BOTTLE BIOLOGY
WISCONSIN

TerrAqua Column

Explore interactions between terrestrial and aquatic systems

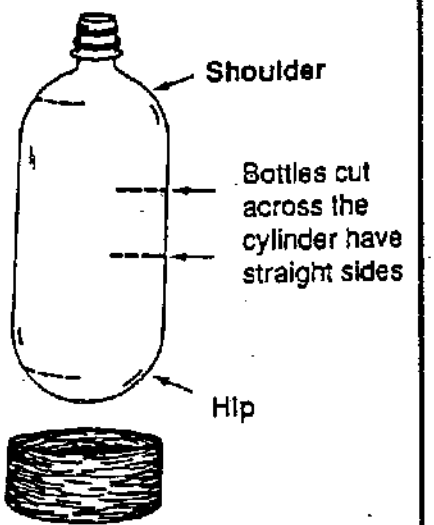
Terrestrial and aquatic ecosystems are frequently viewed as two separate and independent entities. However, land and water systems are connected in many ways. One of the major links between terrestrial and aquatic ecosystems is water.

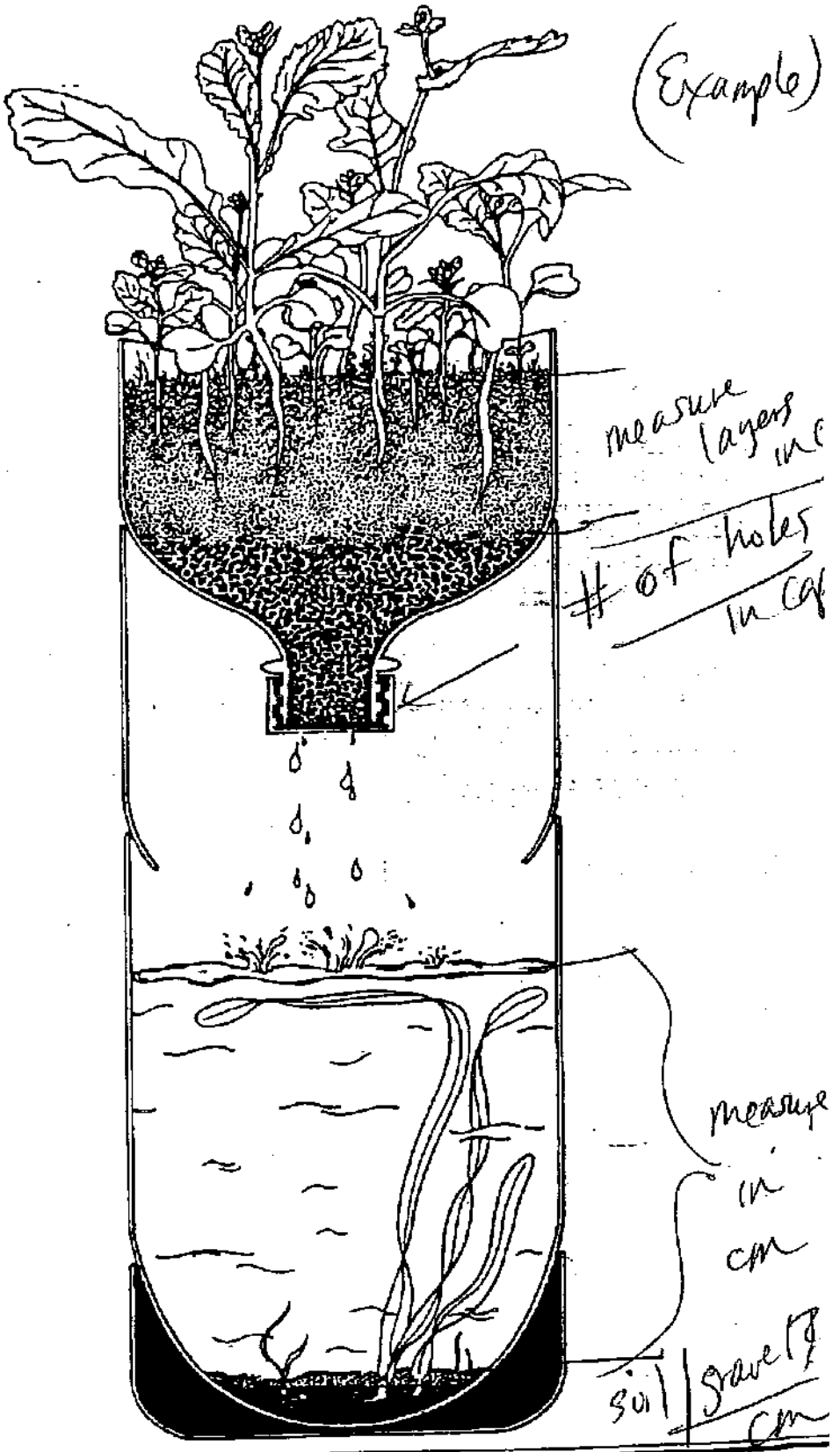
Water is the life blood for the terrestrial community and usually finds its way to wetlands, rivers, lakes and oceans. Passing through the soils of fields and forests, the water picks up compounds such as nutrients and agricultural chemicals. As this solution enters an aquatic community it then modifies biological, physical and chemical aspects of that community.

