EcoColumn

A stroll through a woods, field, wetland, prairie or even desert can reveal dozens of birds, hundreds of plants, thousands of insects and billions of microbes all living and associating in an area smaller than a coat closet.

This small area hosts an astoundingly complex web of interrelations and dependencies. When the entire system is considered, the complexity can be mind boggling.

How can one even begin to understand a system that is so complex?

Ecologists frequently begin to understand a complex system by first creating a simplified model of that system. In building this model, we begin to learn more about a real system and how it works. With the Bottle Biology EcoColumn we can begin to create simple models of complex *ecosystems*.

The EcoColumn allows you to explore a fascinating variety of dynamic ecosystems which begin to model many kinds of aquatic and terrestrial environments. You can create *habitats* and *niches* for insects, spiders, aquatic organisms as well as large plants, small algae and microbes. Individual modules can be used separately or stacked into a stable, free-standing column. Stacked modules can be kept sealed or can be inter-connected to stimulate interactions between systems.

The tapered sides of EcoColumn chambers allow a close-up view of organisms from aquatic environments. Roots of plants are also made visible, and a module can be viewed from underneath as well. Columns can be constructed and observed, noting changes over time. For the more advanced student, rigorous studies of ecology, population dynamics, water chemistry and many other sciences can be conducted in an EcoColumn. There is no limit to the number of ways that the modules can be designed and put together. What kind of biological question could you try to answer in an EcoColumn?

Materials

- several 1- or 2-liter plastic bottles
- Bottle Basics tools for marking and cutting bottles, plus equipment for making ventilation and port holes, including the following:
  - marker or grease pencil
  - razor blade in safety holder
  - scissors
  - box top or drawer
  - paper punch
  - awl and/or tapered reamer
  - propane torch or Bunsen burner
  - nail poke or needle
- clear waterproof tape
- silicone sealant for chambers that will need to hold water

Department of Plant Pathology, 1630 Linden Drive, Madison, WI 53706 1-800-462-7417 wfp@fastplants.cals.wisc.edu

Tips

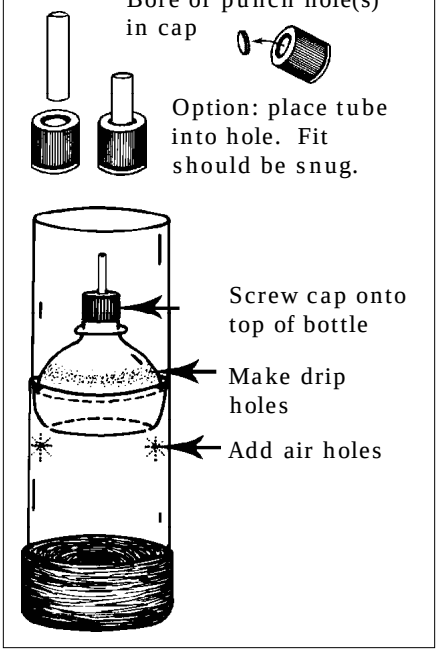
Use the same brand of bottle for all of the EcoColumn units making up a final construction. Different brands of bottles can have slightly different diameters or shapes which can lead to complications. Also, avoid bottles which have bulges at the top of the hip which makes them difficult to stack.

Use waterproof tape to fix bottle part A to part B. Some clear tapes are waterproof, but check first by taping a test strip to a scrap piece of bottle and leaving it under water overnight.

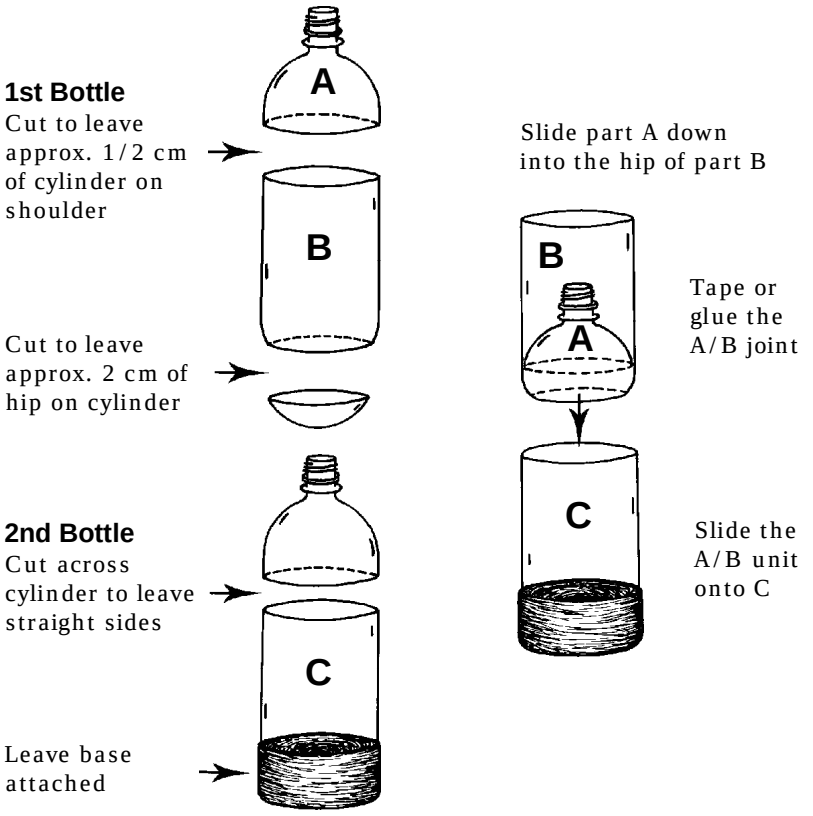
If the unit is going to contain a terrestrial system be sure to add drip holes in piece A. Units with drip holes pierced into the top of part A will hold some water and can be used to make a unit which is bog-like in character.

If the EcoColumn unit is going to hold water, seal the A/B joint with a silicone sealant after taping. The sealant also acts as a glue to make a strong joint.

Add Finishing Touches



Cut and Combine Bottles



Explorations

- Consider the different types of habitats you might expect to find in an ecosystem such as a temperate forest, prairie or desert. How many of these habitats can you include in one EcoColumn construction?
- What other ecosystems might you model? Consider modelling the differences between similar ecosystems such as tropical and temperate forests; swamps, marshes and bogs; or lakes, rivers and oceans.
- Put a fruit fly module below a chamber containing a hungry spider or praying mantis. Connect them with a narrow tube which will allow flies to wander upward but which prevents the spider or mantis from descending into the fruit fly chamber. Fruit flies will live off of bananas and other fruits.
- Plant seeds or small plants in a chamber filled with soil (or filled up to the bottle mouth). In time, root growth will be visible along the clear sides, and from underneath as well. Patterns of root response to crowding, overwatering and other variables could be compared among species of plants.
- How does the presence or absence of insects affect the plant life? The aquatic life? The rate of decomposition?
- How do the systems behave with little water? With excess water? With acidic or otherwise contaminated water? Are some populations more susceptible to contaminants than others? Do some populations serve as “filters” for contaminants?