Mesocosms

Summer Project

Write up due August 10th (first day back)

AIM: Setting up sealed Mesocosms to try to establish sustainability. (Practical 5)

Mesocosms A biological system that contains the physical features and organisms of an ecosystem but is restricted in size or scope for use in conducting scientific experiments. They are small experimental areas that are set up as ecological experiments. They can be fenced-off enclosures in grassland or forests could be used as terrestrial mesocosms; tanks set up in the laboratory can be used as aquatic mesocosms. Ecological experiments can be done in replicate mesocosms, to find out the effects of varying one or more conditions. For example, tanks could be set up with and without fish, to investigate the effects of fish on aquatic ecosystems.

Another possible use of mesocosms is to test what type of ecosystems are sustainable. This involves sealing up a community or organisms together with air and soil or water inside a container.

You should consider these questions before setting up either aquatic or terrestrial mesocosms.

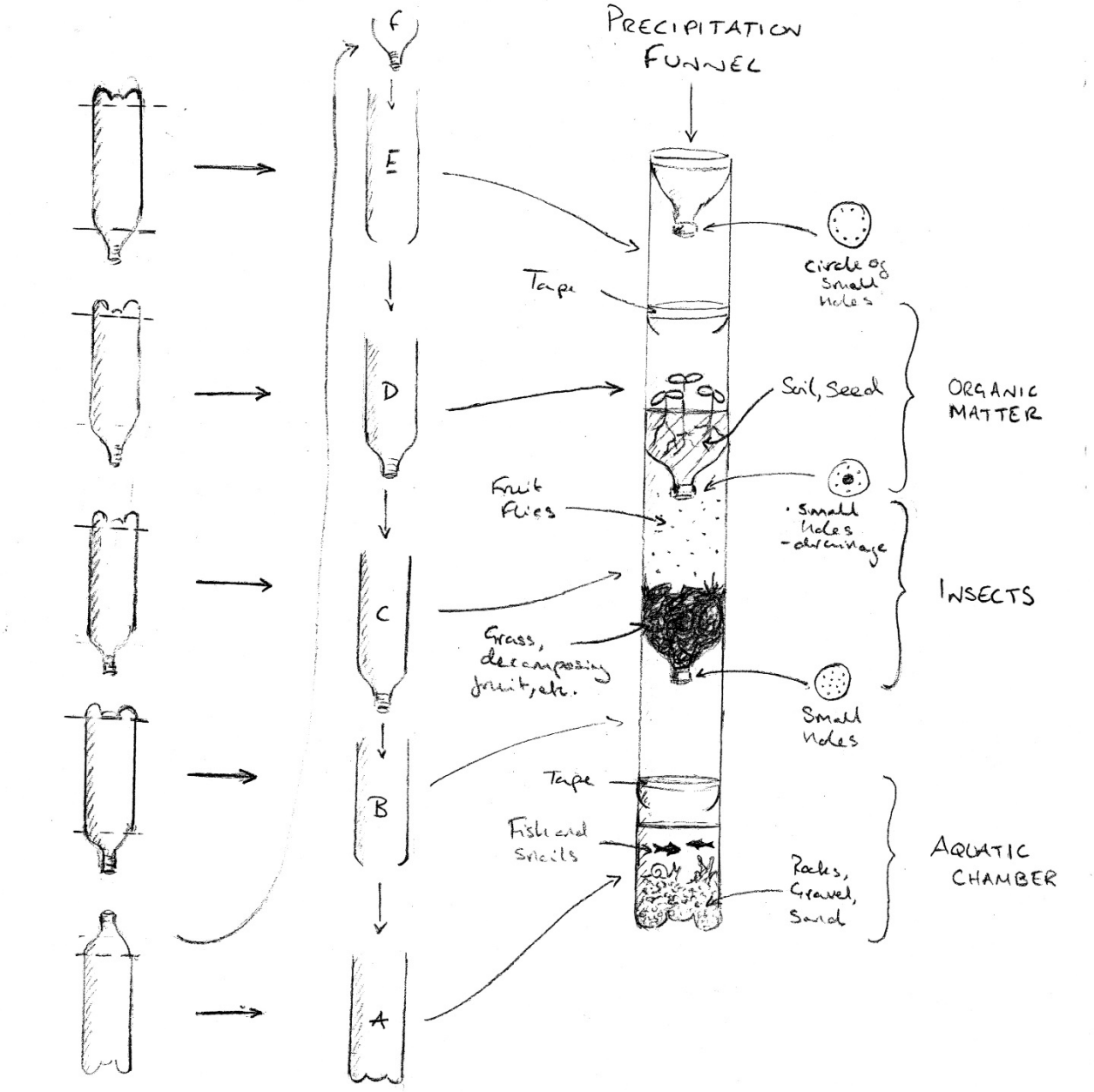
- Large glass jars are ideal but transparent plastic containers could be used. Should the sides of the container be transparent or opaque?
- Which of these groups of organisms must be included to make up a sustainable community: autotrophs, consumers, saprotrophs and detritivores?
- How can we ensure that oxygen supply is sufficient for all the organisms in the mesocosm as once it is seals, no more oxygen will be able to enter
- How can we prevent any organisms suffering as a result of being placed in the mesocosm?

