Salt Marsh Secrets.
Lesson Plan.

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Abstract

The purpose of this lesson is to highlight salt marshes ecological importance to students. The whole activity and students' presentations might take two class periods. The first part of this lesson can be assigned as a research activity following by a class discussion. In this lab activity students will read about some facts of salt marshes ecology and use real-life data to make estimations about fiddler crab colony population & food material consumption, practice calculations of measures of central tendency, work with proportions & percents, and use basic geometry to estimate volumes of water absorbed by the marshes due to fiddler crab colony activity

A Bright Idea Nikbakht, Sharareh & Meadows, Yelena. (2016). A bright idea. http://serc.carleton.edu/sisl/2012workshop/activities/83569.html

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About this lesson:
The purpose of this lesson is to highlight salt marshes ecological importance to students. The whole activity and students' presentations might take two class periods. The first part of this lesson can be assigned as a research activity following by a class discussion.

In what type of classes could this lesson be used?
This lesson is suitable for students in any basic Algebra, Pre-calculus, or Environmental Science classes.

Prerequisite skills
- Students should know basic geometry such as how to calculate area and volume of regular shapes, as well as calculating percentage, average, and ratio.

Summary of the Lesson

Part I.
Students conduct an online research about the importance of salt marsh and its crucial role to the environmental health of the coastal areas. They need to summarize their results into a two column table which compares the benefits of. protecting and maintaining salt marshes vs draining and destroying them.
Students use a class period to present their tables to their peers as well as initiate conversations about the health of salt marshes and any other related issues.

Part II.
Background information:
Forests are good natural carbon sinks. Trees take up carbon from the atmosphere, they photosynthesize, they store that carbon, and they turn it into wood. But forests are not the only ecosystems that store a lot of carbon. In fact, coastal ecosystems mainly mangroves, salt marshes, and sea grasses take up and store large amounts of carbon as well. One of the reasons that these coastal ecosystems are just now being recognized as important carbon sinks is because most of the carbon in these ecosystems is stored below ground in the soil. So it's not in the biomass of the trees the way it is in a forest, where we can see that carbon. In these coastal systems, it's almost entirely below ground where we can't see it. These soils under these coastal ecosystems tend to be several meters deep and they often store carbon that is decades if not thousands of years old." Says a NOAA expert, an ecosystem ecologist and bio- geochemist Dr. Ariana Sutton-Grier (Resource: http://oceanservice.noaa.gov/podcast/may14/mw124-bluecarbon.html)
One of the ways blue carbon is sequestered from the atmosphere by the marshes (at rates ten times higher than most forested systems) is by "sucking in" the carbon dioxide through rain water and air and storing it in the spongy bay mud, called peat, at 2-6 feet deep. The bay mud has been storing CO2 as long as it existed. If disturbed or destroyed, they release the carbon dioxide back into the atmosphere.
So, how does the rain water get to the peat? The ecosystem depends on its many habitants to achieve this. Fiddler crabs are one of these organisms. They live in large colonies and burrow holes 30.5 cm to 92 cm deep, thus allowing air and rain water to reach the depths of peat, allowing spongy peat to absorb the water. These crabs ingest particles of sand and mud and they use their mouths to scrape up the food materials from the sediment and then deposit the sediment back on the ground in sand pallets (they look like small pyramids of sand balls, one pile in one day). One fiddler crab consumes 0.4 grams of food materials every 6 hours. During this process they keep the marsh healthy by: (1) allowing the peat to "breath"; and (2) controlling the spread of bacteria
(http://animaldiversity.ummz.umich.edu/accounts/Uca_pugilator/

Fiddler crabs live in colonies. One of the ways you can identify a male crab from a female is by brighter color and its large claw that is at least four times larger than the other.

During a research field trip, a group of scientists came across a big colony of Fiddler crabs. They estimated diameter of each burrow to be close to 1.3 cm. They captured several fiddler crabs, recorded several measurements and released the crabs back to their habitat.

Math Skills Practice:

Refer to the introductory text, figures 1, 2, 3 to answer the following questions:

Question	Answer
1. Based on the 1m grid in Figure 3, estimate the number of fiddler crab burrows per square meter(assume an average of 2 borrows per each 25 cm^2 increments).	1. ____________
2. Assuming these burrows are cylindrical tubes. Calculate the minimum amount of rain water one burrow holds in cm^3.	2. ____________
3. Calculate the maximum amount of rain water one burrow holds, in cm^3.	3. ____________
4. Based on your answers to questions 1 and 2, calculate the minimum amount of rain water these burrows allow to sip into peat per square meter.	4.____________
5. Based on your answers to questions 1 and 3, calculate the maximum amount of rain water these burrows allow to sip into peat per square meter.	5.____________
6. Approximate number of crabs in 1 square meter? (assume only one crab lives in every, borrow)	6.____________
7. How much food material, in grams, will a colony of crabs (similar to ours in figure 3) occupying 100 square meters consume in a 6 hour period?	7. ____________
8. How much of the fungi, in grams, does the colony consume in the 6 hour period? (assuming food material consists of: 25% fungi, 33% diatoms, 20% vascular plants; and almost 22% unknown materials).	8. ____________
9. How much of the diatoms, in grams, does the colony consume in the 6 hour period?	9. ____________
10. Based on the data in the Figure 1, how many fiddler crabs were caught?	10. ____________
11. What percentage of the caught crabs were males?	11.____________
12. What percentage of the caught crabs were females?	12. ____________
13. What is the average length of a male fiddler crab large claw?	13. ____________

