

BOTTLE BIOLOGY

ECOSYSTEM VOCABULARY

Limiting Factor

Limiting factors are things that prevent a population from growing any larger. *Due to the size of the bottle the environment can only contain the amount of worms that are already there. In better terms the population will not increase anytime soon*

Abiotic Factor

Abiotic factors are non-living chemical and physical parts of the environment that affect living organisms and the functioning of ecosystems. *In the self contained ecosystems, examples of abiotic factors are Soil, water and rocks.*

Biotic Factor

Biotic factors are the living components of an ecosystem. They are sorted into three groups: producers or autotrophs, consumers or heterotrophs, and decomposers or detritivores. *In the self contained ecosystems, examples of biotic factors are plants, fish and algae*

Ecosystem

An ecosystem is a community of living organisms in conjunction with the nonliving components of their environment. *In my bottle the environment inside is similar to what is in the outside world like air, water and soil. They all interact with each other in order to have a functioning system.*



I. Purpose

- ✦ Design an ecosystem that is self contained
- ✦ Observe and understand the interaction of biotic and abiotic factors
- ✦ Understand nutrient cycling and energy flow

II. Essential Question

Can your ecosystem be self sustaining and maintain life of all original organisms within it?

III. Hypothesis

If I design the ecosystem correctly, it will be self sustaining ?



Habitat

the natural home or environment of an animal, plant, or other organism. *The bottle contains a fish and worm that are both in their normal habitats(one aquatic and terrestrial)*

Population

all the inhabitants of a particular town, area, or country. *The population in the bottle is at a low rate due to the limited factors.*

Community

an interacting group of various species in a common location. *For example, a forest of trees and undergrowth plants, inhabited by animals and rooted in soil containing bacteria and fungi, constitutes a biological community.*

Species

a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding. *Species within the bottle are worms and a fish*

Population Density

measurement of population per unit area or unit volume; it is a quantity of type number density. *The population in the bottle is low due to the size of the environment*

Carrying Capacity

The maximum population size of the species that the environment can sustain indefinitely, given the food, habitat, water, and other necessities available in the environment. *The carrying capacity of the bottle is at a good level because there is enough to resources available for everything to continue to survive*

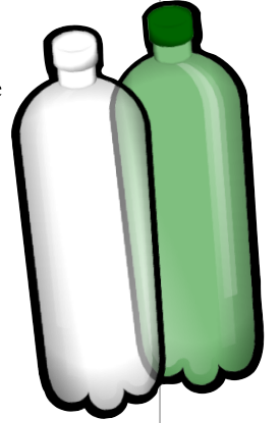
Niche

The way in which an organism fits into an ecological community or ecosystem. *Worms are an example of this because they are part of the ecosystem and play a major role at the same time.*

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iv. Materials

- ♦ Aquatic Animals
- ♦ Terrestrial Animals
- ♦ Plants
- ♦ Water
- ♦ Wicking String
- ♦ Clear Packing Tape
- ♦ Four 2Liter Bottles
- ♦ Box Cutters
- ♦ Stove
- ♦ Probes



v. Procedure

Construction

Cut Bottle into Separate Parts

Melt or cut bottle into separate parts to make the self sustained ecosystem



Puncture Hole-Tie String

Puncture hole in designated bottle cap. Take a piece of thick string (about a foot) and tie string to secure into cap.

Add Aquatic Material

Add whatever you would like that would fit within the aquatic aspect of your BioBottle (rocks, water, algae, sea grass, fish, frogs, tadpoles, snails etc)



Add Terrestrial Material

Add whatever you would like that would fit within the terrestrial aspect of your BioBottle (seeds, grass, plants, lizards, worms moss, sticks, soil, insects etc)

Predator

An organism that is hunting. *There are no predators in the ecosystem but a good example is frogs (predator) eats flies (prey)*

Prey

An organism that is attacked. *There are no preys in the ecosystem but a good example is fly (prey) is eaten by a frog (predators)*

Cooperation

The process where groups of organisms work or act together for common or mutual benefits. *Worms turn up the soil allowing the nutrients to get into the ground and down into the water to benefit the fishes aquatic ecosystem.*

Parasites

An organism that lives in or on another organism. *There are no known parasites within my bottle but, a good example of this is lice or leech*

Mutualism

Mutualism is the way two organisms of different species exist in a relationship in which each individual benefits from the activity of the other. *Without the plants the worms cannot survive, when they churn up the soil it helps other seeds and plants continue to live.*

Producer

Producers are organisms that make their own food. *Examples are the plants and algae in the bottle.*

Arrange all material

Add finishing touches to complete the self sustaining ecosystem. Once it goes in you cannot remove it or add to the bottle.



