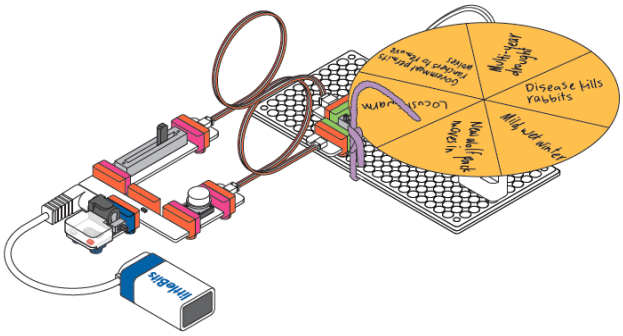
littleBits education

LESSON

Ecosystem Dynamics



Overview

In this lesson, students will:

- Explore how change affects populations of producers and consumers in an ecosystem.
- Discuss effects and make informed predictions of population changes in an ecosystem.
- Engineer a random ecosystem scenario generator with littleBits.

THE CHALLENGE

Build a randomized ecosystem spinner for the "Wheel of Change" game.

Lesson Tags

GRADE LEVEL:

Elementary (grade 5)

SUBJECTS:

Science, technology, engineering

DIFFICULTY:

Intermediate

DURATION:

60 minutes

PREREQUISITE KNOWLEDGE:

- littleBits basics
- Basic knowledge of ecosystems and how energy is transferred within them

Supplies

Bits:

- STEAM Student Set (power, button, slide dimmer, number, DC motor, 2 wires, fork, battery and cable, wheel and mounting board)

Tools Used:

- Pen/pencil
- Markers
- Scissors
- Tape
- Ruler
- Optional: timer

Other Materials:

- Pipe cleaner
- Deck of cards
- Construction paper

Description

LESSON OUTLINE:

INTRO: Introduce the lesson prompt and assess students' current knowledge.

CREATE: Groups of 2-3 students start to build their inventions.

PLAY: Students test their prototypes to make sure that it works, then play the "Wheel of Change" game.

REMIX: Repeat the game.

SHARE: Reflect on the activity and share out responses.

ASSESSMENT STRATEGIES:

FORMATIVE ASSESSMENT: Circulate the classroom as students work, assessing their use of the Bits, teamwork, and any other relevant skills you wish to focus on. Depending on students' level of experience, you might look for students putting Bits together backwards (e.g. trying to force them together and not aligning the right sides and getting a magnetic snap), students not adding a power source etc.

SUMMATIVE ASSESSMENT Students should complete the student handout. You may choose whether this is an individual or group submission.

Standards

NGSS

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Vocabulary

Ecosystem	Food chain/web
Producer	Consumer

Resources

ATTACHMENTS

Ecosystem Dynamics Student Handout

SUPPORTING LINKS

PBS Learning Media: How Yellowstone Wolves Caused a Trophic Cascade

TIPS & TRICKS

#1: Keep an eye on the clock, and where students are at. Some students will want to spend too much time in the Create stage, and some students will try to speed through it.

#2: We occasionally update our Bits and accessories, so some of the names and images included in the student handout may look different from those in your STEAM Student Set. Use your Invention Guide from within your Kit to support students with the parts that they have accessible to them.

PACING (60 mins)

Prep + Setup

Intro (10 mins)

Create (15 mins)

Play (15 mins)

Remix (10 mins)

Share (5 mins)

Close (5 mins)

Instructional Steps

Step 1: SETUP

DURATION: 10 minutes (prior to class)

This lesson can be done individually or in small groups (2-3 students). Each group will need one STEAM Student Set and a lesson handout. Set up a central location in the classroom for assorted materials and tools.

Each group will need a power Bit, button, slide dimmer, number, DC motor, 2 wires, fork, battery and cable, wheel and mounting board. Younger students can start out with just these materials, so they aren't overwhelmed and don't try to add unnecessary Bits. Older/more confident students can have access to any Bits in their Kits.

NOTES

- You should use a classroom timer or digital timer to help keep students on track.

Step 2: INTRODUCE

DURATION: 10 minutes

Discussion

Elicit student responses to gauge understanding and warm-up for the activity.

1. Ask students to name organisms in a given ecosystem, preferably ones that you've discussed in class previously. For example, Yellowstone National Park; the Amazon; the Great Barrier Reef; or a local environment. As students suggest animals (and even plants!), capture these on the board.
2. Show the video of the Wolves in Yellowstone, then ask students to reflect on what they think happened to the rabbits when the wolves were introduced? What do you think would happen to the rabbit population if elks weren't part of this system? This will set the stage for the ecosystem that we'll be focusing on in the game.
    a. In the Yellowstone example, elk is the wolves' main source of food so we'd expect rabbit populations to increase as the wolves made a comeback (due to the improvement in vegetation as the elk population decreased). Without the elks, we could expect the rabbits to serve as the primary food source for the wolves and thus, rabbit populations would decrease as wolves increased.