Construction of a TerrAqua Column can allow you to model and explore relationships between land and water ecosystems.

Bottle Anatomy

Bottles cut across the shoulder or hip have tapered sides





Department of Plant Pathology, University of Wisconsin, 1630 Linden Dr., Madison, WI 53706
Wisconsin Fast Plants and Bottle Biology are NSF funded instructional materials development projects in the biological

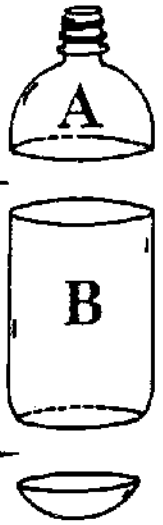
BB 1-21-91

Cut Bottles

1st Bottle

Cut, leaving 1-2" of the cylinder on the shoulder

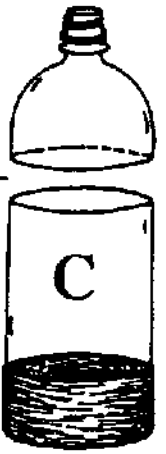
Cut, leaving 3/4" of the hip on the cylinder



2nd Bottle

Cut across top of cylinder leaving straight sides

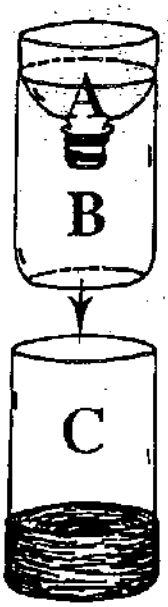
Leave base attached



Combine Bottles

Invert Part A onto the straight side of Part B

Slide the A/B unit onto C

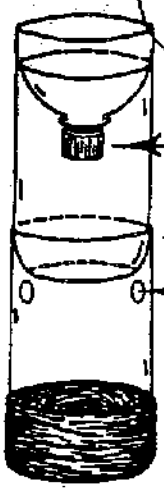


Add Finishing Touches

Punch small holes in cap

Screw cap onto bottle

Cut or melt holes into the top sides of the lower bottle



Column Construction

This column is composed of two units. The upper, terrestrial unit is made by cutting a bottle to make pieces A and B as shown in the illustration. These two pieces can be held together by a wide transparent tape such as bookbinding or mailing tape. The lower, aquatic unit is made by cutting a second bottle to produce piece C. Biological materials for the aquatic system can come from a pond, lake, puddle or fish tank and can include algae, phytoplankton, zooplankton, aquatic plants and insects. A variety of plants can be used in the terrestrial system. Because of their rapid life cycle, Fast Plants work well.

