

# K-12 IYS Activity



## Summary

The participants will be introduced to soil and its importance, as well as the concept of ecosystem services. Then, the students will engage in a game of *Jeopardy*, where they will be challenged to think more about the way that these services impact their daily lives. Afterwards, each team will use their “winnings” to buy the services they feel are most important. Participants will gain an appreciation for the multitude of ways soil supports human health and well-being.

## Learning Objectives/Outcomes

1. Students will be able to state why soil is complex and connected to everything on Earth.
2. Students will be able to describe why it is essential that people collaborate across disciplines and work collectively to protect it.
3. Students will be able to review the value of soil ecosystem services from both an ecological and economic perspective.

## Key Words

Soil, Ecosystem Services, Carbon Sequestration, Nutrient Cycling, Biodiversity

# Soil Ecosystem Services in *Jeopardy*

## Materials (per student, group etc.)

- AV System/Projector—to project either the online game version or the Powerpoint file (PPT) that is also posted to January's soils.org/iys website.
- Monopoly/Fake Money
- Buzzers: one per team

## If the room does not have AV capabilities:

- Blackboard/Chalkboard
- 24 Pieces of 8×10 Paper: Front Value of the question (\$100-\$500); Back: Answers.
- Question List (provided)
- Poster: List ecosystem services with “monetary values”

## Ages of Audience

High School

## Recommended group size?

Unlimited

## Where could you offer this?

Local School, Library, Etc.

## What type of room do you need?

Classroom, preferably with AV capabilities

## Type of Lesson (may be more than one)

Interactive, *Jeopardy* + Real World Application

## Time Needed

45-60 minutes

## Methods/Procedures

### INTRODUCTION—LECTURE

Soil is quite possibly our most valuable natural resource. It is considered non-renewable, because it is created at such a slow pace that it cannot keep up with the rate at which it is destroyed. Throughout history many civilizations have fallen, simply due to mismanagement of the soil. In order to prevent a similar fate, we must become stewards of

the soil, its rich biodiversity, and the many ecosystem services it provides us with. Ecosystem Services are the benefits that people receive from the environment. Biodiversity is the degree of species variety within an ecosystem. Biodiversity is important because each species fills a niche in its ecosystem, and if we lose that species, we may also lose the vital service they provide to humans.

### ASSESSMENT: JEOPARDY GAME

Go to <http://www.jeopardyapp.com/play/soil-ecosystem-services> to play the game on-line or download and use the *Jeopardy* PPT also listed under January on the soils.org/iys website.

- Online Version: When you click on a dollar amount, a question appears. To display the answer, click “Correct Response”. If using the website to keep score, click the green check mark for a correct answer and the red X for an incorrect answer. Be sure to choose the appropriate team. To return to the game board, click “Continue.”
- Downloadable PPT Version: Click on a dollar amount to view the question (1). To view the answer, click on the soil logo in the bottom-right corner. To return to the game board, click on the soil logo again. Tally points on the chalkboard/whiteboard.

### If making a physical version of the game:

1. Print out Question List (for Game Moderator)
2. Print out Answer Bank (1 per team)
3. Print or draw out game board using 24 pieces of 8×10 paper. For the first 4 pieces, write the “Category Titles:” *Supporting Services, Regulating Services, Provisioning Services, and Cultural Services*. For the remaining 20, include the dollar value on one side (\$100-\$500) and the corresponding answer on the backside.
4. Set-up game on chalkboard/whiteboard with categories across the top row and with each corresponding column ascending from \$100 at the top to \$500 at the bottom.

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Celebrating the



2015  
International  
Year of Soils

[soils.org/IYS](http://soils.org/IYS)

## Soil Ecosystem Services in Jeopardy

- Chose a team to start and have them select a category and a value of their choosing.
- Read the corresponding question from the list.
- Whichever team “buzzes” in or raises their hand first gets the first chance to answer.
- If student is correct, allocate points to their team. If the student is incorrect, deduct points from their team and open the floor to other teams.
- Whichever team answers correctly may select the next question.
- At the end, tally up the points.

