a part in helping these areas become restored. Students will use the rubric to ensure they include all required elements on the board.

Nature Based Solutions Infographic Assessment Rubric

REFERENCES

- Kesler Science: https://keslerscience.com/
- What's Killing Coral Reefs?: https://youtu.be/14ot4DrXdds
- Can Protecting Mangroves Save the Planet?: https://www.youtube.com/watch?v=8E6LVhgfrwg&pp=ygUUdGhyZWF0cyB0byBtYW5ncm92ZXM%3D
- "Caribbean Mangrove Forests May Serve as Coral Shelters" | Smithsonian Voices | Smithsonian Tropical Research Institute Smithsonian Magazine: https://www.smithsonianmag.com/blogs/smithsonian-tropical-research-institute/2021/07/26/caribbean-mangrove-forests-may-serve-coral-shelters/
- Marine Ecosystems worksheet (reefrelief.org): https://www.reefrelief.org/wp-content/uploads/2020/03/Marine-Ecosystems-worksheet.pdf
- Coral Reef vs. Mangrove Ecosystems- Worksheet (reefrelief.org): https://www.reefrelief.org/wp-content/uploads/2020/03/Coral-Reef-vs.-Mangrove-Ecosystems-Worksheet.pdf
- "What are nature-based solutions and how can they help us address the climate crisis?" | Stories | WWF (worldwildlife.org): https://www.worldwildlife.org/stories/what-are-nature-based-solutions-and-how-can-they-help-us-address-the-climate-crisis
- Nature-based solutions: Mangroves - Climate Champions (unfccc.int): https://climatechampions.unfccc.int/system/mangroves/
- "What are nature-based solutions and why do they matter?" (climatechangenews.com): https://www.climatechangenews.com/2019/12/09/nature-based-solutions-matter/#:~:text=Instead%2C%20nature-based%20solutions%20could%20include%2C%20restoring%20and%20conserving,help%20replenish%20groundwater%20in%20regions%20facing%20water%20scarcity.
- Make a mangrove, an ecosystem game https://pbskids.org/plumlanding/games/ecosystem/make_a_mangrove.html
- Coral Reefs 101 https://www.youtube.com/watch?v=ZiULxLLP32s
- Reef or Wrong Jamboard: https://jamboard.google.com/d/1axk1PKdWIl79armgwZMkwNZIPZrRdscbAZQKvnU4bbw/viewer?pli=1&f=0
- Inside the Mangrove Forest https://www.youtube.com/watch?v=cwTZhyA57mA
- Mangrove Forests Jamboard https://jamboard.google.com/d/1tjSaFHy-FEoINvn3Gb3tSYPXNKqqfJFSCagt4XmikxA/viewer?f=6
- Reef or Wrong Game https://southeastfloridareefs.net/uploads/Activities%20and%20lesson%20plans/K%20-%205/Coral%20Reef%20Race%20for%20Survival.pdf
- Make a Mangrove Game https://pbskids.org/plumlanding/games/ecosystem/make_a_mangrove.html

- Sand Dune Formation and the Rock Cycle https://www.youtube.com/watch?v=-xHMc2n5Uaw&t=23s
- Dune https://education.nationalgeographic.org/resource/dune/
- Dune Chart and Google Earth Checklist https://docs.google.com/document/d/1IjEHr0U3fGaLDv6591lLQaxprlRYkX7CT1F0dQJT4us/edit
- Google Earth: https://earth.google.com/web/
- Virtual Tour of Coral Reefs VR Tour Coral Reefs
- Gibberagong Mangrove Information Mangroves
- Oregon Conservation Strategy Coastal Dune Conservations
- North Carolina State University Coastal Dune Eco Systems
- Smithsonian Institution Mangroves
- Environmental Protection Agency Coastal Reefs