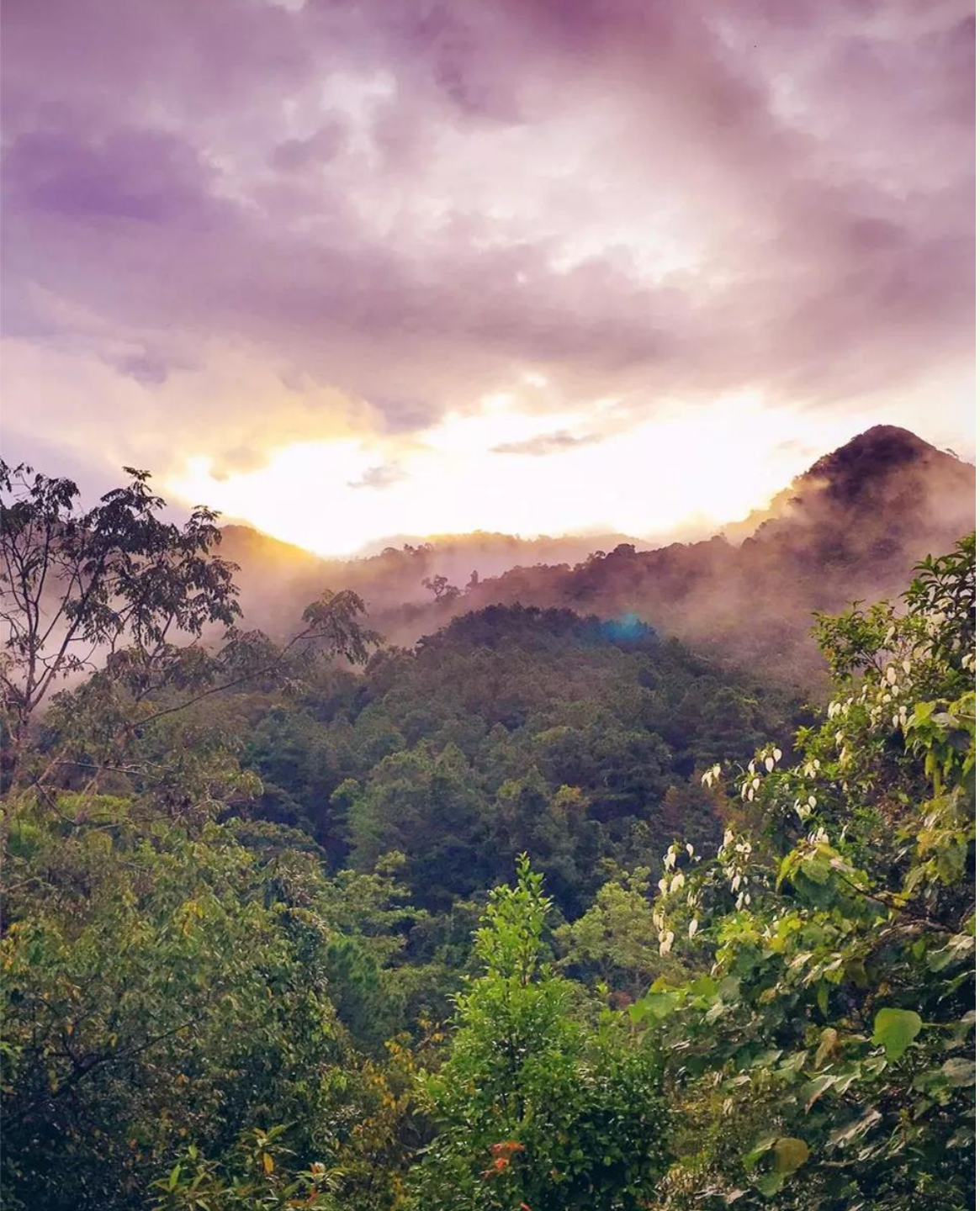
GLOBAL ECOSYSTEM CLASSIFIER

Capstone Project
Data Analytics Bootcamp 2024
Cohort no. 2