14. What is the average width of a female crab? 14. ___________

15. What is the average width of a male crab? 15. ___________

16. What is the average height of a female crab? 16. ___________

17. What is the average height of a male crab? 17. ___________

18. Which gender crab was wider? 18. ___________

19. By how much? (in cm) 19. ___________

20. What is the ratio of left-handed crabs (L) to right-handed ones (R)? 20. ___________

21. What is the ratio of male crabs to females? 21. ___________

22. What percent of crabs with width of 1.2 cm are males? 22. ___________

Chincoteague Field Station, VA; May 14, 2014 data:

Male (L/R)/Female	Big claw length (cm)	Width (cm)	Height (cm)
Female		0.9	0.7
Female		1	0.8
Female		1.1	0.7
Female		1.1	0.7
Female		1.1	0.6
Female		1.2	0.8
Female		1.7	1.1
L	1	1.2	0.8
L	1.7	1.5	1.1
L	2.9	1.7	1.2
L	3	1.6	1.1
L	3.1	1.8	1.3
R	1.2	1.2	0.8
R	1.3	1.2	0.8
R	1.5	1.2	0.8
R	1.5	1.4	0.8
R	1.8	2.8	1.3
R	2.2	1.6	1.2
R	2.2	1.6	1.1
R	3.2	2.2	1.3
R	3.3	1.9	1.2

