



# INTEGRATED PEST MANAGEMENT

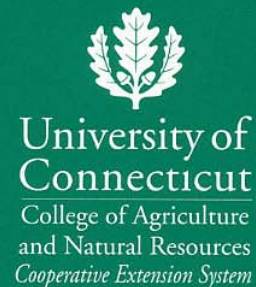
## Unit 3 Lesson 7 Building Your Own Biosphere

**Focus Areas:** Biodiversity; Science

**Focus Skills:** Hypothesizing, analyzing requirements (research), planning, constructing diagrams, building a terrarium

**Level of Involvement:** AVERAGE

INTEGRATED PEST MANAGEMENT  
Unit 3 Lesson 7: Building Your Own Biosphere





*Dedicated  
to Reducing  
Pesticides*



University of  
Connecticut  
College of Agriculture  
and Natural Resources  
Cooperative Extension System

## Unit 3 Lesson 7: Building Your Own Biosphere

**Focus Areas:** Biodiversity; Science

**Focus Skills:** Hypothesizing, analyzing requirements (research), planning, constructing diagrams, building a terrarium

**Level of Involvement:** AVERAGE

### Objectives

- \* To design an enclosed environment that will support plant and animal life
- \* To determine the needs of an ecosystem, i.e., size, amount of air, water, type of soil, as well as the flora and fauna (plants and animals)

### Essential Question

What are the ingredients necessary to build a balanced ecosystem?

### Essential Understandings

- \* Ecosystems have unique needs in terms of the amount of water, air, and sunlight necessary to support life.
- \* Ecosystems have input and output by living and nonliving components that integrate to form a living interdependent unit.

### Background

**Model Planet Ecosystem:** When the eight crew members entered Biosphere 2 in 1991, their mission was to live for two years in a self-contained environment. Soon after the doors closed behind them on the Arizona desert, problems began. Food was hard to produce, and carbon dioxide unexpectedly rose to toxic levels. After a ventilation exercise to adjust CO<sub>2</sub> levels, scientists began to focus on other ways to use Biosphere 2 as a lab to learn more about Earth—before CO<sub>2</sub> levels become toxic in **our** biosphere.



## Unit 3 Lesson 7: Building Your Own Biosphere

### Background (continued)

In this activity, you will design and build your own biosphere based on a single ecosystem.

An ecosystem is a system that has input and output by living and nonliving things knit together as an organized unit. Input can be in the form of energy from the sun or rainwater introduced into the ecological unit. Output is what the ecological unit produces, such as heat, carbon dioxide, oxygen or waste products.

To make your biosphere habitable for life, start with soil, air and water—the media that support the bios (life) in the biosphere. You will also need to provide food for the inhabitants inside their enclosed environment.

If you throw a bunch of plants, soil, water and creatures into a glass container and seal it, you'll end up with a pretty wild project. However, it probably will last only a little while. If you want to build a biosphere that will support life, you first need to research and plan.

**Special Instructions:** This is a research project that may be completed at home.

### Challenge Design and observe a mini-ecosystem

#### Logistics

**Time:** two weeks to one month to establish terraria

**Group size:** two to 25

**Space:** room to set up displays

#### Materials

container

soil

plants

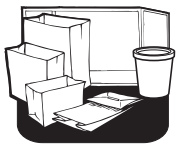
animals

other materials (builder's choice)

Handout 1 Planning and Building the Biosphere \*

Assessment for an Oral Report \*

\* single copy provided





## Unit 3 Lesson 7: Building Your Own Biosphere

### Preparations

1. Prepare copies of Handout 1.
2. Distribute Handout 1 and review instructions.

### Activity

#### Introduction



#### Plan the biosphere

1. Pick an ecosystem to build or replicate. It can be from your area or from another place on the planet. Try to find a similar experiment or environmental problem in the news to use as a model for your experiment. Maybe you can solve the problem.
2. Determine the needs of the ecosystem. The air, water and soil are important, but so is selection of the flora and fauna (plants and animals). You can purchase seeds and plants, then research the needs of insects, fungi and microorganisms.
3. When you determine the species you want, research the type of food and amount needed to sustain life in your biosphere. Figure out which members of the food web should be in the ecosystem to keep everything alive. You may need to provide imported food, like worms, for an animal higher on the food chain.
4. Research the size of your biosphere. Size is relevant to food production. If your biosphere has a large consumer, like a mouse, turtle or fish, make sure there are enough plants, animals or both to meet that animal's food needs. For example, a field mouse needs to eat 10 to 100 times its biomass in grass each day.