neue fische



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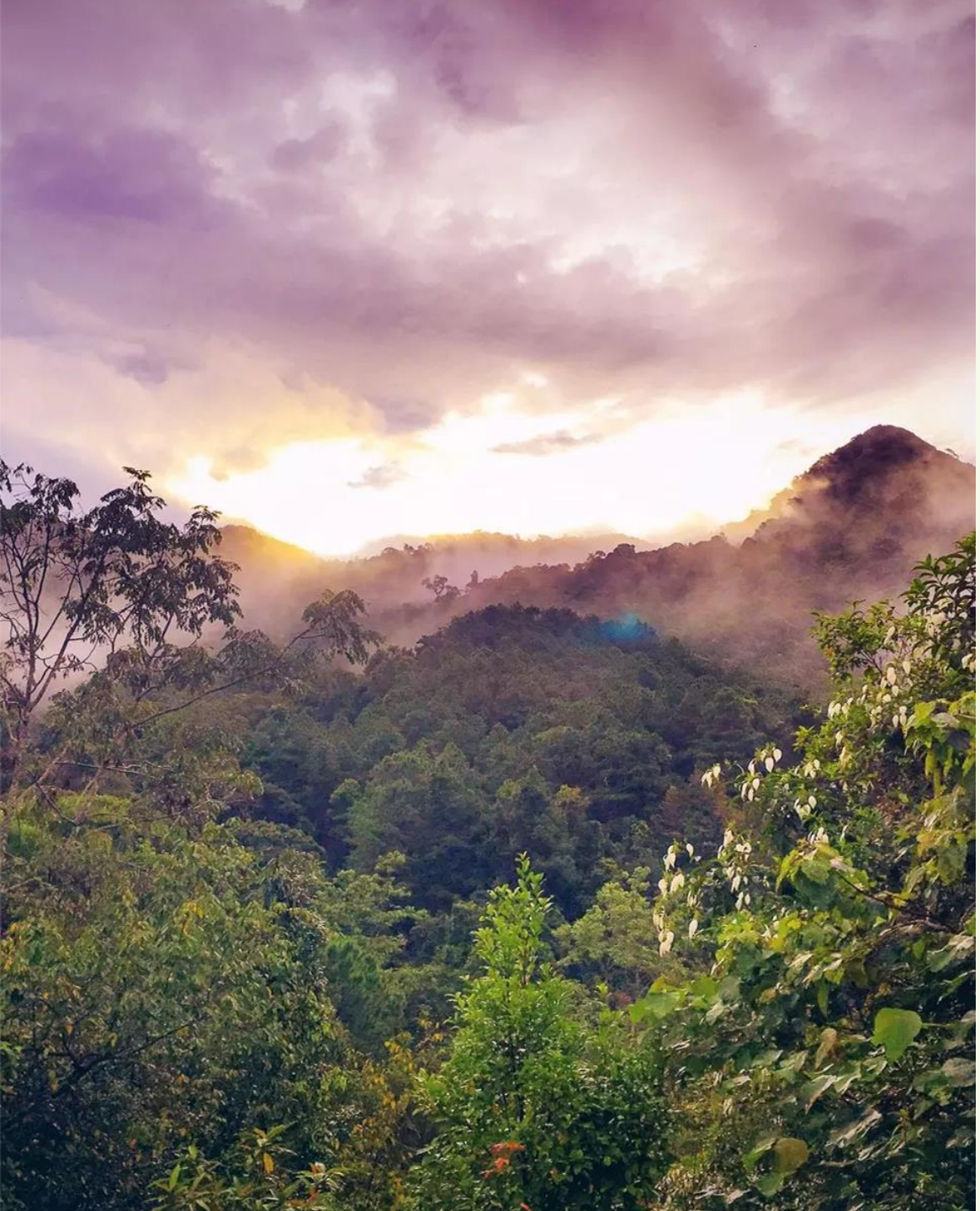
MEET THE TEAM

