

Compiled Slides

MJ

ONE

Enclosed Ecosystem

Mason J.R.

Defining

Goal - *The goal of this project, is to have a successful growth of life inside a semi-enclosed ecosystem.*

Primary Functionalities - I think the big trait that needs to work is a recycling atmosphere, because the life inside (plants) needs carbon dioxide and oxygen to be on a continuous stream. I need fertile soil and small life, because I'm creating an ecosystem, not just one plant. The structure of the object holding this all together will take some consideration, but I would like to keep it as a rectangle, that way I can shift its height in case it's too short for plants to grow without curling.

Secondary Functionalities - Getting rocks and small miscellaneous earth will be helpful, because I think it's the little things that will churn out bigger results. It also needs proper sunlight and a stable environment free from exposure and irritation. I'm not worried about the seal being super tight, I think a little oxygen from the outside may be good. I'll use a cork if I have to create a tight seal, but I haven't experimented enough to know yet.

Defining continued

Constraints - What worries me most for this project is that the life inside may not thrive if it's sealed too tight, or not tight enough. I'm also questioning if I need to include small critters into the ecosystem, because they may end up eating the plants. All of these questions will be answered through experimenting with this project, so really I'm not worried, but they are things that get me thinking. Another concern is how gentle I need to be with the enclosed ecosystem, I'm not sure if I should keep it in one spot or take it back and forth from my moms to my dads.



research

There are **two** ways to create an enclosed ecosystem, inside can either be filled with water, submerging all the plants (in which case I would need fish), or it could be just soil and the plants.

Pros - Some pros of the process are it's an active give and take. I am seeing how what I add effects the environment. Also I think it's really interesting, especially with little bugs. Another pro is that there is a lot of information out there in case I run into an issue, and I can release the life in the end. I'm excited to see what is going to happen each day during this project, which is the biggest pro.



Terrarium



Aquarium

Research continued

Cons - Some cons are that the piece could break, and that the seeds won't sprout. If I add small bugs to it, they may eat the plant life, which won't be good. I'm concerned with my ability to make a functional container, I won't be able to make it out of glass, though I may use a glass container. It needs to be see-through, which is why I can't use wood. Any or all of these Cons may be resolved through the use of trial and error as I run through the whole process.



Research Takeaways

The biggest takeaway is that this is a project that is probably going to require a lot of trial and error to get the results I'm looking for. This is good, because it will only make the project better in the long run. Another big takeaway is that there are a couple ways to tackle this idea, one underwater and one above water, perhaps it will be useful to do both, however I am going to prioritize the terrarium.

Project takeaways

I'm most excited to tackle this project over the others that I chose because it will breed the best result if done right. I'll have my own little personal ecosystem.

It's certainly an interesting challenge as I have to breed life in this small sliver of environment and let it thrive. It may take multiple attempts, but I know that I can get it done.

I'm also going to be attempting to brew a chewing gum for myself as I have told you about before.

TWO

Enclosed Ecosystem Design

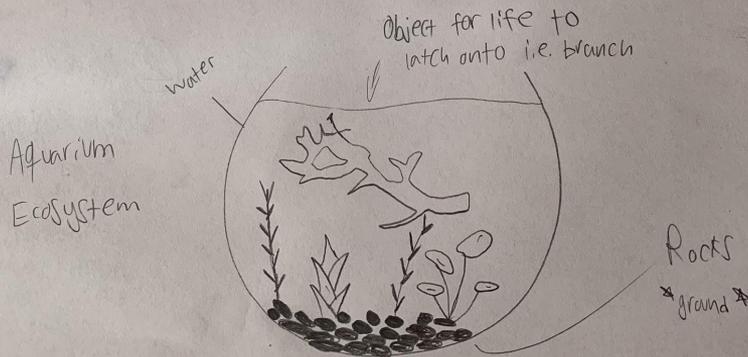
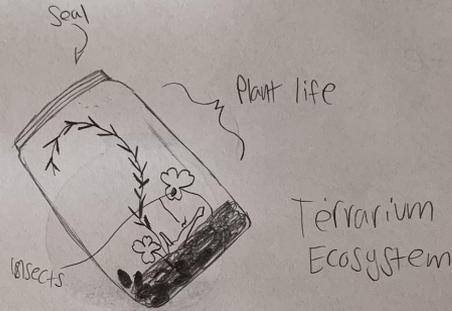
Mason J.
2/27/21

Key Features

IDEA DESIGN Sketch

2/17/21

MASON J.



