



BIODIVERSITY

INVESTIGATING MESOCOSMS

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Overview: Mesocosm experiments can be used to improve predictions of the impact of climate change on individual species and whole communities by parameterizing metapopulation and metacommunity models and by testing and refining population and community ecology theory.

A mesocosm is an isolated ecosystem you can control in class which can be terrestrial or aquatic or both. You can have multiple systems and change varying factors about one and measure changes. For example, "To what extent does CO₂ concentration influence midday temperatures?"

Level: Adjustable for ages 12-19, MYP3-DP2, 2-6 havo/vwo, grade 7-12 equivalent

IB curriculum links: Integrated Science/Biology criteria B and C, DP IA or EE ideas

Skills: Datalogging, inquiry, data presentation and interpretation, transfer

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Sample learning goals:

Students are able to collect, process and analyze data from their mesocosm to answer a research question

and

Report on their findings and evaluate the implications of changes to an ecosystem with reference to relevant scientific models and understanding.

MESOCOSM RESEARCH INTO CLIMATE CHANGE EFFECTS

Mesocosm experiments can be used to improve predictions of the impact of climate change on individual species and whole communities by parameterizing metapopulation and metacommunity models and by testing and refining population and community ecology theory.

All can be done as demonstrations or as lab experiments with varying levels of support. For demonstrations before a lab investigation you can prompt students to think about suitable independent and dependent variables and their ranges.

PROCEDURES

- Build 3 more or less equal mesocosms in a bottle / closed jar / closed aquarium.
- If you Google (images) on these key words you will find plenty of inspirational examples. Be creative and practical.
- Attach and use sensors (e.g. CO₂ conc. and temperature) hooked up to a datalogger which allows you to collect (lots of) quantitative data.
- You could use a small beaker with water and an Alka-Selzer tablet to increase CO₂ concentration in one mesocosm.
- You could include a small beaker or watch glass with KOH solution to reduce atmospheric CO₂.
- In the 3rd mesocosm simply use air with the current CO₂ concentration (approx. 410 ppm).

Let the experiment run for a few days.

EXAMPLES OF RESEARCH QUESTIONS:

-> To what extent does CO₂ concentration influence midday temperatures ?

-> (When your mesocosm has germinating seeds included)

How do germinating seeds impact CO₂ concentration ?

or:

How do photosynthesizing seedlings impact CO₂ concentration ?

-> Is the increase/decrease of CO₂ concentration correlated with day-night rhythm?

-> Has the biomass of plant X increased or decreased when the CO₂ concentration went up ?

ALTERNATIVE / FURTHER INVESTIGATIONS:

- With more sensors (O₂ , humidity, light intensity, etc) you can obviously expand the scope of your research.
- Also you could introduce a pollutant in one (of three) mesocosms and try to monitor any effects in your ecosystem.
- Comparing sterilized soil to unsterilized soil maybe gives us more insights into the effects of more radiation on bare soil (including UV) on regeneration capability observed by germination rates of certain seeds.
- If you made an aquatic mesocosm you could e.g.monitor population growth or decline of for example algae, water fleas or Paramecium sp. when you change some ecosystem parameter.

Zooming out you can ask inquiry questions about how this links to climate change with direct reference to CO₂ levels, and students can even discuss the environmental, political, economic, social, health or moral factors of this (linking to IB sciences criterion D)