3. **Writing Box #1:** Imagining the elk-free scenario, ask students to record their thoughts on what would happen if this food web suddenly lost all wolves. What's a likely scenario that would cause all wolves to disappear from the food web? What would happen to the rabbit population? What would happen to the plants? Can you think of any other changes to the ecosystem?
4. Ask students to briefly share out what they recorded.

Introduce the Challenge

Explain that they'll use littleBits and the littleBits Invention Cycle to create a "wheel of change" spinner to role-play and predict these kinds of ecosystem changes. The activity will be broken up into the following steps:

CREATE: Build your spinner following the directions given.

PLAY: Students test their prototypes to make sure that it works, then play the "Wheel of Change" game.

REMIX: Repeat the game.

SHARE: Reflect on the activity and share out responses.

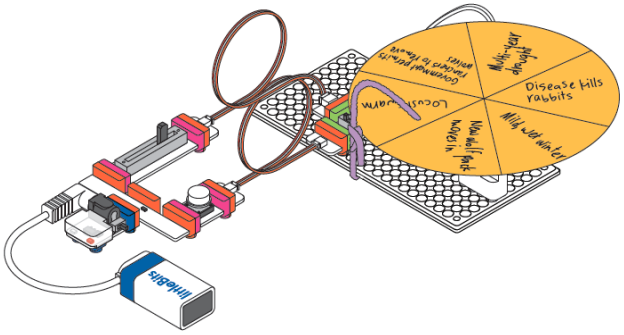
Divide the class into groups of 5 and have them set up their workstations.

Step 3: CREATE

DURATION: 15 minutes

Students will follow the instructions and diagrams in the student handout to build their spinner. The spinner should contain the following events: Disease kills rabbits; Mild, wet winter; New wolfpack moves in; Locust swarm; Government permits ranchers to remove wolves; Multi-year drought.

NOTES



- If students need a little extra help getting started, reference the Bit Index in their STEAM Student Set Invention Guide or the littleBits website to learn how specific Bits work.
- The Create phase may take more or less time, depending on the group and students' familiarity with littleBits. You may want to give students guidance on what they should do after assembling their circuit (e.g. move on to the Play phase to test their circuit), so they can self-pace.

Step 4: PLAY

DURATION: 15 minutes

Test your invention!

Power on your circuit! When the button is pushed, the number Bit should count up. As the counter nears ten, the wheel should begin revolving slowly. As the wheel revolves, move the slide dimmer all the way to the right and then all the way back to the left to stop the revolutions and re-set the number Bit.

Play the 'Wheel of Change' Game

There are five roles in each game. Assign roles to each student in the group: In each turn, the Multiplier multiplies the cards to determine the wheel revolutions; the Operator will operate the circuit; two Forecasters will ideate on how the result of the "wheel of change" affects the ecosystem; and one Time-Keeper will operate the timer to ensure that the two "Forecasters" talk for a predetermined amount of time. Rotate roles after each turn. If there are fewer than five students per group, the Multiplier can double as a Forecaster.

As groups conclude their builds, instruct them in the rules of the "Wheel of Change" game below.

1. From a complete deck of cards, create your playing deck by keeping only the cards numbered 4–10; you'll remove all aces, 2's, 3's, and face cards.
2. The **Multiplier** will choose two cards at random, and multiply the values together. For example, a 4 and an 8 would equal 32.
3. The **Operator** will press the button as many times as the product of the two cards. For example, the button would be pushed 32 times. This determines how long the wheel is allowed to spin!
4. As soon as this number is reached, the **Operator** slides the slide dimmer to the right, then left, to reset the number Bit and stop the spinning. Whichever section the pipe cleaner is touching when the wheel stops is the event that has occurred.
5. The **Timer** reads the phenomena aloud for the two Forecasters, starting the timer for one minute.
6. The **Forecasters** must ideate what changes might be affected by this phenomena.
7. The **Timer** calls "time!" at the end, and everyone rotates roles.

Step 5: REMIX

DURATION: 10 mins

Repeat the game so that every student has two tries being the forecaster.

Step 6: SHARE

DURATION: 5 mins

Writing Box #2: Ask students to conclude their round by recording the following:

- The most interesting effect that one of your teammates forecasted
- The phenomena that was the hardest to forecast

If time, ask students to share out their responses.

Step 7: CLOSE

DURATION: 5 mins

Students should take apart their inventions and put away the Bits according to the diagram on the back of the Invention Guide. Students should clean up their workspace and return any usable materials/tools.

Step 8: EXTENSIONS

Consider the following invention or discussion prompts:

- Ask students to create different randomizers using littleBits! Students might suggest using the slide dimmer to directly power the wheel, and use dice to determine how many seconds they let the wheel spin before they reset the slide dimmer.
- Allow students to brainstorm different events to capture on their spinners, and encourage them to make a video of their predictions!