Key Features are:

Container

Thriving atmosphere with a water equilibrium

Soil and rocks

Fresh water

Microfauna

Key Feature Approach

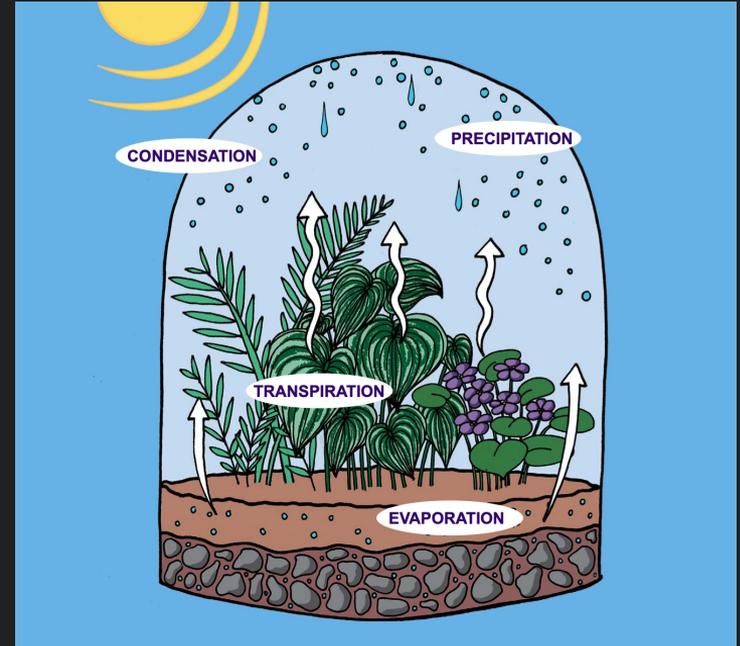
Terrarium container

- Glass container
- Ideally 10x20



Project Necessities

- Mist bottle
- Soil
- Miscellaneous natural material such as...
 - Moss
 - Gravel
 - Bark
 - Charcoal (Horticultural)
- Plant selection (Neanthe Bella Palm, nerve plant, and possibly typical plants.) *I will test it*



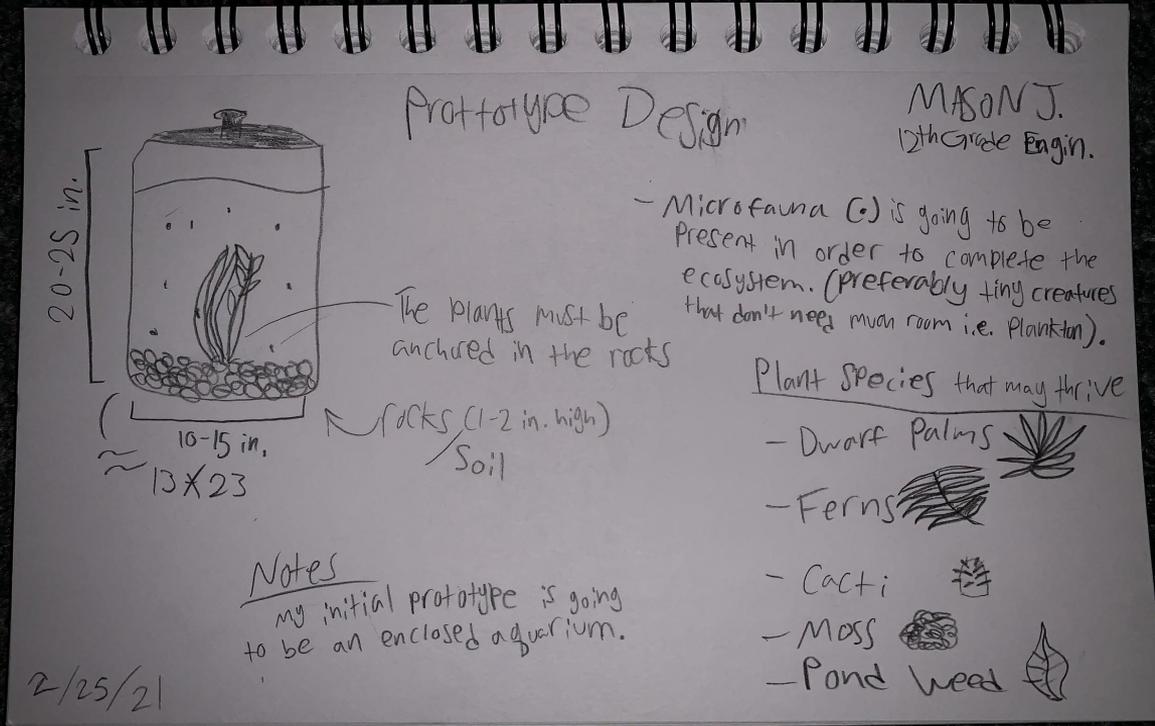
Prototype Design

Prototype Goals:

- Experiment with which plant species will thrive, and which will die in this environment.
- Experiment with the effects of an aquarium vs terrarium

Approach to Goals:

- I will use the same container throughout, because I don't have a lot.
- Time will tell
- Change the water precipitation
- Experiment with microfauna.



