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# Ecosystem Jenga!

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# Ecosystem Jenga!

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Students are often taught that ecosystems are "delicately balanced." But what, exactly, does this mean? How do we help students relate what they learn in the classroom about ecosystems to the world immediately around them?

As scientists who work closely with middle school students as part of a National Science Foundation–funded Graduate Fellows in K–12 Education program called Project Fulcrum, we have learned that abstract concepts, such as "delicately balanced ecosystem," are often not truly understood. We addressed this concern in a seventh-grade science classroom in Lincoln, Nebraska, by introducing students to locally threatened saline wetlands and the endangered Salt Creek tiger beetle (see Figure 1). To give students a tangible model of an ecosystem and have them experience what could happen if a component of that ecosystem were removed, we developed a hands-on, inquiry-based activity that visually demonstrates the concept of a delicately balanced ecosystem through a modification of the popular game Jenga. This activity can be modified to fit classrooms in other regions by focusing on a locally endangered plant or animal, which can be determined by contacting local governmental agencies (e.g., Department of Natural Resources).

## Preparation

Jenga is a popular block-balancing game sold by most large retailers. Small wooden pieces are stacked together to form a tower. Players remove pieces until the tower falls. This activity works best with small groups (four to eight students), and therefore multiple sets are necessary. The price of the Jenga sets is approximately $16–20; however, homemade blocks would also work in this activity. For a class of 24 students working in groups of four, six Jenga sets would be needed. Alternatively, if students are working in groups of eight, then three sets would be needed. Prior to the activity, we modified the Jenga sets to represent our local saline wetland ecosystem. We did so by painting the ends of equal numbers of blocks red, blue, green, and yellow to represent different components of the ecosystem (both ends of each block

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should be the same color). Paint pens are an easily available resource for setting up this activity, and the paint dries quickly. The blocks should be arranged randomly when building the initial tower. The activity worksheet that accompanies this article should be copied and distributed one per each group.

## In-class discussion (before activity)

This activity can be used as an introduction or supplement to an ecology or environmental science unit. The activity can be used to introduce ecosystem concepts (e.g., an ecosystem has living and nonliving components, different types of ecosystems such as tundra, desert, etc.), or reinforce ones students have already learned about. Our activity focused on the local Salt Creek tiger beetle; however, any plant or animal in any ecosystem may be used.

To begin the activity, have students answer the following questions in a class-discussion format:

1. What are the important resources that all living things need?
2. What would happen if a part of the ecosystem (living or nonliving) was removed permanently from the ecosystem?
3. If a plant goes extinct, could this cause some animals to go extinct as well? If so, how?

Next, divide class into groups of four to eight students. Distribute one Jenga game, one die, one Activity Worksheet, and one pencil to each group. Have each group of students set up the Jenga tower three blocks wide, with each level of blocks being perpendicular to the level below it. For example, if the blocks in the first level are pointing north-south, the blocks in the second level will point east-west. Also, make sure that students distribute the different-colored blocks randomly throughout the tower.

Before starting the activity (but keeping students situated in their groups), have the class discuss what the tower represents. Students should recognize that the tower represents a healthy ecosystem and that each block represents one component of the ecosystem (for example, red = animal species, green = plant species, blue = water, yellow = air). These color assignments are large general categories of ecosystem components and can be designated before the activity and given to students. If there is an organism of interest to the class or local ecosystem, the corresponding block color can be assigned to that organism. We suggest using the large categories, because this shows students that *all* the components of an ecosystem are critical to its health and does not place a disproportionate importance on any single organism. To begin the activity, have students complete the questions on Part I of the Activity Worksheet. Next, explain the directions to students (see Part II of the Activity Worksheet), have them play the game two times, and then have students discuss their results with the whole class. Guide students through the discussion with the following questions:

1. How many blocks did you have to remove to destroy your tower? Was it the same each time?

**Note:** Groups will have many different answers. There

**FIGURE 1** **Background**

Most people associate environmental destruction with coral reefs and rainforests that are (in most cases) located thousands of miles from their homes. Most Nebraska residents are unaware that one of the rarest ecosystems in the world is right out their back door. Saline wetlands and salt flats historically dotted the landscape of Lancaster County located in southeast Nebraska. Currently, areas just outside of the city borders of Lincoln are the last known locations of the Salt Creek tiger beetle. The Salt Creek tiger beetle is a predatory insect that captures other small invertebrates with its mouthparts. This behavior, and the tendency for these beetles to have stripe-like markings, gave rise to the tiger beetle's name. The Salt Creek tiger beetle is an indicator species for these rare saline wetlands: The presence of this beetle indicates that the wetlands are in good health.

Salt Creek tiger beetle population numbers have dropped to fewer than 500 individuals, resulting in the beetle being one of the rarest insects in the world. This drop in numbers led local scientists to work towards getting the Salt Creek tiger beetle onto the federal endangered species list, which was accomplished in October of 2005. The beetles' disappearance has been linked to habitat loss from city development, pollution, and pesticides.

