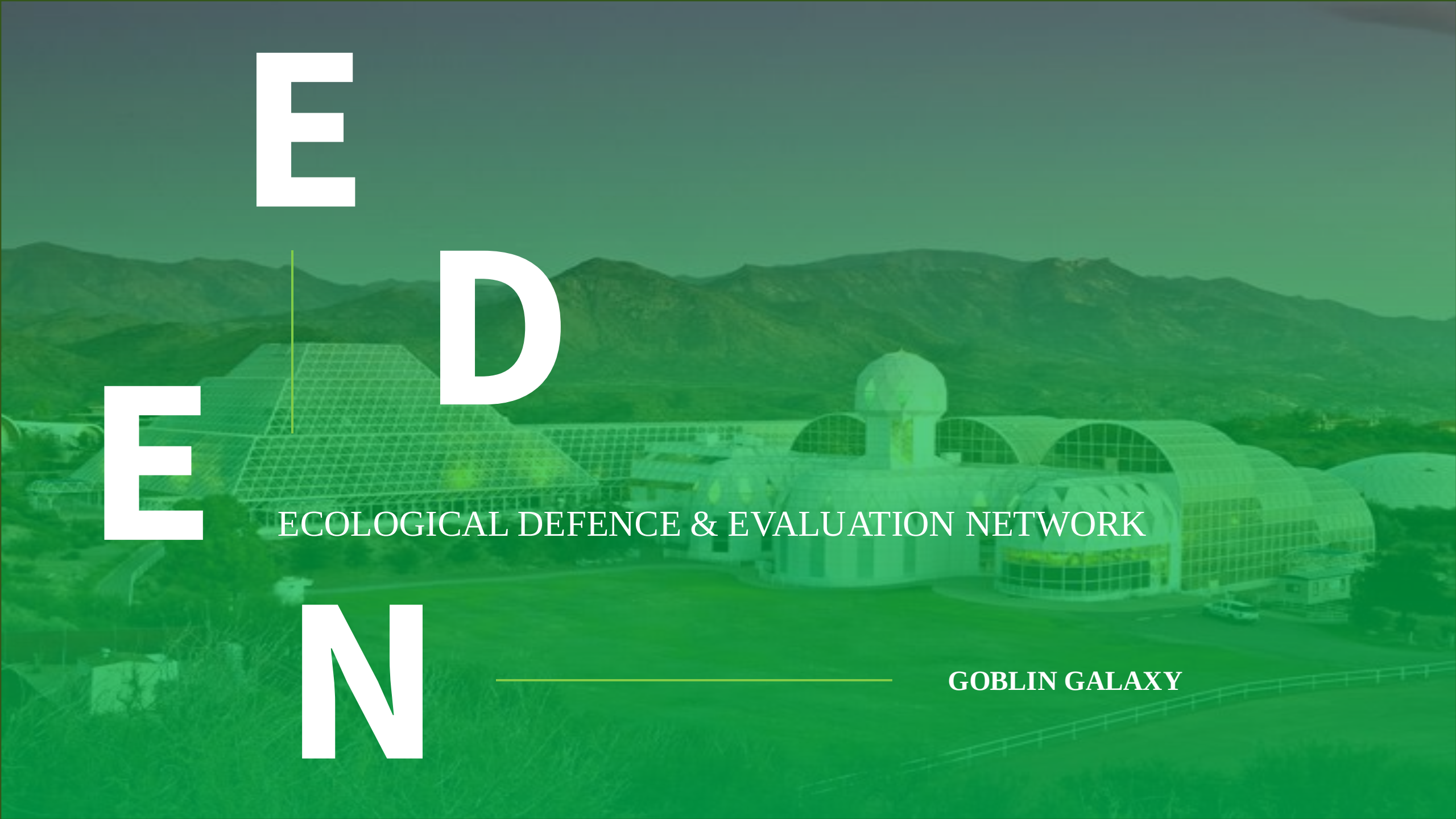


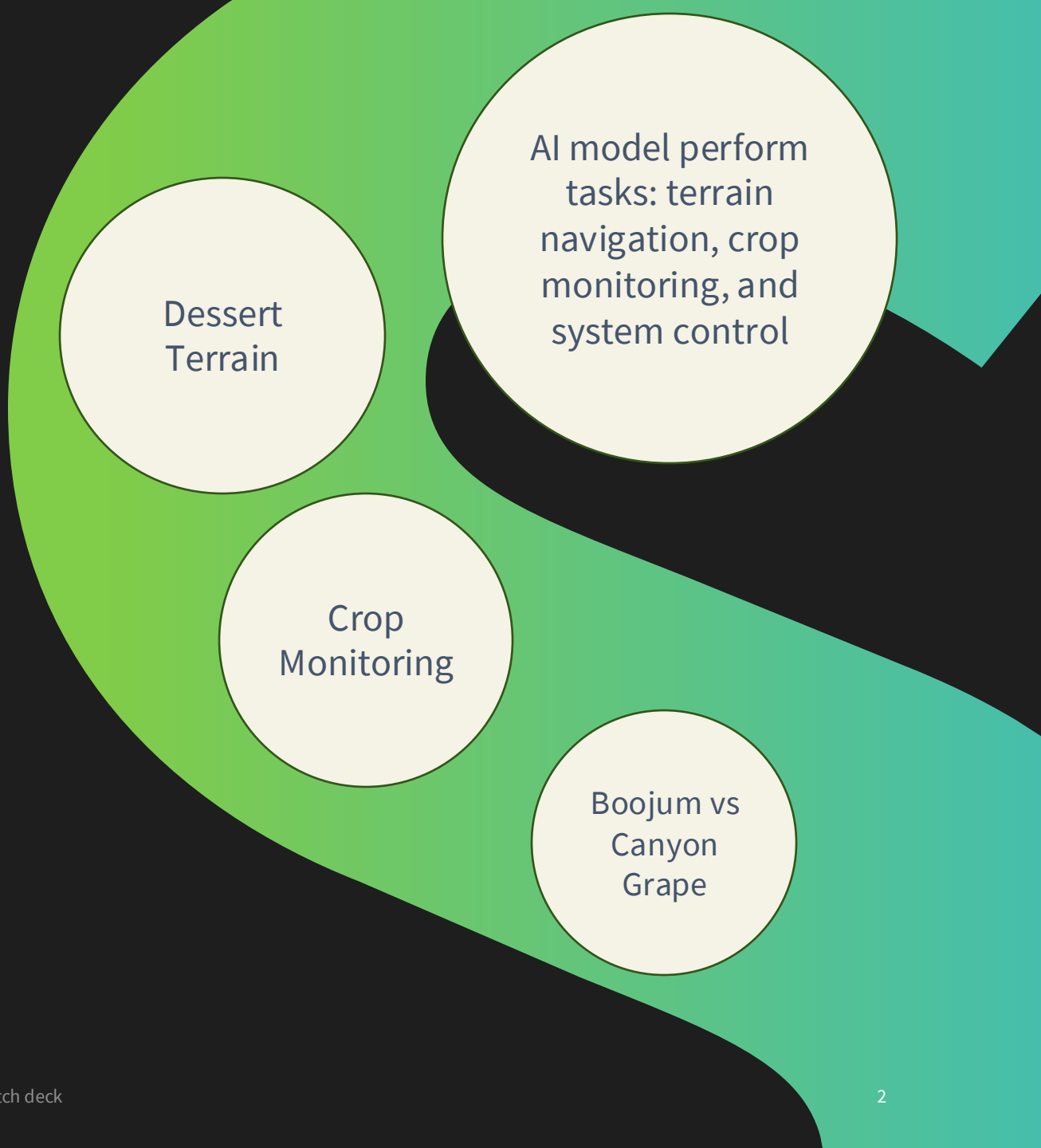
EDEN

ECOLOGICAL DEFENCE & EVALUATION NETWORK

GOBLIN GALAXY

BREAKING DOWN THE PROBLEM

We wanted to break down the problem into something that is achievable but not boring. We know it is unrealistic to complete a project for all biomes and all tasks, so we decided to focus on a specific aspect in the biosphere that can be stretched into something bigger.



