Mush, Mush - Make Room for Mushrooms

Description/Organizer:

The ultimate recycling plan . . . the cycle of life’s renewal . . . there’s “fungus amongus” and we’ve found a fun way to start growing mushrooms! You and your students will convert rolls of toilet paper into a bouquet of edible oyster mushrooms in three weeks, simply by adding mushroom spawn and boiling water. Why are mushrooms important?

The Teepee Oyster Roll Kit, along with toilet paper and a sense of humor, will help you create the ultimate recycling plan.

Background Information:

Many Kentucky farmers are searching for crops to replace tobacco income lost since the master tobacco settlement and the subsequent tobacco quota buyout. Mushroom production is an economically sustainable alternative crop raised on some Kentucky farms.

Nancy Butler, from McLean County, Kentucky, is producing mushrooms as an economically sustainable crop and as an alternative to her tobacco base acreage. Like many other Kentucky farmers, this woman in agriculture has experienced diminished economic returns in growing tobacco because of the national tobacco settlement, the tobacco quota buyout, changes in demand, and societal pressures. Using logs harvested from her woods, Ms. Butler has inoculated the logs using dowel spawn to place mushroom spores and nutrients into the logs. The logs, once living materials, are broken down by millions of microscopic bacteria, fungi, and other decomposers. As decomposers break down these organic materials, they release the nutrients back to the soil to be used by the next generation of plants, and the cycle begins again.

Mushrooms have adapted over the centuries to live in these specialized eco-environments, a part of a system breaking down and recycling organic matter in nature. Over time, the organic materials actually become part of the soil, enriching it in the process and providing a possible home for future “fungus amongus!”

Mushrooms are considered delicious and nutritious and the ultimate health food. Mushrooms are ecologically important. Mushrooms are a sustainable forest product.

Here in the West we are finally discovering what Asian herbalists have known for thousands of years . . . that mushrooms are good for you! In Asia, mushroom products have historically been prescribed in conjunction with chemotherapies and other therapies we label here as “alternative.” In just the last few years, western medicine has been taking a more serious look at the potential medicinal properties of various mushroom species. Though most studies are...
still underway, some interesting results have already surfaced. Some mushroom components have shown promise in assisting in the treatment of cancer, diabetes, high cholesterol, and Alzheimer’s disease. We know for certain most mushrooms are good for us; they taste good and provide a good low-fat, low-calorie source of vitamins, fiber, and vegetable protein, whether cooked or raw.

Mushrooms are the reproductive structure of the fungus, called “fruit bodies,” which function much like the flower of a green plant. Unlike green plants, fungi cannot manufacture their own food and instead create an extensive network of filaments (called mycelium) that convert organic materials (called substrates) into compounds absorbable by the fungi. Successful cultivation produces an abundant harvest of the fungal fruit bodies we collectively call “mushrooms.”

Specifically, oyster mushroom cultivation is practiced around the world as an economical means of producing tons of mushrooms quickly from a variety of agricultural by-products. Composite substrates include sawdust and straw, but a wide variety of materials can be used, thanks to the aggressive colonization habit of this species. These characteristics make the oyster mushroom an exciting project within the classroom - using toilet paper.

Shiitake mushrooms are the most popular in Kentucky used as a crop alternative; however, the oyster mushroom is used in this lesson as a means of convenience.

**Academic Expectations:**

AE 2:31 Students demonstrate the knowledge and skills they need to remain physically healthy and to accept responsibility for their own physical well-being.

2.2 Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events.

2.6 Students understand how living and non-living things change over time and the factors that influence the change.

**Program of Studies:**

**Big Idea: Unity and Diversity (Biological Science)**

**Primary Enduring Knowledge – Understandings**

*Students will understand that*

- Most living things need water, food and air, while nonliving things can continue to exist without any requirements.
- Plants and animals have features that help them live in different environments.

**Big Idea: Unity and Diversity (Biological Science)**

**Grade 4 Enduring Knowledge – Understandings**

*Students will understand that*

- Organisms have different structures that are used for different functions. Observations of the structures of a certain organism can be used to predict how that organism functions or where it might live.