ALEXANDER SCHMIDT
Data acquisition & maintenance

SOMA PASUMARTHY
Web dev & database maintenance

NOAH KÜRTÖS
Data acquisition & model interpretation

HEIKO FRÄMBS
Project management & communications



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PROJECT GOALS

INTERACTIVE PLATFORM FOR ECOSYSTEM CLASSIFICATION USING HISTORICAL SATELLITE DATA WITH FUTURE CHANGE FORECASTS

DEFINING CLASSIFICATION PARAMETERS

SATELLITE DATASETS

VIIRS **Radiation Data**

MODIS **Vegetation Data**

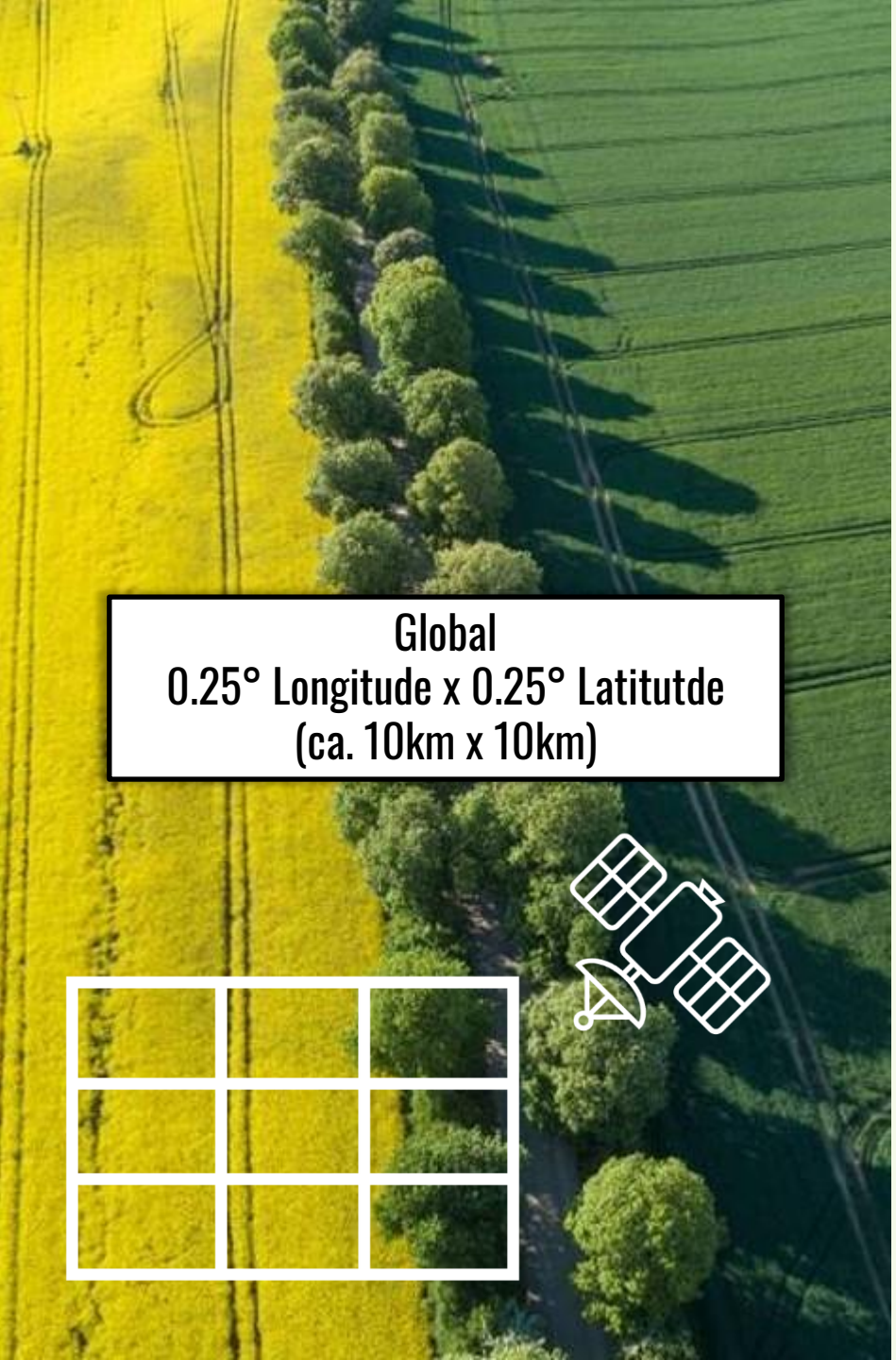
GLDAS **Land Assimilation Data**

ECOSYSTEM CLASS

Urban Buildings

Temperate Forest

Hot Desert



DEFINING CLASSIFICATION PARAMETERS

SATELLITE DATASETS

VIIRS **Radiation Data**

MODIS **Vegetation Data**

GLDAS **Land Assimilation Data**

ECOSYSTEM CLASS

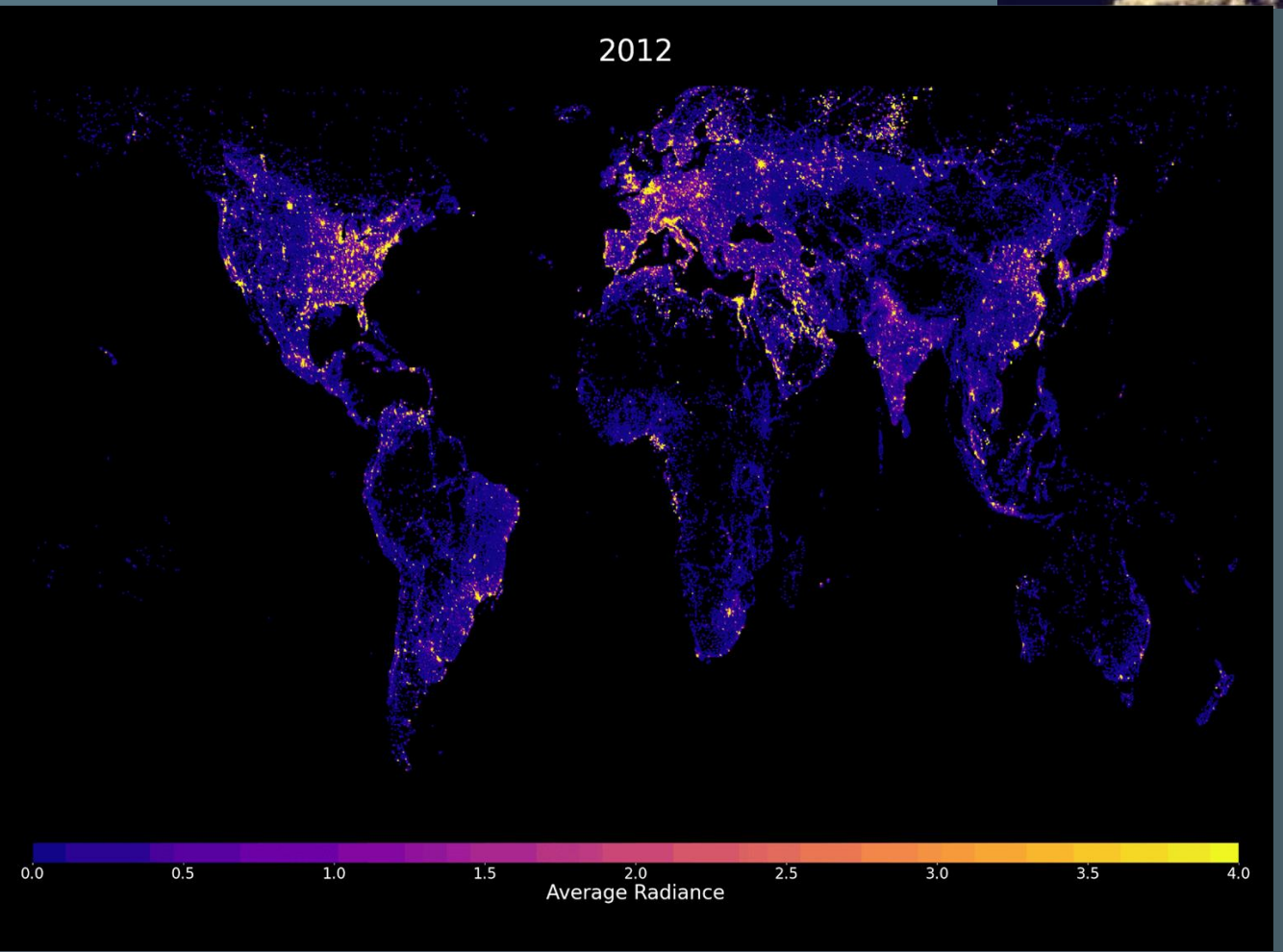
Urban
Buildings

Temperate
Forest

Hot
Desert

VIIRS Radiation Data

Nighttime Lights



DEFINING CLASSIFICATION PARAMETERS