## Unit 3 Lesson 7: Building Your Own Biosphere

### Activity

#### Introduction (continued)

5. Research the environmental needs of the biosphere. How much water will it need? What is the pH of the soil? How about temperature? Lighting?
6. State a hypothesis about your project.
7. Put the facts together and figure out where to get the species for the project and how to contain them. Your plan should include: the biosphere design, the materials, soil, water and air, as well as the plants and animals that will live inside.

#### Involvement

##### Build the biosphere

Use a clear container to build your own biosphere so that you can monitor the growth and development. Try grown seedlings or plants, a healthy water supply, soil with microorganisms and other life—everything you think you'll need should be based on your research and plan. Here are some hints:

- \* Glass jars (with lids) can be used for small biospheres. Make sure the glass is very clean before you build the biosphere. An aquarium tank is another way to contain your biosphere project. To create a closed aquarium, secure a tight-fitting lid and seal it with tape.
- \* Collect the species according to your plan.
- \* Insects can be captured in nets or by hand. Make sure they meet your ecosystem needs.
- \* Be humane to all living things you use. Do not use endangered or threatened species.



## Unit 3 Lesson 7: Building Your Own Biosphere

### Follow Up

#### 1. Monitor the biosphere

Set up a log to record the following data results over a one-month period. Monitor your experiments and write each observation; data collection is important in science. As part of the scientific research you are performing in this project, record as much as you can about the state of the biosphere at the beginning of the experiment. Make a final check at the end of the experiment to compare aspects of your biosphere before and after.

- \* Take temperature readings at the same time each day or several times a day.
- \* Check soil and water quality. Inexpensive and simple kits to test nutrient contents can be bought in hardware and gardening stores. Try the pH test. It's fun!
- \* Population check: count the plants and animals by species. Record the numbers.
- \* Measure the heights of the plants. Draw illustrations to document physical changes.

#### 2. Make calculations

To measure the results of your experiment, take the data (observations, pictures, temperatures, population records, pH or water quality tests, etc.) and see what has changed or stayed the same in the biosphere. The measurements and recordings you make will help define the change. For example:

- a. Calculate growth in plants (from measurements).
- b. Calculate declining populations (from counting and recording).
- c. Calculate increasing populations (from counting and recording).



## Unit 3 Lesson 7: Building Your Own Biosphere

### Follow Up

#### 2. Make calculations (continued)

d. Calculate percentages of surviving species.

e. Graph and compare changes in temperature, lighting, pH and water quality.

#### 3. Develop a conclusion

Based on your data, you will reach a conclusion about your hypothesis. You might:

- \* Explain results using data, facts and observations.
- \* Explain the scientific concepts at work in your biosphere.
- \* Explain similarities and differences between your research and the environmental research scientists are doing locally or worldwide.
- \* Explain what your team learned from the project.
- \* Look at reasons your biosphere plan worked or did not work.
- \* Identify any cause and effect relationships to explain changes that occurred during the experiment.
- \* Present facts on the changes that occurred or processes you saw (water cycles, decomposition of materials, etc.).

### Assessment

Report on your biosphere. Use the Assessment for an Oral Report.



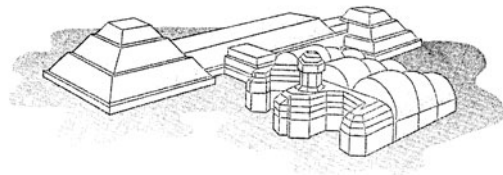
## Unit 3 Lesson 7: Building Your Own Biosphere

### Follow Through

#### Biosphere 2: An update

Biosphere 2, a three-acre, glass-and-steel structure in Oracle, Arizona, was created to help us better understand Biosphere 1 — the earth. In Biosphere 2, scientists created seven ecosystems, including a rain forest and an ocean. The first experiment in 1991 involved eight scientists (and more than 3,000 species of plants, insects and other animals) who lived in the sealed enclosure for two years. They had planned to grow their own food and study the earth's ecology in miniature. However, levels of CO<sub>2</sub> became life-threatening, food was insufficient to meet the needs of the inhabitants and the experiment was deemed one of mixed results.

Today, Biosphere 2 is a research and educational center affiliated with Columbia University. Scientists are using the model biosphere to study timely issues like climate change, biodiversity, water resources and rising temperatures in hopes of applying the lessons to the real world. College students from different schools may spend a semester doing research at the facility.