Your local National Fish and Wildlife Services can help you identify local ecosystems you can use as the centerpiece of this activity. Making the activity specific to your area will help educate your students about local wildlife, as well as local conservation issues.

## Activity Worksheet — Ecosystem Jenga

### Part I

How do we know if an ecosystem is healthy? What would a healthy ecosystem look like?

How do we know if an ecosystem is unhealthy? What would an unhealthy ecosystem look like?

What are some ways in which the nonliving parts of the ecosystem can be damaged?

What does the tower of blocks represent?

What does each color of block represent?

What does removing a block represent?

### Part II

**Materials (one set per group of 4–8 students)**

- Jenga game
- Die
- Student worksheet (one per group)
- Pencil

**Directions**

1. Roll the die. If you roll a 1 or 6, you have not damaged your ecosystem, so do not remove a block. If you roll a 2, 3, 4, or 5, use the table below to determine which block you should remove. Do not take blocks from the top!
2. If you have to remove a block, set that block aside and make a tally on your worksheet. Do not return any blocks to the tower! *This would be a good time to explain to the students that you cannot return blocks to the tower because, for instance, if an animal goes extinct, it cannot magically appear again in the ecosystem.*
3. Take turns rolling the die and removing blocks until the tower falls.
4. Record the number of blocks taken of each block type by placing a tally mark in the appropriate box, and also record who pulled the last block from the tower before it fell.

| Number on die | Ecosystem damage |
|---|---|
| 1 | No damage to ecosystem |
| 2 | Water pollution = blue |
| 3 | Animal extinction = red |
| 4 | Plant extinction = green |
| 5 | Air pollution = yellow |
| 6 | No damage to ecosystem |

| Color of block | Type of damage | Number of blocks taken first round | Number of blocks taken second round |
|---|---|---|---|
| Blue | Water | | |
| Red | Animals | | |
| Green | Plants | | |
| Yellow | Air | | |
| Totals: | | | |
| 1. Type of final block removed | | 1. | 1. |
| 2. Student name who removed last block | | 2. | 2. |

are no right or wrong answers for this question. Writing each group's results on the board will illustrate that all ecosystems are unique, so no two will be destroyed in the same manner. We conducted this activity in a number of classrooms and on average it took the removal of 12 blocks for the tower to fall; however, some groups removed as few as 3 blocks, while others removed 20 blocks before the tower collapsed.

2. Who is to blame for the ecosystem destruction?

**Note:** Fingers will be quick to point to the last person who pulled a block from the tower; however, everyone who took a block from the tower helped make the tower fall. Everyone involved shares the blame for ecosystem destruction.

3. What would happen if the Salt Creek tiger beetle went extinct?

Possible answers:
a. Maybe nothing. The ecosystem would be weaker, but removing this species of insect might not cause the entire ecosystem to be destroyed.
b. The ecosystem could collapse.

4. Could a plant going extinct cause the extinction of the Salt Creek tiger beetle?

Possible answers:
a. Yes, the tiger beetle may eat an insect that feeds on that plant.
b. No, tiger beetles do not eat plants.

**Note:** Because scientists do not know what would happen if the Salt Creek tiger beetle were to go extinct, there are no incorrect answers to the last two questions; however, students must be able to support their answers with data from their games.

## Activity benefits

This activity allows students to learn about ecosystems in a tactile way. Although a field trip to an actual ecosystem is ideal, not all schools can offer students this opportunity. This activity gives students a concrete and tangible model with which to work. We observed that students were excited to play the game, and even those students who normally were disruptive or unengaged participated in the activity. Aside from our own observations, a number of teachers commented that this was the case.

By completing this activity, students

- observed how each trial was different and that it took the removal of more, less, or different blocks to destroy the ecosystem;
- demonstrated how species going extinct may weaken, yet not destroy, an ecosystem;
- discovered that the destruction of an ecosystem can't always be blamed on the extinction of a single species;
- were more aware of the local saline wetland ecosystem and the endangered Salt Creek tiger beetle; and
- showed a continued interest in the local ecosystem as evidenced by bringing in articles from the local newspaper to share with the class.

These results led students to the realization that all ecosystems are different and why different ecosystems respond differently to destruction. Although we focused on a seventh-grade class, other teachers at different levels including first, second, and fifth grades have adapted the activity for their classes.

## Extensions

Through this activity, students can also learn the value of restoring ecosystems. To model restoration, you can have students return a yellow or blue block (air and water) to the tower whenever they roll a 6. Students will see that restoration helps prolong ecosystem life, but if the damage continues, the ecosystem still collapses. You can also incorporate a lesson on the importance of keystone species to ecosystems by starting with a tower that has a combination of red and green blocks at its base. When students roll a 1, they must remove a block from the bottom layer, which represents the keystone species. Students discover that the extinction of a keystone species has a larger and quicker impact on the ecosystem than do other species.

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