COMING UP WITH A CLEAR GOAL

EXTENSIVITY

We want our project to be easily extensible. The end product should be able to replicable for other biomes

RELEVANT

We want our project to be relevant to the endeavors at Biosphere 2. To do this we did some research

SPECIFIC

We wanted to focus specifically on the Desert Biome and the tracking of specific objects in the biome.

ACHIEVABILITY

Training LLM and setting up the model is time consuming, but realistic. It also fits the challenge descriptions. (not including the extension)

IMPACT

The idea can be beneficial for the biosphere as there can be “Expert” models for each of the projects in Biosphere 2. It also achieves close monitoring for specific projects if real time data can be utilized.

CREATIVITY

We wanted to take the challenge a step farther. Instead of following the stages and coming up with the minimum, we thought predicting the future of life stock depending on given parameters could be useful to many aspects for B2TWIN.

THE PLAN

STAGE 1

We get Ollama running locally on our computers.

STAGE 2

We get data to start with from GitHub and make it usable by our LLM.

STAGE 3

We connect to a comprehensive data archive for access to all data and do something useful with it.

STAGE 4

We get our LLM to communicate with other models and collaborate.

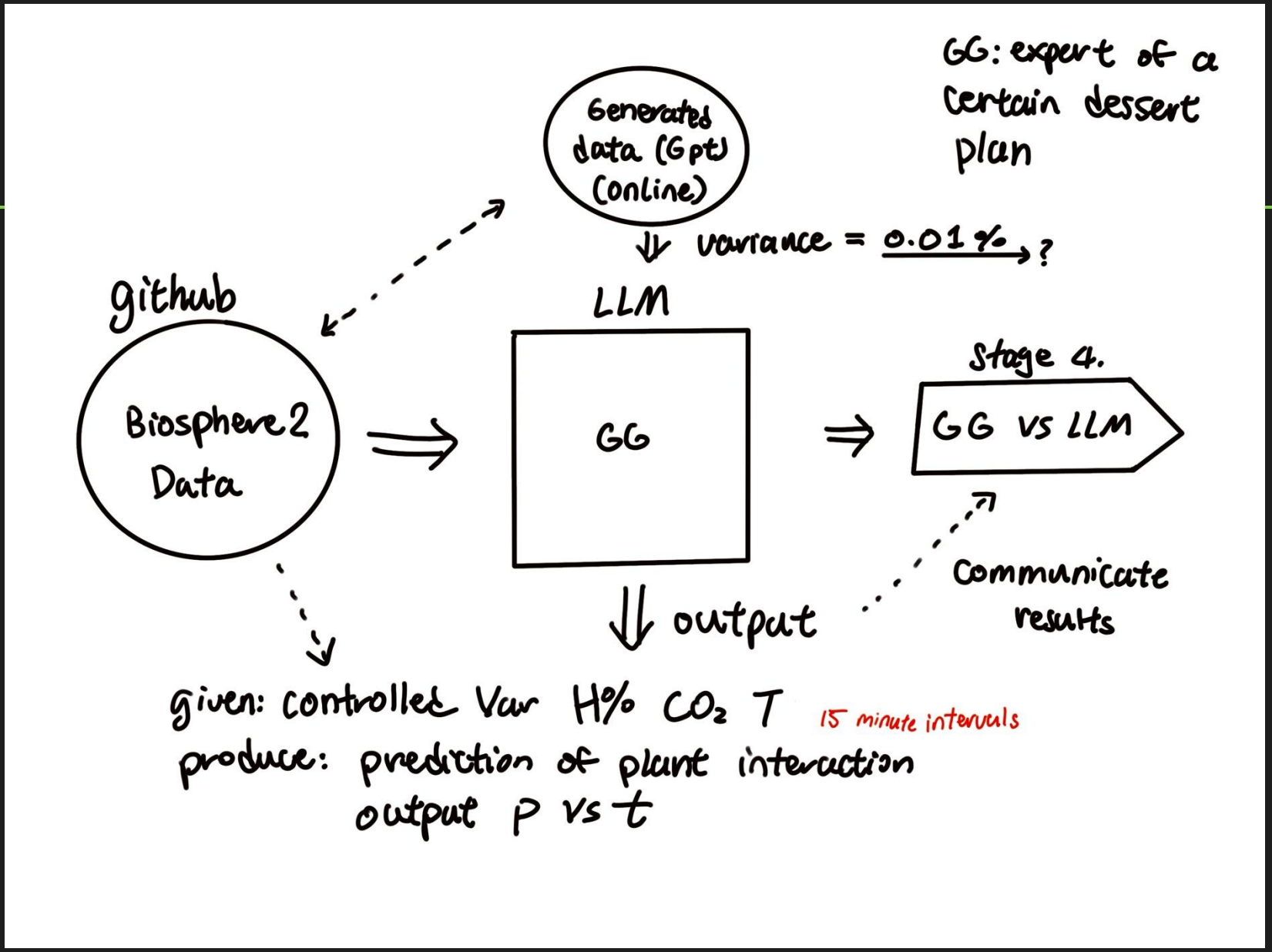
THE PLAN

Our plan was to train a model to recognize how climate changed as time moves on.

We would then train the model on synthetic data of two plants native to Arizona.

The expected output would be a prediction of the population of the plant over time if certain conditions were met.