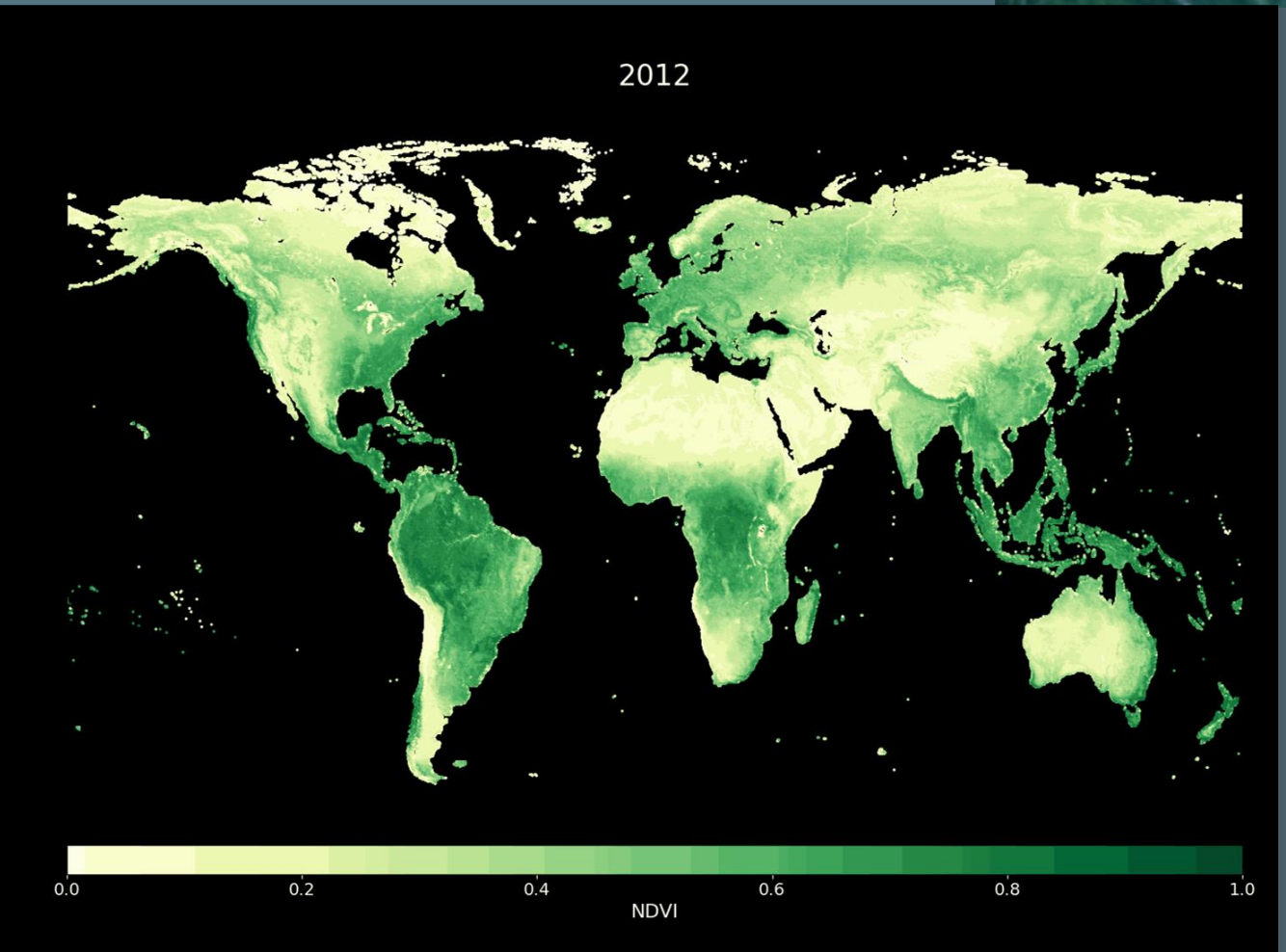
- GLOBAL GRID OF ENVIRONMENTAL PARAMETERS
- PROXIES FOR ECOSYSTEMS
- NIGHT LIGHT: **BUILDINGS**

lat	lon	radiance
30.625	52.875	0.06233251
30.625	53.125	1.1414515
30.625	53.375	0.03187271
30.625	53.625	0.04536383
30.625	54.125	0.0026296854
30.625	54.625	0.03666957
30.625	54.875	0.10111413

year	sum_radiance	%_change
2,012	66,342	-
2,023	86,146	+29.85%

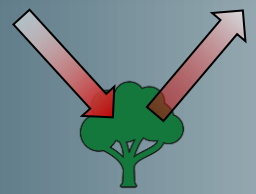
MODIS Vegetation Data

Normalized Difference Vegetation Index (NDVI)



