Buck Gully Science Career Excursion Program Study Guide

Overview of Program: Located at Buck Gully Nature Reserve, this program provides students with exposure to variety environmental science careers in botany, geology, ecology, entomology, and ornithology. High School students explore these STEM careers as they hike through the breath-taking trails of the reserve and conduct science-based observations, data collection, hands-on experiments, and field data analysis. Each student will undergo a brief exposure to the 5 listed science careers as well as be immersed in 1 of the 5 careers to grasp a deeper understanding of that career. For their main career, students will be randomly divided to become an ecologist, geologist, or botanist. The geologist will be researching suspended sediment transportation, botanists will use quadrants to assess the biodiversity of native and non-native species, and ecologists will investigate fertilizer concentration in soil. NGSS alignments: HS-LS2-6, HS-LS2-7, HS-LS4-5, HS-ESS3-5.

Objective of Study Guide: This study guide is offered to provide short and simple activities that can be completed in a classroom setting. The suggested activities are designed to encourage open discussions and reflections on the program's content.

General Vocabulary Terms *See appendix for definitions

- Watershed
- Field Research
- Botany
- Geology
- Entomology
- Ornithology
- Native Species
- Non-Native Species
- Invasive

Geology

NGSS Standards Covered HS-ESS2-5, HS-LS2-7
Section's Vocabulary Terms: *See appendix for definitions

- Geology
- Sediment Transportation
- Sediment Deposition
- Erosion

Suggested Classroom Activity:

- Objective: Illustrate examples of sediment transportation and sediment deposition. Begin a conversation discussing potential sediment sources and management strategies.
- Materials: Different size sediment, rulers, and the geology handout (see appendix)
- Procedure:
  - Go over vocabulary terms associated with this station.
  - Bring sediment of different sizes (sand, pebbles, etc.) or take your students out to collect sediment from your school ground (have them put their sediment back from where it was collected-everything in nature belongs in nature). Each student can have one piece or if the sediment is limited, students can be paired up.
  - *Everyone take your sediment piece and measure your piece to determine the current classification in size and shape.* Pass out handouts and rulers.
  - Using every pupil response, have your students share which size and shape of sediment they have. For example, *raise your hand if you have a "silt size sediment, raise your hand if you have a "very angular" shape sediment.*
  - *Let's say your sediment was outside on our school ground and we had a significant amount of rain.*

- *Do you think your sediment would travel in this scenario? Where would it go? Would it travel a long distance? Why or why not? Would it break into smaller pieces? Why or why not?* If your students are in pairs, you can have them share their ideas with their partners, if they are not already in pairs have them partner up with an individual that has a different size sediment and share their thoughts on the questions.
- *Flip over your handout and look at the map.*
- *Find on the "X" on map.*
- *Let's pretend that your piece of sediment was found near the "X" location. After a significant amount of rain, where could your sediment possibly be deposited or in other words where would your sediment be found after it rained? Why that location? How would sediment deposition effect the plants and animals in the area?*
- *Let's say near the "X" on the map there was a construction site with uncovered piles of sand size sediment. What could happen in terms of sediment transportation and sediment deposition after rainfall in this scenario?*
- *What could happen to an ecosystem if there is too much sediment deposition in one area?*
- *Other than rain, how could sediment be carried into a watershed? Potential answers-water from the hose, wind, etc.*
- *You found your sediment from _____. Where else can sediment come from? Potential answers-parks, hillside, etc.*
- *We will learn more about sediment transportation and deposition on our Buck Gully Science Career Excursion Program. It will be helpful to remember the key terms and concepts we went over today.*

Botany:

NGSS Standards Covered HS-ESS2-5, HS-LS2-7
Section's Vocabulary Terms: *See appendix for definitions

- Botany
- Native Species
- Non-Native
- Invasive
- Quadrant
- Monoculture

Suggested Classroom Activity:

- Objective: Concepts pertaining to invasive plant species.
- Materials: Washable marker, plant activity cards (hole punch and yarn or tape to have student wear the cards)
- Procedure:
  - Go over vocabulary terms associated with this station. Clarify the difference between the terms, "non-native" and "invasive".
  - Have students stand in a marked boundary in an indoor or outdoor open space. If you need to, use cones or rope to mark out an area. The area should be big enough to fit all your students but small enough where they are able to touch each other with a one pivot move.
  - Select one student to be an invasive plant. Ask that student to wear the invasive plant card. Select one student to be the invasive plant marker give them the washable marker. They will be in charge of marking all of the invasive plant species. See Appendix for activity cards
  - *For everyone else, please grab a native Orange County plant card (it's okay if the plant is repeated)- you will become that plant in our game.* Out loud, have a few student share plant facts from their plant card.
  - *Find a place within our boundary and claim your spot where you will live and hopefully grow.*
  - *SAY NAME, is an invasive Orange County plant.* Have the invasive plant marker mark the invasive plant with an "X" on the back of their hand. Place the invasive plant in a prime spot where they will be able to touch another plant.
  - *We are going to the play a game similar to the game Ninja. The invasive plant can shoot its seeds by making one leg pivot motion and one movement with their arms towards another plant. If the invasive plant touches any part of another plant it means that the invasive plant took over that native plant and the originally native plant turns into an invasive plant. SAY NAME OF INVASIVE PLANT MARKER will mark the back of your hand with an "X" if you turn into an invasive plant.*

- Have each student make a move. Do about 2-3 rounds or until most plants have turned into invasive plants.
- After the last round, ask all the invasive plants to sit down and the native plants to remain standing.
- Discuss with the group what happened during the game. *How could our ecosystem in this game alter with the introduction of this invasive plant species (*the students should consider the information from their plant cards)? *What could happen to the native animals that relied on the native plants for survival?*
- *What are some possible places/sources this invasive plant could have come from?*
- *What are some ideas you have to help prevent the introduction of invasive plant species in Orange County?*
- *Those who will be assigned as Botanists for the Science Career Excursion program will be learning more about effects of non-native and invasive plant species and will be collecting field data on the percentage of non-native and native plants from multiple survey locations.*

Ecology

NGSS Standards Covered HS-LS4-5,HS-LS2-6,HS-LS2-7
Section's Vocabulary Terms:

- Biotic
- Abiotic
- Fertilizer
- Nitrate
- Riparian
- Watershed
- Point Source Pollution
- Non-point Source Pollution

Suggested Classroom Activity:

- Objective: Introduce the use of fertilizers and the concept of a watershed.
- Materials: Small bag of fertilizer, ecology handout, and pencils
- Procedure:
  - Go over vocabulary terms associated with this station.
  - Set out a bag of fertilizer to give a visual for your students. *For our upcoming Science Career Excursion program, some of you will be ecologists researching if fertilizer is present in the soil and/or the stream.*
  - *Why is fertilizer commonly used?* Take guesses. *Yes, to help plants grown. People can use it on their personal lawns, or places like golf courses and farms are businesses that use fertilizers often.*
  - *What is fertilizer made of?* Take guesses. *Good thoughts.*
  - Pass around fertilizer bag. *As the bag is passed around, look at the ingredients of the fertilizer and take note of the main ingredient.*
  - Once everyone has had a chance to look ask, *what was the main ingredient in this fertilizer? Yes, nitrogen.*
  - *Nitrogen promotes plant growth which can be good, in certain situations. If there is too much nitrogen in an ecosystem it can have negative effects.* Show image (see appendix). *How could too much nitrogen effect certain plants from growing? How could too much nitrogen effect animal life?*
  - *If fertilizer is used on plants, how does fertilizer end up in a streams, lakes, and oceans?* If the students don't mention it, bring up non-source and source pollution.
  - Pass out the ecology handout to each of your students. See appendix.
  - *Everyone look at your handout titled, "Santa Ana River Watershed Location Map".*
  - *Who can remind me, what is a watershed?*
  - *Find on your watershed map where Rancho Cucamonga and Lake Elsinore are located. How could fertilizer from a home in the Rancho Cucamonga area end up in Lake Elsinore?*
  - *Using a pencil, mark a possible the route fertilizers could travel in this scenario.*
  - *What effect could an abundance of fertilizers have and a lake ecosystem?*
  - *How could fertilizer originally from inland (for example Yorba Linda) end up in the ocean? Find a route on your watershed map. What effect could an abundance of fertilizers have on an ocean ecosystem?*

- *We can see through the watershed system how things that are picked up from water from all, areas including inland areas, have an effect on our bodies of water.*
- *Those that will be assigned as ecologist for the Buck Gully Career Excursion Program will be collecting field data on levels of nitrogen present in the soil and/or the stream at Buck Gully Reserve. Consider the concepts we discussed today when collecting the field data.*