

Learning Cycle Planner

Ecosystem in a Bottle Lesson
TerrAqua Investigation Column

Common Curriculum Goal:

Topic: Ecosystem Dynamics

Learning Objective: Students experience the fragile balance of an ecosystem, how different components interact, and how different inputs impact the system.

Exploration Phase:

Hands-on Activity:

Build a TerrAqua investigation column, fill it with soil, plants and water, and observe and record changes over time (Materials and procedure below).

Exploration through Media: Video

Introduction the Ecosystem Services Review:

<http://www.youtube.com/watch?v=HbU41UhnWN8>

Concept Development Phase:

Concepts to be taught: Ecosystem dynamics, systems thinking, human impacts on ecosystems, biodiversity, energy flow in an ecosystem, pollution and waste, recycling/reuse, and ecosystem services.

Procedures to be taught: Inquiry, experimental design, monitoring a dynamic system through careful observation, and detailed data recording

Activities: Article: “More Than Meets the Eye”

<http://edibleportland.com/content/currentissue/> Ecosystem services provided by farmers.

Other resources for extensions:

http://www.bottlebiology.org/investigations/terraqua_main.html

http://www.bottlebiology.org/investigations/terraqua_fill.html

http://www.bottlebiology.org/investigations/terraqua_observe.html

http://www.bottlebiology.org/investigations/terraqua_explore.html

Connections to other Lessons: CO2 Aquariums, Bath Tub Simulation, and Ocean Currents

Teaching across the Curriculum: Economics

Ecosystem in a Bottle Lesson (Bottle Biology, 2009)

Allow multiple class periods for construction, assembly, and observation.

Materials: Two 2-liter soda bottles, one bottle cap, wicking material-fabric interfacing or cotton string, water, soil and plants

Procedure:

Step 1 – Remove label from the 2-liter bottle. On bottle #1, cut 2 cm below shoulder to produce component "A," a shallow funnel top and "C" a deep reservoir.



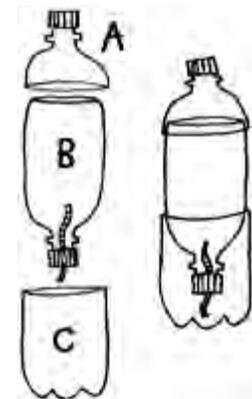
Step 2 – Poke or drill a 1 cm hole in bottle cap.



Step 3 – Cut Bottle #2, 1 cm below hip to produce component "B" a deep funnel unit with hip taper.



Step 4 – Fill reservoir with water. Add soil and plants to top chamber. To be effective, the wick should run up into soil, not be plastered along a side of the bottle. For better drainage, place a layer of gravel, sand or vermiculite in the bottom of the soil unit.



Step 5 - Fill the top unit of your TerrAqua Column with soil you collect, or with potting soil from a gardening store.

Step 6 - Fill the lower aquatic unit with tap water, or water from a pond, lake, puddle or fish tank.

Step 7 – Keep a detailed list of what components are added to their TAC and where the components came from.

Step 8 – Form a hypothesis stating how your TAC will change over a specified amount of time

Step 9 – Monitor your TAC each day and make detailed notes of changes

Step 10 – After the specified amount of time, evaluate the accuracy of the hypothesis.

(Image and procedure from Bottle Biology, 2009)

Helpful Information:

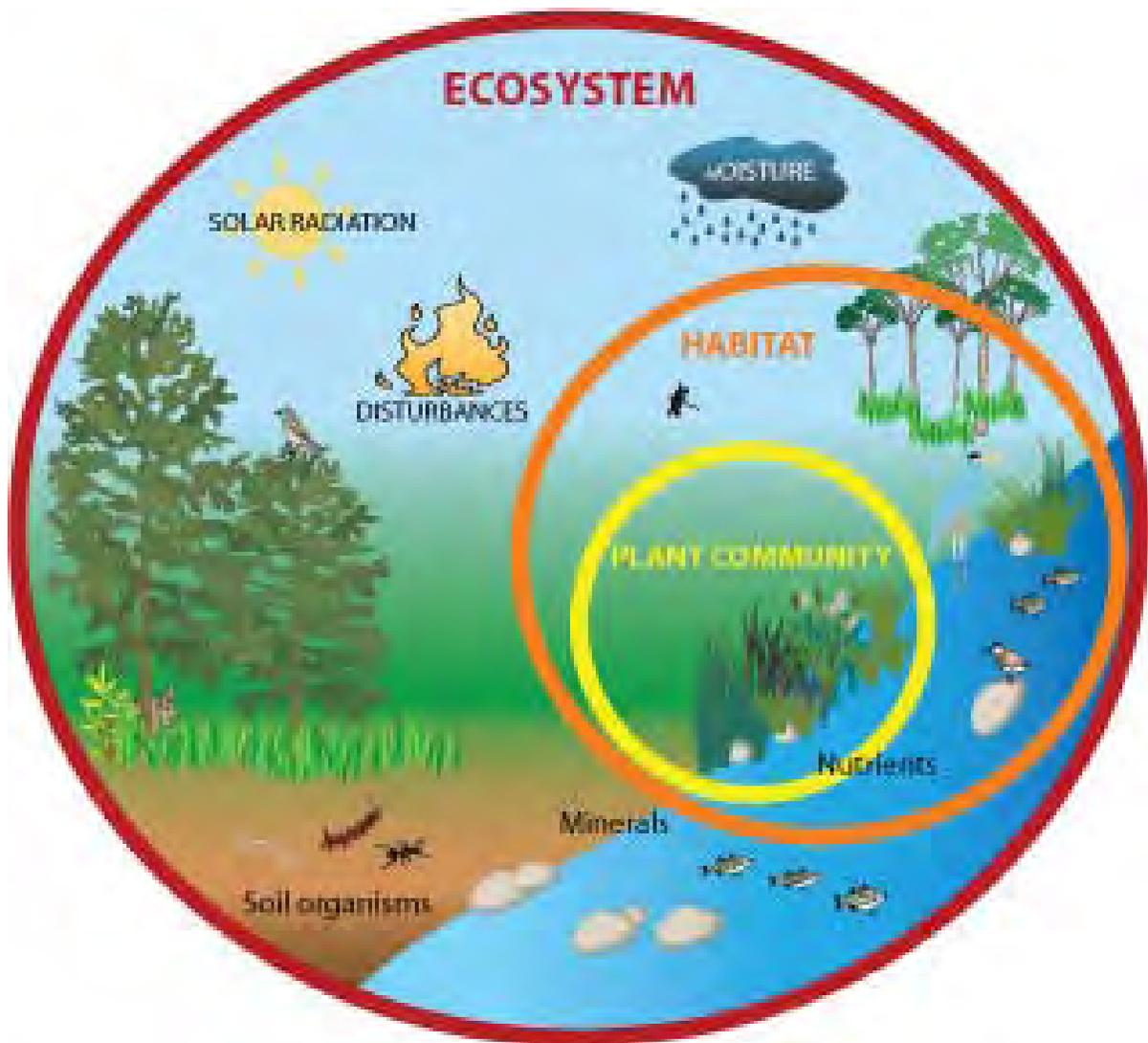
Collected soil and water will likely contain algae, phytoplankton, plant seeds and insect larvae. Store-bought soil and tap water will include far fewer organisms. (To observe this, fill one TerrAqua Column with soil and water from nearby woods or park and another with potting soil from a garden store and tap water. Set them side by side and observe for several weeks.

Terrestrial and aquatic plants are excellent indicators of change in your system. Fast-germinating and fast-growing plants will most effectively register change in a short period of time.

Grasses, particularly lawn seed mixes, work well. Prairie grasses grow more slowly but have deep roots that are interesting to observe. Radishes and beans also work well, though you will need to soak dried beans overnight before planting. Fast Plants, which have been developed to complete their life cycle in 35-40 days, are ideal candidates for experimentation in TerrAqua Columns.

The hypotheses, in this case, should mostly be incorrect, but nonetheless valuable. This is a powerful lesson about how to do science since many students always expect to be able to prove their hypothesis. The lesson here is that a disproved hypothesis is not “wrong” the only wrong is not evaluating your results objectively!

Use the image below to introduce Ecosystem Dynamics:



(U.S. Fish and Wildlife Service, 2008)

References:

Bottle Biology. (2009). University of Wisconsin-Madison. Retrieved July 17, 2009, from, http://www.bottlebiology.org/investigations/terraqua_build_2.html

U.S. Fish and Wildlife Service. (2008). *Ecosystem*. Retrieved July 29, 2009, from <http://www.fws.gov/invasives/VolunteersTrainingModule/invasives/plants.html>