DEFINING CLASSIFICATION PARAMETERS

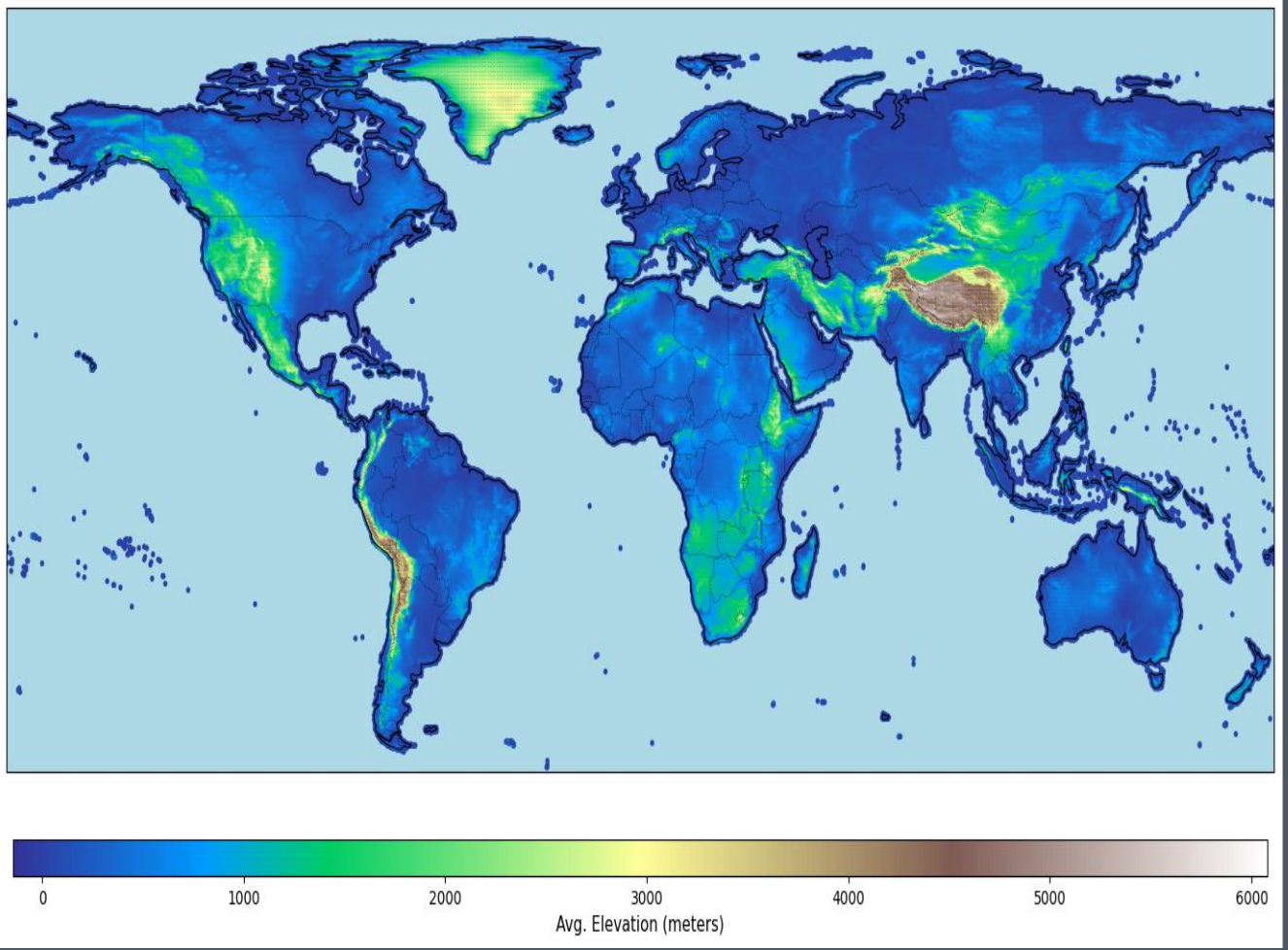
- GLOBAL GRID OF ENVIRONMENTAL PARAMETERS
- PROXIES FOR ECOSYSTEMS
- NDVI: **FORESTS**