**Big Idea: Interdependence (Unifying Concepts)**

**Primary Enduring Knowledge – Understandings**

*Students will understand that*

- The world has many different environments. Distinct environments support the lives of different types of organisms.
- When the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.
Big Idea: Interdependence (Unifying Concepts)
Grade 4 Enduring Knowledge – Understandings
Students will understand that
• Beneficial and harmful are relative terms: any single action can be both beneficial and harmful to different organisms in an ecosystem.

Big Idea: Interdependence (Unifying Concepts)
Grade 5 Enduring Knowledge – Understandings
Students will understand that
• Within every ecosystem are populations or organisms that serve specific functions. Changes to any population may affect the other populations in that ecosystem.

Core Content:
SC-EP-3.4.2/SC-04-3.4.2 - Students will understand that things in the environment are classified as living, nonliving and once living. Living things differ from nonliving things. Organisms are classified into groups by using various characteristics (e.g., body coverings, body structures).
SC-EP-3.4.4 - Students will describe a variety of plant and animal life cycles to understand patterns of the growth, development, reproduction and death of an organism. Plants and animals have life cycles that include the beginning of life, growth and development, reproduction and death. The details of a life cycle are different for different organisms. Observations of different life cycles should be made in order to identify patterns and recognize similarities and differences. DOK 2
SC-04-3.4.3 - Students will compare a variety of life cycles of plants and animals in order to classify and make inferences about an organism. Plants and animals have life cycles that include the beginning of life, growth and development, reproduction and death. The details of a life cycle are different for different organisms. Models of organisms’ life cycles should be used to classify and make inferences about an organism. DOK 3
PL-EP-1.2.01 - Students will identify nutrients (protein, carbohydrates, fats), which are important in the growth and development of healthy bodies.
PL-04-1.2.01 - Students will identify foods containing nutrients (protein, carbohydrates, fats), which are important in the growth and development of healthy bodies.
PL-05-1.2.01 - Students will identify the role of nutrients (protein, carbohydrates, fats, minerals, vitamins, water), which are important in the growth, and development of healthy bodies (e.g., strong bones and muscles, energy).

Concepts:
alternative crops, nutritional value of mushrooms, specialized eco-environments, organic materials, fungi, decomposers, life cycle

Prepare:
For those students unfamiliar with mushrooms, a correlation may be made using an apple. The terminology listed in the Glossary will assist you with this explanation.
Lifecycle of mushroom compared to an apple:
Mushroom spore equals seeds within an apple
Spawn (spore + grain) equals apple seed and soil
Mycelium equals root system
Mushroom equals apple

Order:
Teepee Oyster Roll Kit
Field and Forest Products
N3296 Kozuzek Rd.
Peshtigo, WI 54157
1-800-792-6220
http://www.fieldforest.net/products.html
Large $29.99 (TPL) Small $22.99 (TPS) 10% educational discount
Safety – Warn students to be cautious while examining contents of the kit and the final product. Educate students that some types of fungus and molds may be harmful.

Rolls of toilet paper
Boiling water
Plastic bag
These mushrooms may be consumed with proper preparation - instructions are included in kit.

Glossary:
Decompose - To decay, to rot.
Decomposer – An organism, often a bacterium or fungus, that feeds on and breaks down dead plant or animal matter, thus making organic nutrients available to the ecosystem.
Fungus - Any non-flowering plants that have no chlorophyll, usually reproduce asexually, and grow on dead organic matter or live parasitically; usually mushrooms, molds, and mildews.
Hyphae - One of the long slender tubes that develop from germinated spores and form the structural parts of the body of a fungus.
Mushroom - Any of various fleshy, rapidly growing, umbrella-shaped fungi.
Mycelium - The vegetative part of a fungus, consisting of a mass of branching, threadlike hyphae.
Spawn - The material used as seed to cultivate mushrooms in logs, sawdust, straw, or some other growing medium. Spawn is the mycelia tissue of a fungus, which is used to propagate mushrooms.
Spores - Plants that have no seeds or flowers but are able to develop asexually into an independent organism. The mushroom cap sheds spores much as a flower sheds pollen.
Substrate - Referred to as inoculated once spawn is introduced or planted into it. Invasion of spawn into a substrate is referred to as “spawn run.” A substrate is an assortment of organic materials prepared to provide optimum nutrients for a specific fungus, which is introduced to the substrate in the form of spawn.