Studying the Flow of Agricultural Chemicals

Recent concerns about the interaction between land use and water quality have led to the study of nutrient and chemical flow from terrestrial to aquatic ecosystems. Fertilizers and pesticides used for lawn care and agriculture readily make their way into aquatic systems causing water quality problems ranging from algal growth to the build-up of toxins in drinking water.

The TerrAqua Column allows for the study of various aspects of land-water interactions such as the effects of:

1. Nutrient sources for the terrestrial system
2. Nutrient concentration
3. Type and amount of soil in the terrestrial system
4. Type(s) of plants in the terrestrial system
5. Physical factors such as temperature and light
6. Effect of various pesticides
7. Frequency of fertilizer or pesticide application.

Various aspects of the terrestrial and aquatic systems can be monitored such as the growth of plants and algae. For plants in the terrestrial system, percent germination, height, weight, leaf size, length of life cycle, and seed production can all be measures of plant health. Populations of algae, aquatic plants and animals can be monitored in aquatic systems. Changes in the soil microorganism populations and soil structure can also be monitored. Finally, the solution flowing from the terrestrial to the aquatic system can be examined with a Fast Plant bioassay (*Fast Plant Notes*, Spring, 1990).

BOTTLE BIOLOGY LAB Name_____

Abiotic factors:

-soil comp.//minerals
-pH of the water
-Oxygen/CO 2 levels
-Soil content
-sunlight amounts
-shelter for organisms
-food for organisms
-amount of water/ cycles
-temperature
-humidity
- rocks

Biotic factors:

-duckweed
-algae
-Elodea plants
-radish seeds (pea seeds)
-reeds
-moss
-protozoa
-snails
-guppy
-water beetles
-earthworm

On the first day of your ecosystem, write down the function of each factor you chose for the set-up and predict the kind of interactions each will have on the other parts. (growth, pH changes, increases, decreases in O/CO 2 levels,etc.)

Draw the set-up and label the factors present on day one. Take and record **measurements** of each level, soil, water, etc.

Take the **pH** of your water and soil and count all factors and document these facts.

Explain which are submergent, emergent, or floating organisms.

Explain the role of **producers and consumers** and identify these in your set-up.

Keep a detailed **chart** of the above data and add to it, one entry every week, for a total of 7 weeks.
Record changes in numbers of organisms, pH levels, growth or germination of seeds, color changes in the soil or water, and odors or smells that appear.

A **report** of your ecosystem will be required at the end of the time period, one per group of two people. Each member should write about what they did in this activity and analyze how the ecosystem changed over the specified time.

Biology Ecosystem Report Outlines

Each report must include the following:

--a drawing of the ecosystem with labels and layers identified and measured in cm.

--a weekly chart of the observations, data of measurements such as pH, temp., color, odor/smell, condensation, evaporation, duckweed and guppy counts, germination of seeds, health of plants, and clarity of the water.

--Write about how the abiotic and biotic organisms interacted in the ecosystem and give specific examples of this.

--Identify each organism as a producer or a consumer and give reasons why you chose that title.

--Write about any changes that occurred over the 7 week period, increase in #'s, decreases? Color changes, deaths? And give data from the chart to support this.

--Explain how Oxygen and CO 2, and water are cycled through the ecosystem.

--How often did you have to water the top? What influence did this have on the bottom?

--Write about your jobs/ roles that you did in this activity, such as make the plastic ecosystem, record data on the chart, etc.

--write a conclusion that gives reasons (analysis) of the recorded data about why changes occurred and what caused them.

Ecosystem Report Name_____

Chart and data filled in: (10 pts)_____

Drawing/labels and meas. (5 pts)_____

Abiotic/biotic factors (5 pts) _____
Producers/consumers iden.

Cycling of O2/CO2/water etc.(5 pts)_____

Interactions of factors and effects (5 pts)_____

Job/Role identified (5 pts) _____

Conclusion/reasons for changes or no changes in chart data
And final analysis. (10 pts) _____

Neatness (5 pts) _____

Total _____