Figure 1: Wallops Island Salt Marshes Data

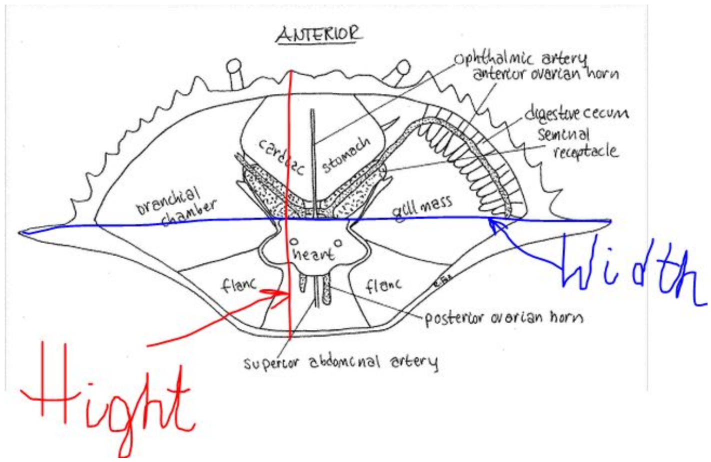
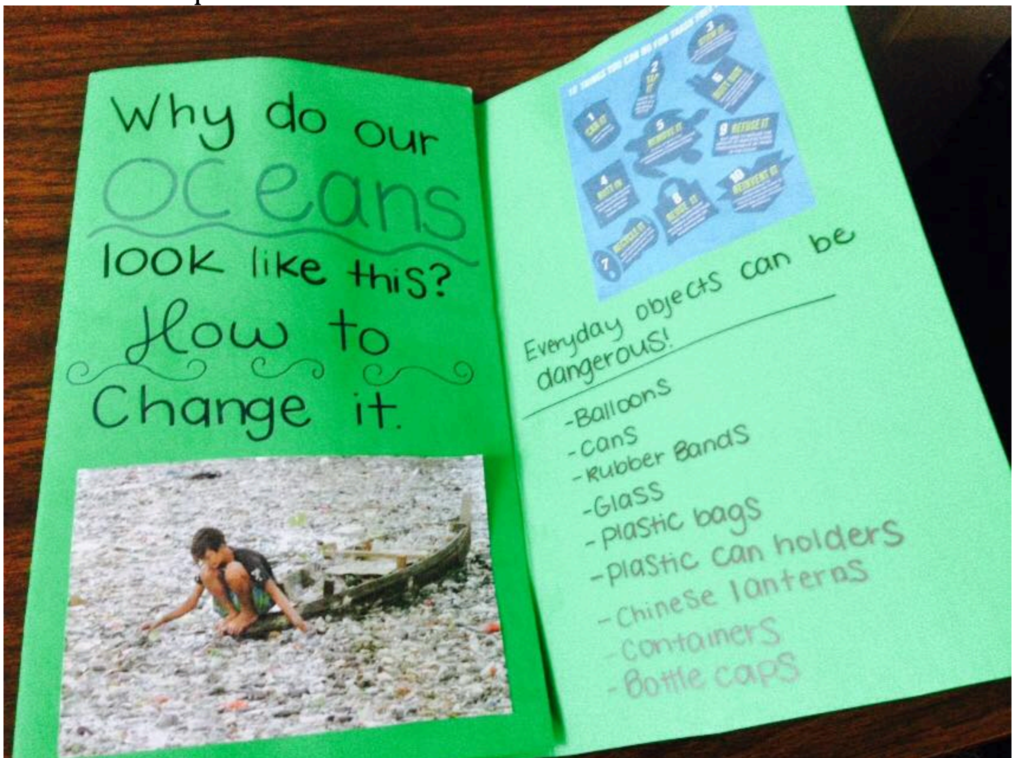
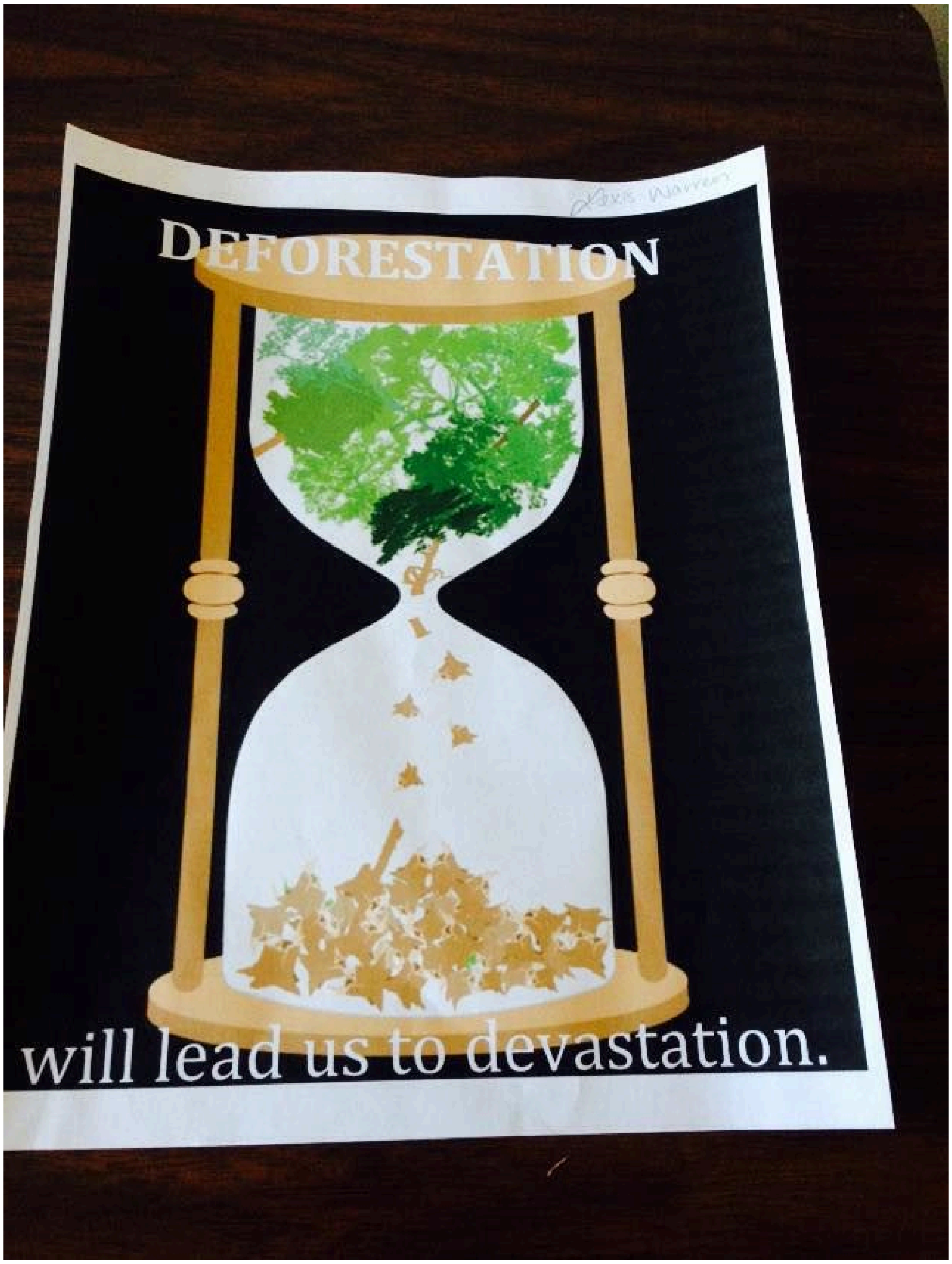


Figure 2: Fiddler Crab Physiology

Figure 3: 1 square meter grid with 25 cm increments of fiddler crab burrows, Wallops Island Salt Marsh, 5/14/2014

Student Examples:




DEFORESTATION
will lead us to devastation.