Essential Questions:
1. How does the class project of growing mushrooms illustrate the concepts in the Glossary (listed below)?
2. What would the world be like if there were no decomposers?
Teach:

Session 1
Oysters on Teepee – Teepee Oyster Roll Kit
( Needless to say, this kit is guaranteed to attract attention!)

Using the kit, you and your students will inoculate rolls of toilet paper. Each roll produces a cluster of edible oyster mushrooms every few weeks for months – you will need only boiling water, some “teepee” (toilet paper), and one of these kits to create an abundance of unforgettable and tasteful mushrooms. Select from large (15 roll) or small (seven roll) kits. Toilet paper sold separately! Follow the directions included in the kit. As you present the activity and kit contents to the students, explain the process using terminology included in the glossary.

After harvesting the mushrooms, you may prepare them for consumption using these directions:

Grilled Mushrooms – one of the best ways to prepare many mushrooms is simply to grill them directly over a charcoal fire. You can also flatten the caps over a few drops of oil on a skillet at medium heat. Turn them over once when browned. Cooking time depends on the thickness of the mushrooms. Serve with a pinch of salt.

Extension: Mushrooms may be harvested and marketed.

Session 2

You and your students may create a compost pile over a period of time and observe the growth of mushrooms within the pile. These mushrooms cannot be consumed.

Create a compost pile outdoors with your students. Observe daily for the appearance of mushrooms, using the appearance to instruct students about the decomposition process. This could be a good collaboration lesson with a Mathematics class.

To make compost:

1. Build an enclosure from chicken wire, approximately 3’ x 3’ x 3’.
2. Put a dry, airy layer (twigs or straw) at the bottom to provide aeration.
3. Create alternating layers of dry (high-carbon) material (dry grass, hay, straw, and small branches) and “green” (high-nitrogen) material (lawn clippings, leaves, dead plants, manures, and kitchen garbage.) The smaller the materials, the quicker they will compost.
4. Every few layers, add some garden soil to ensure that you have decomposers throughout the pile.
5. Keep your pile moist but not soaking wet.
6. The more the pile is turned and mixed, the more quickly it will compost.
7. When your compost is finished, it will be dark brown, look like soil, and have an earthy smell.
8. Observe for decomposers – mushrooms – but DO NOT eat this variety.

Assessment:
Open Response Question:
What is the process that occurs in the toilet paper to make the mushrooms grow? Use specific vocabulary you have learned in this lesson to explain the process.
Rubric:

<table>
<thead>
<tr>
<th>Category</th>
<th>Student Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Shows a clear understanding of the process by including three or more processes that occur in the toilet paper and explaining in detail using appropriate vocabulary.</td>
</tr>
<tr>
<td>3</td>
<td>Shows an understanding of the process that occurs by including three processes that occur in the toilet paper to make the mushrooms grow – correct vocabulary usage demonstrates an understanding of the processes.</td>
</tr>
<tr>
<td>2</td>
<td>Shows some knowledge of the process that occurs by including two processes that occur in the toilet paper to make the mushrooms grow – correct vocabulary usage demonstrates some knowledge.</td>
</tr>
<tr>
<td>1</td>
<td>Shows limited knowledge of process that occurs in the toilet paper to make the mushrooms grow by including only one process – correct vocabulary usage is minimal.</td>
</tr>
<tr>
<td>0</td>
<td>No response.</td>
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</tbody>
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Additional Open Response questions:

- A mushroom is a decomposer. What does that statement mean? How is a mushroom a decomposer?
- How do people benefit from fungi, bacteria, and other decomposers?
- Have the students write a paragraph explaining what they think is meant by the following quote by Loren Eisley: “Nature has no interest in the preservation of her dead: her purpose is to start their elements upon the eternal road to life once more.”