We could then connect our models with other models for other biomes

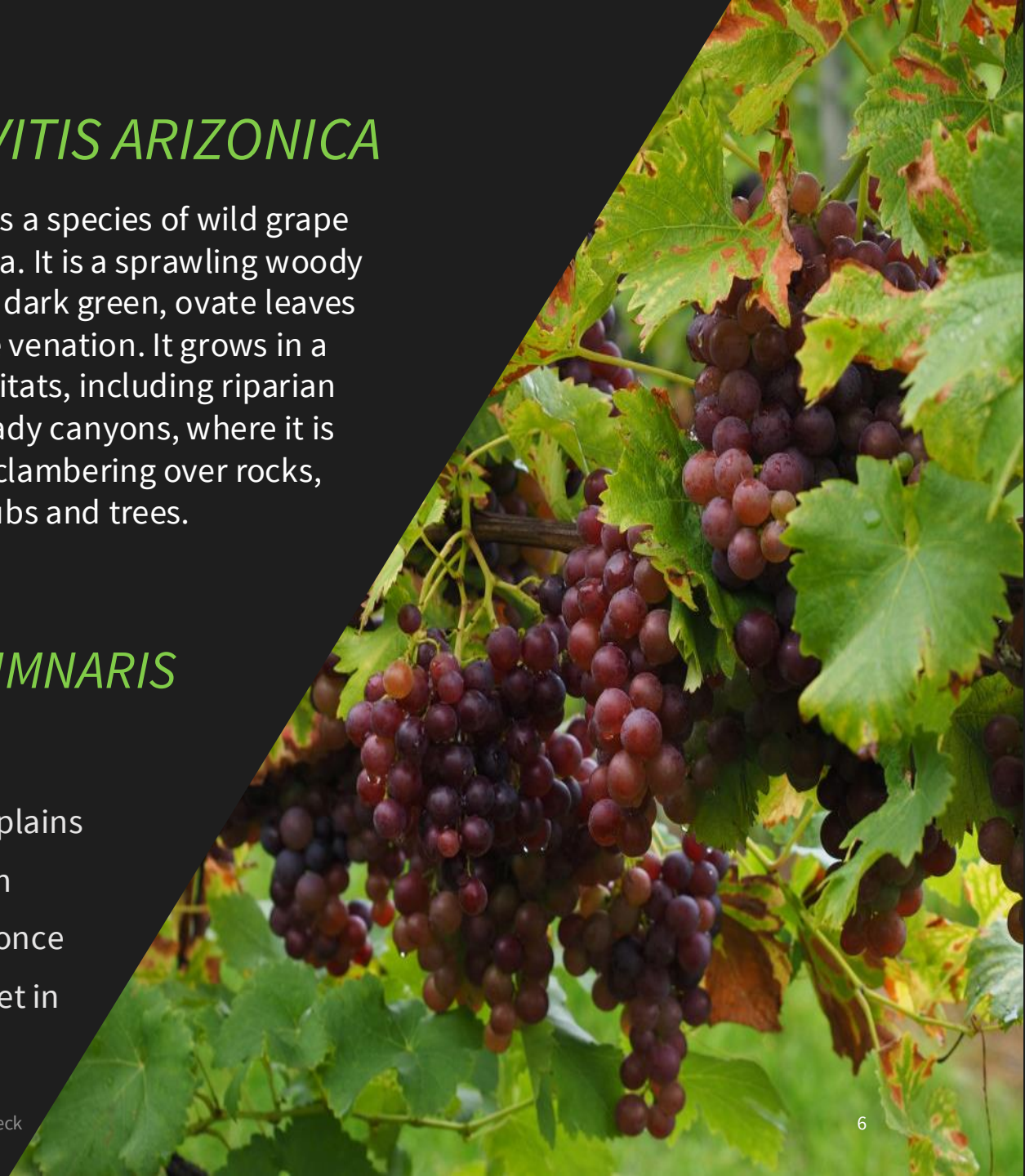


VITIS ARIZONICA

Vitis arizonica is a species of wild grape native to Arizona. It is a sprawling woody vine that bears dark green, ovate leaves with palmate venation. It grows in a variety of habitats, including riparian zones and shady canyons, where it is often found clambering over rocks, shrubs and trees.

FOUQUIERIA COLUMNARIS

Fouquieria columnaris is a treelike succulent. They are native to alluvial plains and rocky hillsides within the Sonoran Desert. They require very little water once established and can reach up to 70 feet in its natural habitat.



SYNTHETIC DATA

PURPOSE

To demonstrate our LLM's ability to use Biosphere 2's biome data to predict plant population changes, we used Chat-GPT to generate synthetic data of two plant species that normally don't grow alongside one another and would theoretically compete for resources.

IMPLEMENTATION

After our synthetic data was generated, we modified the data set to closer reflect the plants' real-life behaviour.