THREE

Build, Test, Evaluate Prototype

3.17.21
MJ

Prototype Build

Approach:

- I took multiple approaches to the build, but ended up satisfied with the one I have now. I poked holes in the top of the can to allow air flow, because before the plant would choke to death. As of now I have no other life in the jar besides the plant. No microfauna

Something I liked:

- I liked the building of the prototype, I enjoy watching the plant grow after its been disconnected from its mother plant. But I think there are still some things to work out

Something I will not do again:

- I will not be trying to use smaller plants again, I find that succulents are simply off to a better start because of more surface area and mass they hold, which holds water longer.



Prototype Test

Test objective:

- I'm testing the lethality of leaving a succulent in the sun for long.

Test method:

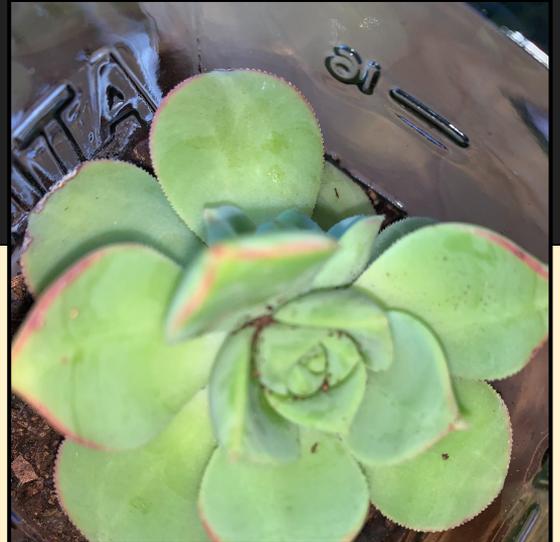
- Obviously succulents need sunlight, and they usually get it all day, but I'm wondering if it being surrounded by glass would burn up the plant. So I poked some holes on top to keep a temperature equilibrium, and I've left the plant in the sun all day for five days.

Test criteria for success:

- If the plant survives then the test will be a success, because previously other plants failed.

Evidence: (see video)

- I have no video, because not sure what it would show, but here's more evidence that the succulent happily survived.



Phase 1 Prototype Evaluation

Aspects of my prototype that I like:

- I like the mix of ingredients in my experiment, I simplified it down to just soil, rocks, water balance, and the plant.

Aspects of my prototype that I did not like:

- I don't like how passive it can be at times, at times I like that as well. I dislike the scarcity of materials it takes to use right now.

Improvements for the next iteration

- I have plans on how to improve the scarcity issue, I think I need to add more natural materials, and maybe some bugs. I'm sure it will improve, even without bugs.



FOUR

Full Documentation

Final Draft

MJ

Final Design

For my final attempt I've realized how much of a small world I've helped grow. As you can see the dirt levels have lowered, and there is greenery enveloping the entirety of the soil. The succulent has lost some thickness, I assume from months of non-proper nutrition and an artificial environment. I've also removed and returned the plant from the jar numerous times. A few weeks before this project came to a close, there was a stray plant that sprouted tall. It has since died, but it's telling of how much better equipped a succulent is for a desert environment.





Dead Plant Remains



Final Build

On my final iteration, these are all the components making this whole work.

- Soil/Rocks
- Frequent watering,
- Horticultural Charcoal
- Sunlight,
- Variety of plant roots
- Mycelium



Charcoal is used for ecosystem management, and its carbon is proliferous, and that carbon is easy to consume.

Final Testing

I specifically wanted to induce a response from fungus on my final attempt, because I know that nature thrives best when it's got all of itself in harmony. I placed it towards a breezy window, and many spores. Besides the rocks, you can see bits of mycelium uncovering themselves, while the majority stays inside.

I think this addition of fungi may have been what allowed the plant to survive as long as it did. Because there's no obvious way to know when the fungi exactly came. Plus mycelium and plant roots provide a mutual benefit. However I never saw sprouting fruit bodies or mushrooms.





360° View

*I think you'll note the endless strides of green lacing all of the soil, up and down. This is from months after months of this plant growing and gestating in this small environment. Along with a proper water source.

** Most of the water came from the humidity that would naturally come.

*** No other video formats could be supported besides short gifs.



Reflection and Evaluation

During this project I encountered numerous problems such as, lack of growth, dying too quickly, irregular sunlight time, and one time I even spilled it. However now that I'm at the end, I think it's clear that the ecosystem I've shown as my final is well above what a first draft is. Not only that, I would never know to do certain things like implement charcoal, use a succulent, keep it in a breezy spot, use rocks at the bottom, etc... if I didn't use some trial and error. I utilized critique from class, and I believe I've displayed substantial growth in this one small project. If I ever repeat this, I'll utilize a bigger space, but what is nice with a compact fit is that everything happening behind the scenes (fungi, root growth, etc...) is displayed better. All in all it was an enjoyable project, and I'm glad it grew into what it did.

Thanks

Thank you for this whole semester, and enabling me, and everyone else, to pursue something we are interested in, no matter the type of project it is. That's truly what makes an engineering class enjoyable. Have a great next year Chase!