The following site may help with the setup of your mesocosm:

http://www.magzinr.com/user/D_Faure/mesocosm

Attached is also a diagram and some information that may help with your project.

Ideas for chamber components (abiotic and biotic factors)



Terrestrial chamber

Soil – The productivity of soil depends on mineral content, drainage, water-holding capacity, air spaces, biota (animals present e.g. earthworms) and the potential to hold organic matter. For the soil in the terrestrial chamber you may want to use one that is locally available, or create your own The most productive soil is loam soil.

Seeds – As you have a limited growing space, your plants will need to be small. You should avoid fast-growing plants such as beans. Cress may be a suitable plant to use, although there are many other options. Visit your local garden centre and see what is available.

The terrestrial chamber should be watered regularly. Water will filter down into the lower ecosystems. Use trial-and-error to see how much water is needed to support all ecosystems.

Decomposition chamber

Organic matter – A mix of leaves, grass, and easily decomposed food such as fruit (do not include citrus fruit or peelings) should make up the material in this chamber. Think carefully about what proportion of each of these components you should use.

Insects – Insects such as fruit flies (*Drosophila*) can fly between terrestrial and decomposition chambers and help decompose the detritus in the decomposition chamber. What other insects could you include? Do you want to put them in the terrestrial or decomposition chamber?

Aquatic chamber

Water – Tap water may be treated with chemicals and so should not be used in the aquatic chamber. Should you use distilled water or pond water?

Substrate – You should put gravel or sand at the bottom of this chamber. Organisms you put in this chamber may need this substrate as part of their life cycle, or as a refuge.

Organisms – Pond weed (*Elodea*), snails and fish could be used in your aquatic chamber. Be careful to select the fish carefully, and limit the number of larger organisms in this chamber. Add only the number of consumers you think that the chamber will support.

Figure: Creating bottle ecosystems. Cut 5, 2-litre fizzy drinks bottles as shown on left of figure, and assemble as indicated. The bottom chamber (bottle A) forms the aquatic chamber, the middle chamber (bottle C) a decomposition chamber, and the top chamber (bottle D) a terrestrial ecosystem. (Artwork by Freddie Crossley).

WRITE UP

Each Week: Take data 2-3 times a week. Pictures are required along with written observations. You must take data for a minimum of 3 weeks.

** If it dies within a few days, start over with another idea (this is not an excuse to stop doing the assignment)**

Observing your ecosystems

- Each week you can make observations of your ecosystems. Each observation should include:
  - the date of your observations and 2 pictures/week
  - the number of days the mesocosm has been running
  - qualitative observations (e.g. plant growth, decomposition rate, turbidity of water, status of the species present, numbers of organisms)

Observations can include the following if you have the materials to do so…….

- pH (of soil/water) (if possible to get the information) Can do a before and after of this since the mesocosm is sealed
- temperature (if possible to get the information) Can do a before and after of this since the mesocosm is sealed
- dissolved oxygen content of the aquatic chamber (if possible to get the information) Can do a before and after of this since the mesocosm is sealed
- additional measurements (e.g. analysis of nutrients – NPK content, etc). (if possible to get the information) Can do a before and after of this since the mesocosm is sealed

These must be included in your mesocosm write up.

1. **Hypothesis**
   What do you think will happen in your mesocosm? Why do you think this will be the case?

2. **Protocol Diagram**
   Draw a diagram that shows your mescosm and the contents in each section if there is more than one chamber. List the abiotic and biotic components.

3. Materials: List all the materials/organisms you used for your mesocosm

4. **Observations**
   - Place pictures here (must have a minimum of 6 pics if your mesocosm lasted 3 weeks. If it lasted longer, add 2 pics/week.
     - the date of your observations and 2 pictures/week
     - the number of days the mesocosm has been running
     - qualitative observations (e.g. plant growth, decomposition rate, turbidity of water, status of the species present, numbers of organisms)

5. Food chains and webs (for organisms placed in your chamber) (Only if you have a chain or web)

Draw food chains you expect to see in each chamber.

- Draw each organism as a circle and give the names where possible (scientific or common name).
- Identify the role of each organism using appropriate letters, for example; producer – P; primary consumer (or herbivore) – C1; secondary consumer (omnivore/carnivore) – C2; tertiary consumer (carnivore) – C3; decomposer – D.

6. Discussion, conclusions and evaluation

- How did your mesocosm turn out?
- What were the main limitations of your mesocosm (include at least 1)? How may these limitations have affected your experiment? How could you avoid these limitations if you were to do the experiment again?
- What turned out well in your mesocosm?
- What did you learn by creating a mesocosm? And don't say, "I learned what a mesocosm is".