### APPLICATION: PURCHASING ECOSYSTEM SERVICES

- Pass out play money or 8×10 inch cards (with dollar amounts) to each team based on their “total winnings.”
- Tally up the total “winnings” for each team and either pass out play money or 8×10 cards.
- Explain to students that each team will represent a governing body and will be responsible for “purchasing” ecosystem services that they feel should be protected as a part of their hypothetical nation’s Environmental Policy.

#### Ecosystem Service Costs:

- Seeds—\$100  
Primary Production—\$200  
Water Cycle—\$300  
Nutrient Cycling—\$400  
Soil Fertility—\$500
- Pests—\$100  
Disease—\$200  
Carbon Sequestration—\$300  
Water Filtration—\$400  
Air Purification—\$500
- Gemstones—\$100  
Raw Materials—\$200  
Energy Resources—\$300  
Medicine—\$400  
Food—\$500
- Recreation—\$100  
Art—\$200  
Ecotourism—\$300  
Spirituality—\$400  
Education/Science—\$500

### EVALUATION: WRAP-UP/DISCUSSION

- Share which ecosystem services you chose to purchase and why.
- Based on what your group chose, do you think that your city can survive with just these services alone?
- If we continue operating at “business as usual,” do you think we will be able to maintain all of these ecosystem services?
- What happens if we lose one of these components (i.e. water purification, air purification, soil fertility)? If this happens in one country, how does it impact their neighbors?
- What can we do to ensure that we continue to benefit from the ecosystem services that soil provides?

### SAMPLE ANSWERS TO DISCUSSION QUESTIONS

It is very difficult to rank the importance of ecosystem services, because we depend on nearly all of them for our survival and because different people and cultures value each aspect differently.

- How long can we last without air? Water? Food? While these may be most important to our immediate survival, alone they would not be enough to maintain life on Earth. How long can we last if temperatures continue to heat up and sea levels continue to rise? If we lose the ability of the soil to control disease, how long could human health be maintained. Many of the ecosystem services that soil provides are intimately connected and if we lose one, many others may suffer.
- It gets very expensive, very fast to replace the services that nature already provides us for free. For example, ten years ago NYC’s groundwater became too polluted to drink. They were told it would cost \$6-8 billion to build a filtration plant, and millions still annually to operate it. In the end, they chose to invest \$1 billion in restoring the watershed, allowing the soil to purify their water instead.
- If we lose one of these components, other services will inevitably be affected, because everything in the soil is deeply connected. When we look at a map, we see boundaries around nations, but these are just lines on a map. In reality, wind blows and water flows right past

these lines, so what happens in one place greatly impacts the areas downstream or downwind. We all rely on the soil for our survival, so it is important that we collaborate and work collectively to protect it!

- We can increase sustainability in both agriculture and in industry. We can educate people around the world about the importance of soil. We can write to our politicians and request that they pass laws to protect the soil or to incentivize carbon sequestration. We can choose to buy from corporations that are better stewards of the environment. We can choose to buy our food from farmers who take care of the soil. We can compost our food waste and plant our own gardens.

### ANSWER BANK

Disease, Water Cycle, Carbon Sequestration, Energy Resources, Medicine, Primary Production, Soil Fertility, Food, Nutrient Cycling, Spirituality, Education/Science, Ecotourism, Raw Materials, Seeds, Recreation, Pests, Gemstones, Air Purification, Habitats, Water Filtration

### SUPPORTING SERVICES

- 100—The soil serves as a storage house for *these*, which when germinated can re-vegetate whole landscapes.  
**ANSWER:** *What are Seeds*
- 200—The soil provides support for plants, holding them in place and giving them access to water and nutrients so they can undergo photosynthesis, which leads to *what*?  
**ANSWER:** *What is Primary Production*
- 300—*What* continuously moving process, involves evaporation, precipitation, snowmelt, runoff, and movement into the soil? **ANSWER:** *What is the Water Cycle*
- 400—*This* recycling of materials through the soil frees up substances like carbon, nitrogen, and phosphorus, making them available as the building blocks for new living matter, such as plants.  
**ANSWER:** *What is Nutrient Cycling*
- 500—*This* is the ability of a soil to supply nutrients necessary for plants to live and grow.  
**ANSWER:** *What is Soil Fertility*