	lat	lon	ndvi
	30.625	117.125	0.4907304348
	30.625	117.375	0.3191789855
	30.625	117.625	0.4666876812
	30.625	117.875	0.5306688406
	30.625	118.125	0.6149615942
	30.625	118.375	0.6579163043
	30.625	118.625	0.7000971014
	30.625	118.875	0.5989065217

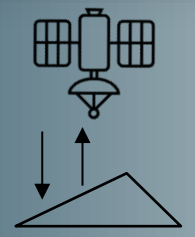
Copernicus

Elevation Data



DEFINING CLASSIFICATION PARAMETERS

- GLOBAL GRID OF ENVIRONMENTAL PARAMETERS
- PROXIES FOR ECOSYSTEMS
- Elevation: **MOUNTAIN**



lat	lon	elevation
30.875	16.625	97.5077493456
30.875	16.875	109.07020696
30.875	17.125	108.6844774882
30.875	17.375	80.8458383348
30.875	17.625	56.5768642426
30.875	17.875	28.7260633045
30.875	18.125	11.3719178836
30.875	20.125	3.2457014322
30.875	20.375	44.3661664327

GLOBAL ECOSYSTEM CLASSIFIER

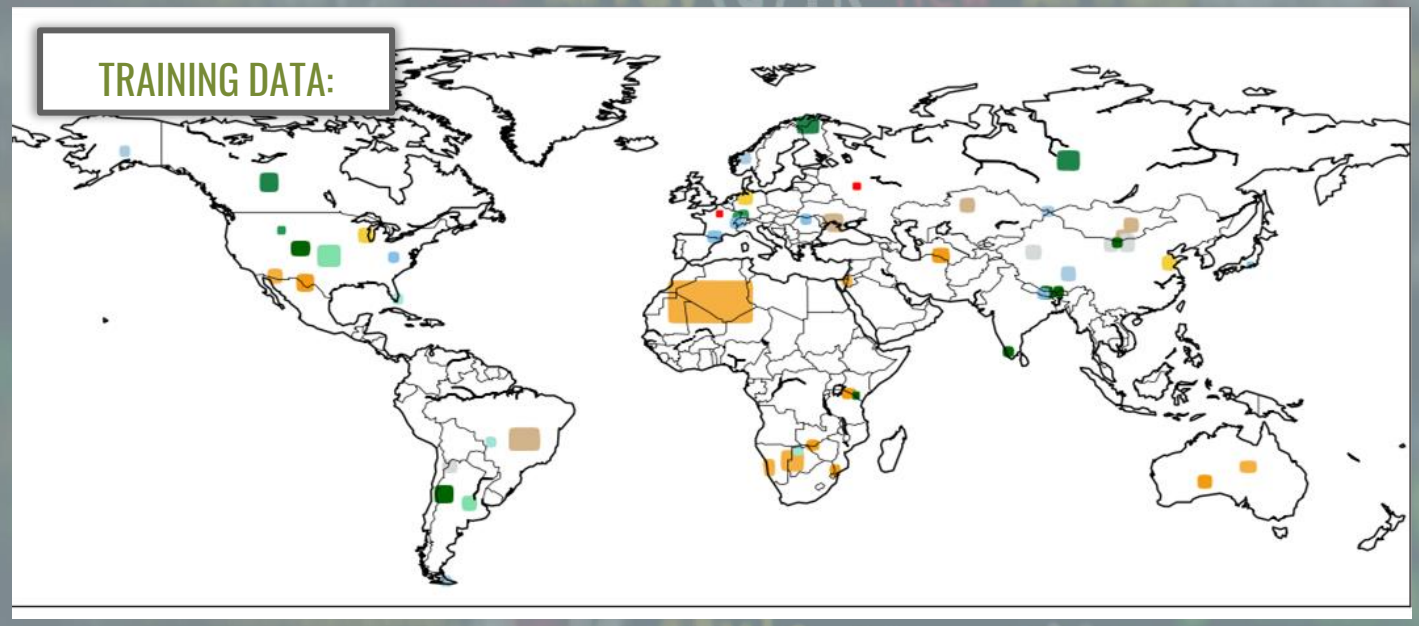
RANDOM FOREST

builds multiple decision trees using random subsets of data and features, then combines their predictions to obtain a singular prediction.

