High School Biology: Litter & Landfills

Standard

SB5. Obtain, evaluate, and communicate information to assess the interdependence of all organisms on one another and their environment.

a. Plan and carry out investigations and analyze data to support explanations about factors affecting biodiversity and populations in ecosystems. (Clarification statement: Factors include population size, carrying capacity, response to limiting factors, and keystone species.)

b. Develop and use models to analyze the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration.

- Arranging components of a food web according to energy flow.
- Comparing the quantity of energy in the steps of an energy pyramid.
- Explaining the need for cycling of major biochemical elements (C, O, N, P, and H).

c. Construct an argument to predict the impact of environmental change on the stability of an ecosystem.

d. Design a solution to reduce the impact of a human activity on the environment. (Clarification statement: Human activities may include chemical use, natural resources consumption, introduction of non-native species, greenhouse gas production.)

e. Construct explanations that predict an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire).

Teaching Tips

Preparation Provide gloves, sorting containers (boxes), trash bags (biodegradable preferred). Students will need cameras or cell phones with camera function and the Litterati app. Optional: engage students in an eco-engineering challenge to build garbage grabbers that help students collect trash without touching it.

Directions for this lesson are written for teachers. Provide students with the Community Science Lab Report from the appendix. Break students into groups of 3-4 for the Community Science Project.

Phenomenon: Present phenomenon in lesson without explanation before or after students view it.

What Do you Notice? Engage students in writing a tentative explanation (or labeled drawing) that tells what, why, how.

What Do you Wonder? Engage students in asking their own questions, which will form the basis for their research.

Student Research After each student writes a question, consider placing each question on a sticky note, grouping them in categories, and allowing students to learn more in small groups according to their interests. A curated collection of articles is provided for use in small groups, using the Jigsaw protocol. https://www.jigsaw.org/

Teacher-Directed Activity Direct students to graph or chart data from the Litterati project and analyze the results. Prompt students to consider these tips and ideas from Global Stewards: http://www.globalstewards.org/ecotips.htm Then engage students in designing and conducting a project to prevent or reduce waste, based on their findings.

Zero Heroes Lesson Activity This is a Community Science Project to collect data on sources of litter in the schoolyard. An analysis of students' Litterati data, as well as open data from a wider impact area (https://opendata.litterati.org/) can help define the problem and consider the most effective project they could organize to prevent or reduce litter.

Revised Explanation Allow students to revise their initial explanations of the phenomenon, reflecting what they have learned. Clear up misconceptions about the topic. Engage students in discussion of solutions at individual, corporate, and societal levels. Let students choose, design, implement, and assess a project to contribute to a solution.

Teacher Resources

Additional lesson resources can be found in the education part of the Litterati app: https://edu.litterati.org/

Biology - Community Science Project: Litter & Landfills

The Phenomenon

What do you notice? (tentative explanation)

Engage students in observing the phenomenon. What do you notice? Students will write a tentative explanation that includes who / what / why / and how the phenomenon occurs.

What do you wonder? (student questions)

Engage students in asking questions about the phenomenon. These questions will provide the basis for their research.

Curated Resources for Jigsaw Research www.jigsaw.org/

The Problems

Let 'em Litter? What is the Right Role for Individuals? Barash, David; Psychology Today; December 2, 2019
        https://www.psychologytoday.com/us/blog/pura-vida/201912/letem-litter-what-is-the-right-role-individuals
Doing Well by Doing Good; Roper, Stewart; Journal of Business Research Volume 66, Issue 11, November 2013, Pages 2262-2268
        https://www.sciencedirect.com/science/article/pii/S0148296312000501
The Litter Myth (podcast); Throughline on National Public Radio, September 5, 2019 https://www.npr.org/2019/09/04/757539617/the-litter-myth
Malaysia Sending Back Plastic Waste to Foreign Countries ; NewsELA adaptation from Associated Press, June 11, 2019
        https://newsela.com/read/malaysia-plastic-waste/id/52546
Catastrophic Effects of Littering on Wildlife https://www.conserve-energy-future.com/littering-effects-humans-animals-environment.php
Animals Stuck in Plastic https://www.plasticsoupfoundation.org/en/plastic-problem/plastic-affect-animals/animal-stuck-plastic/

The Proposed Solutions

Keep America Beautiful Being a Good Neighbor: A Guide to Reducing Litter, Managing Trash, and Encouraging Recycling
        https://kab.org/wp-content/uploads/2017/10/BeingaGoodNeighor_AGuidetoReducingLitterManagingTrashandEncouragingRecycling.pdf
Made in GA from Recycled Content https://www.youtube.com/watch?v=mZPgjICfsx4
Eco-Friendly Marketing Guide from the FTC https://www.consumer.ftc.gov/articles/eco-friendly-and-green-marketing-claims
Recycling Basics from EPA https://www.epa.gov/recycle/recycling-basics
Things that can be made out of recycled items https://www.globalcitizen.org/en/content/recycled-plastic-10-cool-products/
What if We Could Put Plastic Trash to Good Use? NewsELA, PBS NewsHour; October 5, 2018   https://newsela.com/read/plastic-pollution-solutions/id/46367/
Additional: NewsELA Lisa Koch's articles on Trash https://newsela.com/text-sets/159432/kochanthropologytrash

The Community Science Project: Litterati   https://litterati.org/

Download the Litterati app.
Choose a schoolyard or RiversAlive site.
Collect litter and discarded items.
Photograph and tag each piece of litter.
Sort litter for recycling and landfill.
Dispose of litter properly.
Upload tagged litter pics.
Analyze data re: types, sources of litter.
Litterati tutorial videos; Litterati FAQs; Litterati impact stories.

Analyze your litter data and that of the larger impact area (https://opendata.litterati.org/) in terms of sources. Consider how trash originating on land ends up in the ocean, using RiverRunner (https://river-runner.samlearner.com/) to follow the path of rain that flows cross ground as runoff. Explore how TerraCycle (https://www.terracycle.com/en-US/) could provide a solution for hard-to-recycle items. Discuss Keep America Beautiful's goal for "each person in America… to pick up 152 pieces of litter to make our nation… litter-free" and decide whether it is n appropriate goal.

Revised Explanation

Allow students to return to their original explanation of the phenomenon and revise it to include what they learned. Prompt students to analyze the impact of litter on an ecosystem and propose the most effective project students could do at school to prevent or reduce litter and waste. Provide them an opportunity to follow through on their project idea(s).