To find out more about Biosphere 2 or to take a virtual tour, go to the website: <http://www.bio2.edu> and explore the various ecosystems. Or, find out how you can visit Biosphere 2, now open to the public.

#### **Extension**

Windows on the Wild Activity Archive: [www.worldwildlife.org/windows/archive.html](http://www.worldwildlife.org/windows/archive.html)

Learn about some of the secret services that ecosystems provide with this on-line version of Biodiversity Performs! This activity is adapted from the World Wildlife Funds Biodiversity Basics — a teaching module for middle school educators focused on biodiversity.





## Unit 3 Lesson 7: Building Your Own Biosphere

### Notes



## Unit 3 Lesson 7: Building Your Own Biosphere

Handout 1

### Planning and Building the Biosphere

#### Introduction

#### Plan the Biosphere

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## Unit 3 Lesson 7: Building Your Own Biosphere

Handout 1

### Planning and Building the Biosphere

#### Involvement

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## Unit 3 Lesson 7: Building Your Own Biosphere

### Assessment for an Oral Report

Name of speaker: \_\_\_\_\_

Rating scale 5 high; 1 low

Presentation contains adequate and accurate information. \_\_\_\_\_

Presentation is well organized. \_\_\_\_\_

There is evidence that presentation has been practiced. \_\_\_\_\_

(If applicable) visuals are used effectively. \_\_\_\_\_

Presentation considers age, interest and prior knowledge of the listening audience. \_\_\_\_\_

Volume, pace and expression are appropriate. \_\_\_\_\_

Speaker makes eye contact with audience. \_\_\_\_\_

Comments: \_\_\_\_\_

\_\_\_\_\_

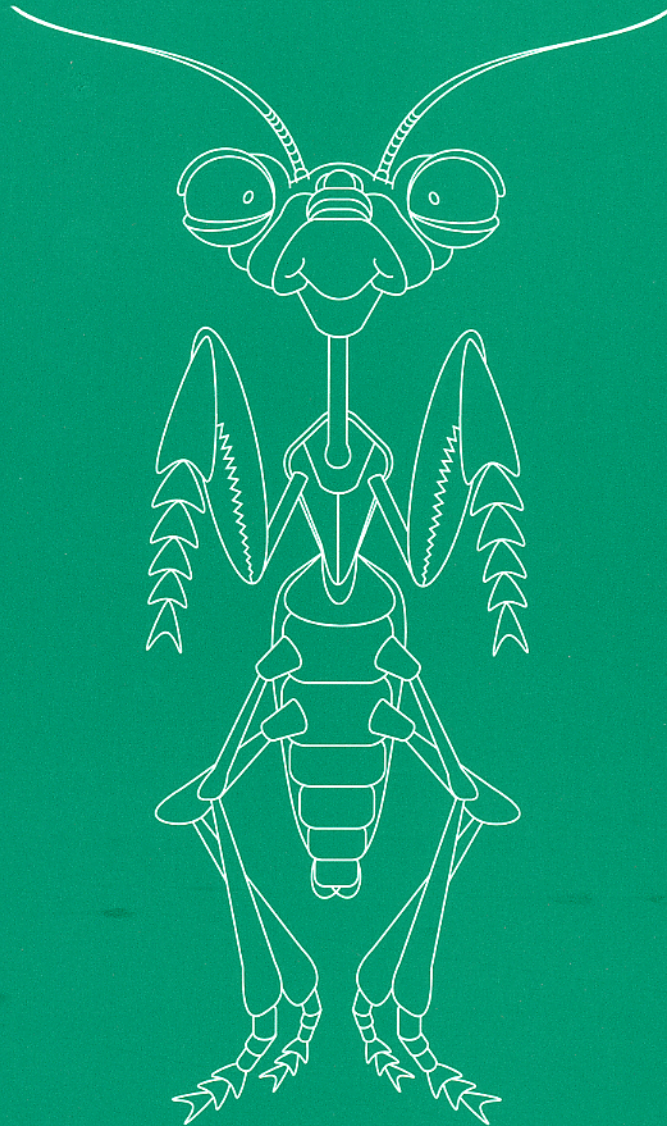
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**INTEGRATED PEST  
MANAGEMENT**



**"Going to Extremes: Hidden Depths (including line drawings of terrarium and Biosphere)"**  
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