Tape Up and Leave in Sunlight

Tape up the bottles so that everything is closed off. Leave in area where sun can shine

Experimentation

In order to have to have a successful experiment you must follow the guide lines correctly. My experience experimenting with the bottle is that you cannot have to much of everything in the bottle.



VI. Data

Day 1

My bottle is all put together and there are no complaints so far.

Biotic: My fish has the tendency to get frightened and hide between the rocks. I see no worm movement

Abiotic: Nothing has fallen out of place and the plants are fine.



Day 1

Consumer

Consumers are organisms that need to eat/ consume food to obtain their energy. *The fish is a consumer*

Decomposers

An organism that decomposes organic material. *The worms in the bottle are decomposers.*

Food web

A system of interlocking and interdependent food chains. *The bottles food web contains information about the what survives off of what*

Food chain

a hierarchical series of organisms each dependent on the next as a source of food.

Herbivore

An animal that feeds on plants. *Worms and fish live off of plants etc. they are for herbivores*

Carnivore

An animal that feeds on flesh

Omnivore

An animal that feeds on both flesh and plants

Carbon dioxide

colorless, odorless gas produced by burning carbon and organic compounds and by respiration. It is naturally present in air and is absorbed by plants in photosynthesis. *Everything in the bottle needs Carbon Dioxide in order to survive*

Nitrogen cycle

The processes by which nitrogen is interconverted in the environment and in living organisms, including nitrogen fixation and decomposition.



Day 3

Day 3

The bottle has survived over the weekend!

Biotic: My fish intent looking to good. The plants are growing and haven't died. My fish died. It was swimming perfectly fine.

Abiotic: There is a filmy residue on the top of the water. The waters transparency is dropping.

Day 4

Biotic: The dead fish is giving nutrients to the plants.

Algae is growing on the rocks and the filmy residue is now a thick layer of some kind of snot like substance. I think that's what killed my fish

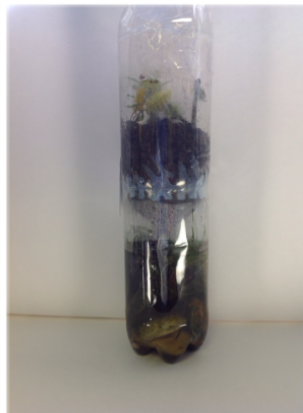


Day 4

Day 5

Biotic: Beans are sprouting. There is work activity

Abiotic: I can see how the water is traveling through the the bottle. The dead fish hasn't made the water dirtier.



Day 5

Day 6

Biotic: I am surprised that the water is still transparent but there is still a lot of dirt in the water. There is a lot of worm movement.

Abiotic: there is algae growing on the rocks and the water level has dropped slightly



Day 6

Day 7

Everything is up to par with the bottle except the fish

Biotic: the beans have grown and I believe that this bottle can continue to survive at this rate

Abiotic: there is more algae growing on the rocks and the significantly dirty because residue is on the bottle cap. The filmy substance on top of the water is now a hunky layer of slim. That's probably what killed my fish.



Day 7

Conclusion

Answer to Essential Question.

Can your ecosystem be self sustaining and maintain life of all original organisms within it?

Yes, a self contained ecosystem can thrive if the correct material is added but aquatically and terrestrially

Hypothesis

If I design the ecosystem correctly, it will be self sustaining ?

Yes, the ecosystem can live by it self if the right amount of everything is added

I would have had a better experience with my bio bottle if I had had more aquatic and terrestrial material and organisms. Without the right abiotic and biotic factors in the bottle, you will not be able to have a satisfactory experience. I was surprised on the other hand on how well the ecosystem functioned without help from the outside world.

One thing I would fix: If more material where available I would have added more aquatic and terrestrial animals. And I should have added fresh water with less silt and algae. The filmy substance that caused the fishes death continues to grow. Without organisms that can break that down the fish suffocates.

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