Question Extensions:

- How do you think micro-organisms might help create more soil? How could we explore this?
- How do you think the Earth would be different if there were no fungi?
- What kind of raw materials must be readily available in your area if you choose to produce “fungus amongus?”

Connect:
Write “oldy but moldy” songs.
Agriculture - sustainable forest product
Environmental/Recycling - decomposition
Economics - production, marketing and sale of crop
Nutrition - protein and other significant minerals and vitamins
Health benefits - medicinal values, immune system and other benefits
Cultural diversity - Japan - Miso soup
Life cycle
Decomposition
Literature Connections: The Log Hotel and The Mushroom Man

Teacher Resources:

- The Log Hotel (Anne Schreiber) Story of a log decomposing in the forest and the host of animals living in the log. Demonstrates simply how everything in nature is connected. Beautifully illustrated with enough lizards, bugs and other critters to keep everyone interested.
• **The Mushroom Man** (Ethel Pochocki) This is the story of an elderly man who is content with his life but still rather lonely. His occupation and his appearance set him apart from others in his town, for he works in the dark in a mushroom factory and, with his oversized head and pale white skin, even resembles the fungi with which he toils. He decides that a pet might be a friend and accept him as he is, and takes in a beautiful stray cat. But the animal, a born wanderer, leaves him. Finally he cautiously befriends just the right animal for him, a mole. Pochocki shows their developing friendship as they share truffles and Christmas gifts, both concluding that the very best gift is having a friend.

• **Mushroompeople**  
  Summertown Food Company  
  560 Farm Road/PO Box 220  
  Summertown, Tennessee 38483-0220  
  1-800-692-6329  Fax – 931-964-2200  
  E-mail: mushroom@thefarm.org

• **Dr. Deborah Hill** – Extension Forestry Specialist – University of Kentucky  
  Department of Forestry  
  University of Kentucky  
  Lexington, KY 40546-0073  
  Phone – 1-859-257-7610  
  Fax – 1-859-323-1031  
  E-mail: dbhill@uky.edu

• **Field and Forest Products**  
  N3296 Kozuzek Rd.  
  Peshtigo, WI 54157  
  1-800-792-6220

• **Grow Lab** – Activities for Growing Minds  
  National Gardening Association  
  180 Flynn Avenue  
  Burlington, Vermont 05401  
  1-802-863-1308

**Web Sites:**

• [www.mushroompeople.com](http://www.mushroompeople.com) – Mushroompeople is America's oldest mail order supply house for everything you need to grow, find, or learn about mushrooms.

• [http://www.fieldforest.net/products.html](http://www.fieldforest.net/products.html) - Field and Forest Products offers superior products and helpful advice for anybody interested in growing their own edible mushrooms.

• [http://www.uky.edu/Agriculture/Forestry/forestry.html](http://www.uky.edu/Agriculture/Forestry/forestry.html) - University of Kentucky, Department of Forestry

• [http://www.ca.uky.edu/agc/pubs/for/for78/for78.htm](http://www.ca.uky.edu/agc/pubs/for/for78/for78.htm) - Introduction to Shiitake: The “Forest” Mushroom, University of Kentucky

• [http://www.ca.uky.edu/agc/pubs/for/for89/for89.pdf](http://www.ca.uky.edu/agc/pubs/for/for89/for89.pdf) - Resources for Shiitake Growers, University of Kentucky

• [http://www.ca.uky.edu/agc/pubs/for/for80/for80.htm](http://www.ca.uky.edu/agc/pubs/for/for80/for80.htm) - Spawn Selection, University of Kentucky
• [http://www.ca.uky.edu/agc/pubs/for/for82/for82.htm](http://www.ca.uky.edu/agc/pubs/for/for82/for82.htm) - Monitoring Moisture Content of Logs, University of Kentucky
• [http://garden.garden.org/home](http://garden.garden.org/home) - National Gardening Association