“GIVEN THE RELATIVE HUMIDITY %, TEMPERATURE IN FAHRENHEIT, AND CO2 LEVELS IN PPM, ALL OVER TIME, GENERATE A SET OF DATA OF THE POPULATION OF THE TWO PLANTS OVER TIME.”

The time should be taken every 15 minute intervals. The CSV file should contain 6 parameters: relative humidity %, temperature in Fahrenheit, and CO2 levels in ppm, time, population of *Vitis arizonica*, and population of *Fouquieria columnaris*. Time is the independent variable. Model all parameters on what is possible in the Arizona Sonora dessert. Give 2689 entries, and 3 CSV files containing different data sets of the same plant. The relative humidity levels should be around 60 to 90, and the temperatures should be around 60-100, and CO2 levels around 250-390. Both populations should start at 100.
The data set should Model the population dynamics with two competing species, taking into account:

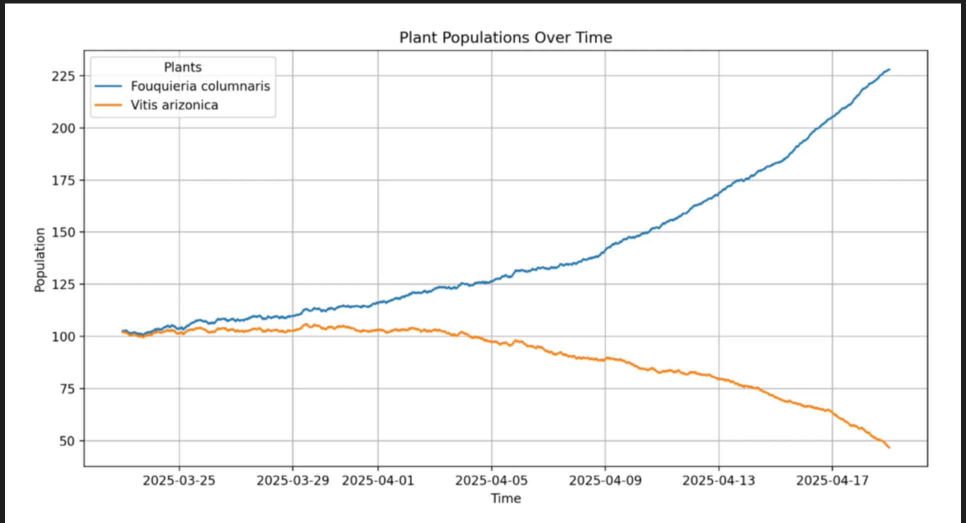
$$\frac{dN_1}{dt} = r_1 N_1 \left(1 - \frac{N_1 + \alpha N_2}{K_1}\right) + f(\text{env\_factors})$$