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# Soil Ecosystem Services in Jeopardy

## REGULATING SERVICES

- 100—A healthy and diverse food web in the soil will include beneficial microorganisms and insects, which help in the control of *these*.  
**ANSWER: What are Pests**
- 200—Biodiversity in soils prevents the spread of pathogens that cause *what?* For example, fungi in the soil produce antibiotics to protect plants from *this*.  
**ANSWER: What is Disease**
- 300—Plants take up CO<sub>2</sub> during photosynthesis and release it into the soil through respiration. When they die the carbon that was in the plant can be stored for long periods of time in the soil as organic matter. This process is known as *what?*  
**ANSWER: What is Carbon Sequestration**
- 400—As water moves deeper and deeper underground, the soil removes solid particles and contaminants, and turns dirty water into clean water through *what* process.  
**ANSWER: What is Water Filtration**
- 500—The ability of the soil to remove gaseous pollutants from the atmosphere and hold them underground or break them down into less toxic substances is known as *what?*  
**ANSWER: What is Air Purification**

## PROVISIONING SERVICES

- 100—*These* valuable resources, often used for jewelry, can be found in soil, especially near rivers and streams.  
**ANSWER: What are Gemstones**
- 200—Soils provide sand, gravel, and clay used as building materials. Soil is also the home for trees and other plants, which provide us with paper, cloth, lumber and firewood. These are known as *what?*  
**ANSWER: What are Raw Materials**
- 300—In the search for more sustainable sources of *this*, many farmers are growing corn and soybeans for use as biofuels, such as ethanol.  
**ANSWER: What are Energy Resources**
- 400—Nearly all of the antibiotics used today, such as Penicillin, were discovered from soil microorganisms. Due to its vast genetic diversity, soil is a major source of discovery for *this*.  
**ANSWER: What is Medicine**
- 500—Soil grows the vegetation that many livestock animals depend on and the plants that provide humans with fruits, vegetables, grains, and more. These soil-derived products that nourish our bodies and provide us with energy are known as *what?*  
**ANSWER: What is Food**

## CULTURAL SERVICES

- 100—Soil provides the turf playing fields for soccer, football, and golf. These activities, supported by soil, are all types of *what?*  
**ANSWER: What is Recreation**
- 200—Soil provides the materials needed to make paint and pottery clay, which are used to create works of *what?*  
**ANSWER: What is Art**
- 300—Soil provides the solid foundation for hiking and mountain biking trails, as well as, campsites and national parks. This can be economically beneficial to communities as it attracts *this*.  
**ANSWER: What is Ecotourism**
- 400—Many cultures throughout history have had deep connections to the Earth. They felt that the soil was sacred, part of their own life cycles, and valued it as the provider of their sustenance. This is a form of *what?*  
**ANSWER: What is Spirituality**
- 500—Exploring and researching the wonders of soil allows humans to better understand the natural world and provides opportunities for advancements in *what?*  
**ANSWER: What is Education and Science**



| Supporting Services | Regulating Services | Provisioning Services | Cultural Services |
|---------------------|---------------------|-----------------------|-------------------|
| \$100               | \$100               | \$100                 | \$100             |
| \$200               | \$200               | \$200                 | \$200             |
| \$300               | \$300               | \$300                 | \$300             |
| \$400               | \$400               | \$400                 | \$400             |
| \$500               | \$500               | \$500                 | \$500             |

**WHAT CONTINUOUSLY MOVING PROCESS, INVOLVES EVAPORATION, PRECIPITATION, SNOWMELT, RUNOFF, AND MOVEMENT INTO THE SOIL?**

**WATER CYCLE**

Sample screens from the game.