$$\frac{dN_2}{dt} = r_2 N_2 \left(1 - \frac{N_2 + \beta N_1}{K_2}\right) + g(\text{env\_factors})$$

- N_1, N_2 = populations of Fouquieria columnaris and Vitis arizonica, respectively.
- r_1, r_2 = growth rates of each species.
- K_1, K_2 = carrying capacities (maximum sustainable populations).
- α, β = competition coefficients representing the impact of one species on the other.
- $f(\text{env\_factors})$, $g(\text{env\_factors})$ = environmental adjustments.

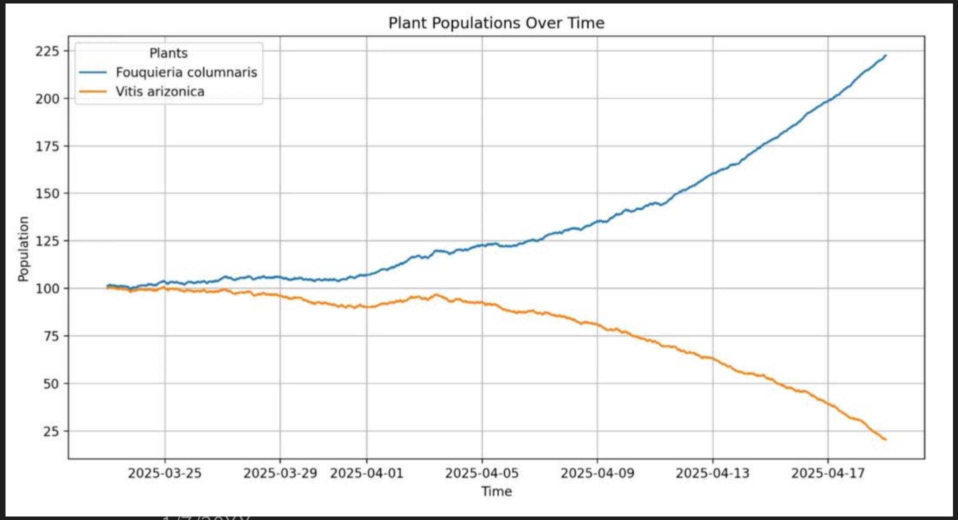
POPULATION SIMULATION RESULTS

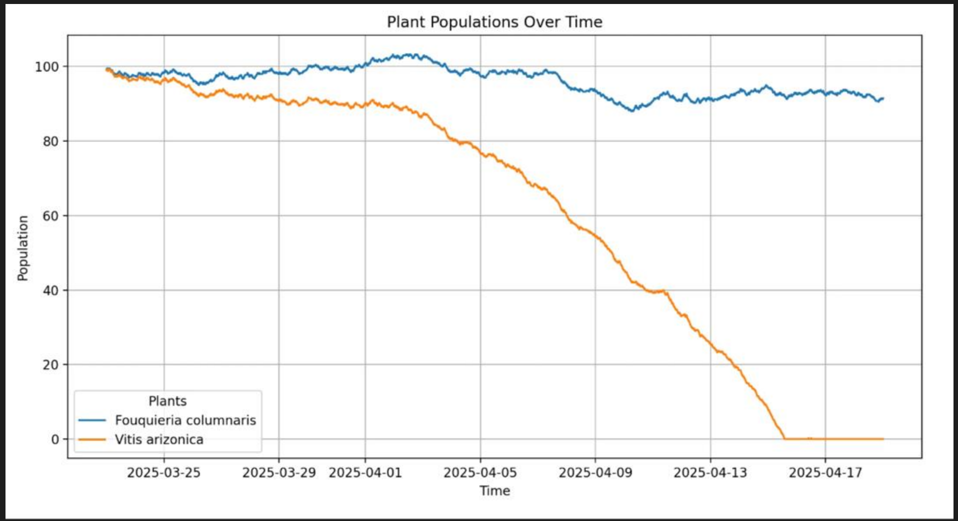
GRAPHS



SIMULATION 1 TABLE

Simulation 1	Temperature (F)	Relative Humidity (%)	CO2 Level (ppm)
Mean	80.3	74.7	319
Standard Deviation	11.7	8.5	40.8
Maximum	100	90	390
Minimum	60	60	250





TRAINING EDEN (ECOLOGICAL DEFENCE & EVALUATION NETWORK)

SETTING UP THE LLM

We began with Ollama but do to environment issues, switched to ().

FEEDING DATA

Feeding the correct Data into the speed wasn’t

ANALYSING RESULTS

Study tools are easy to use and accessible for all demographics

SCALING FOR THE FUTURE

BOTS THAT ARE SMART AND SPECIALIZED

With our initial idea, the bots within each biome will be specialized for their biome and are able to provide smart feedback to users.

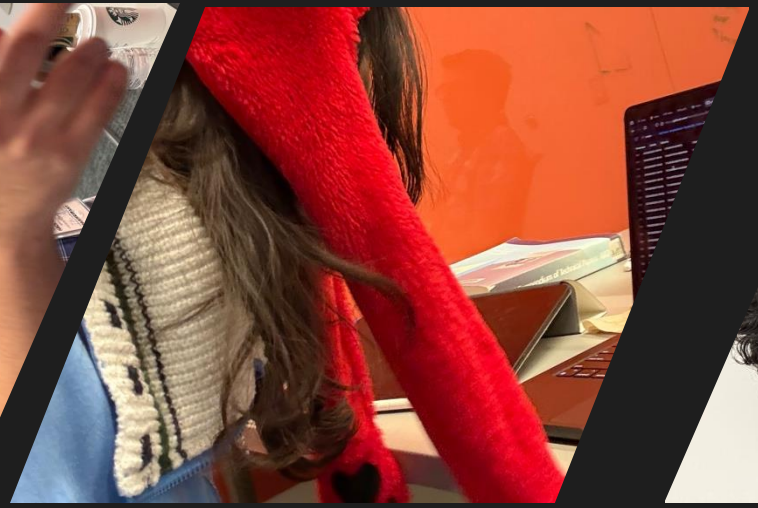
INCREASE DATABASE FOR TRAINING (UTILIZE EXISTING AI)

If we train our model on more data and equip it with intelligence from other chatbots, it can be a very efficient in problem solving.

EXPLORING NEW POSSIBILITIES

Using our model's predictions, we can find new ecological interactions that maximize growth, and by incorporating genetic engineering we can modify existing plants to create new ecosystems work together to thrive in certain environments.

STAGES OF HACKING (BLOOPERS)



“BUT..”

When the logic is all clear but the machine decides otherwise

“HUH?”

The moment when everything makes sense except the error message

“…"

When you don’t have the energy to deal with life anymore

“FINALLY”

Finally getting the model to accept its training.

ALPHA TESTING ☺

Questions	Answers	Validity
Real Biosphere Data		
What is the maximum temperature		
What is the temperature at 20:33		
What was the Modal CO2 admission		
What is the range of relative humidity percentages?		
Synthetic Data		
In what conditions will cause the population of a plant to go to zero?		
Which plant becomes more abundant		
What conditions are ideal for the success of both plants?		
How would the effects from global warming theoretically affect the populations of both plants.		