~300 000 pixels

~100 parameters

15 ecosystems



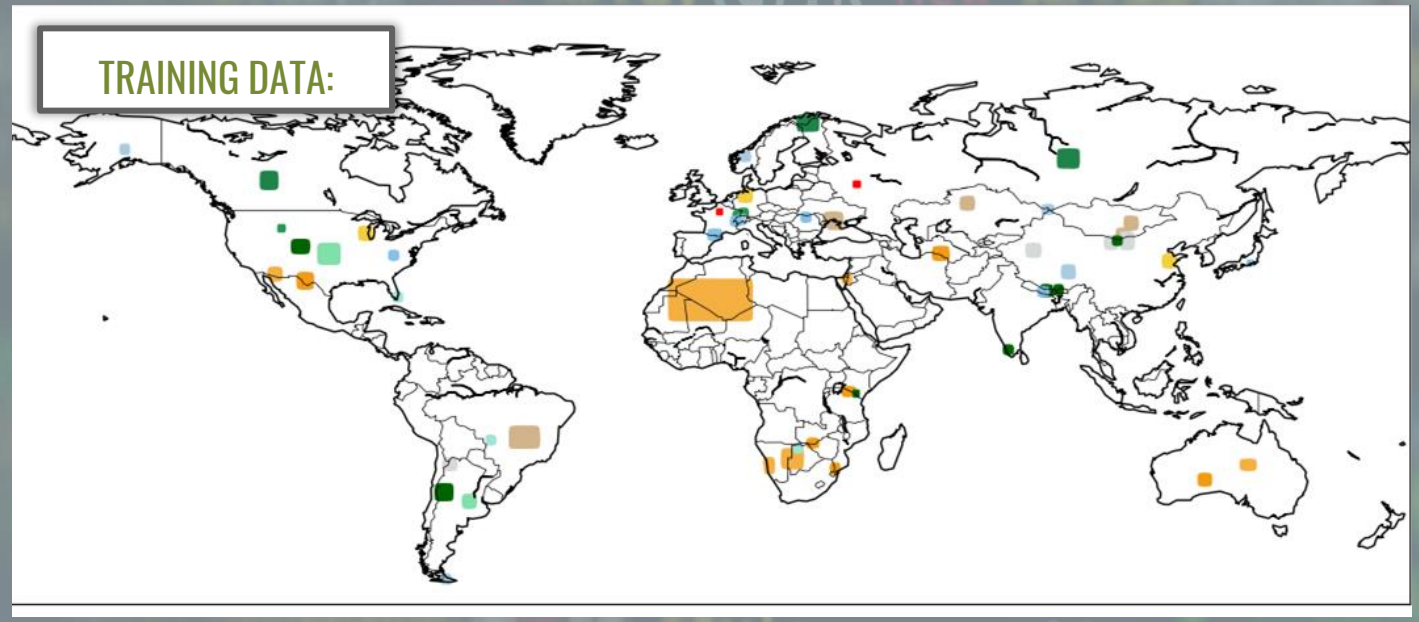
ECOSYSTEM			
Artificial	Urban	Buildings	
	Agriculture	Fields	
Natural	Grassland	Steppe	
		Savannah	
		Meadow	
		Swamp	
	Forest	Boreal/Taiga	
		Temperate	
		Tropical	
	Montane	Montane forest	
		Alpine tundra	
		Subalpine	
	Desert	Semi-arid	
		Cold	
		Hot	

~300 000 pixels

~100 parameters

15 ecosystems

TRAINING DATA:



73 representative training points

10% training data

100 estimators

ECOSYSTEM

Artificial	Urban	Buildings	
	Agriculture	Fields	
Natural	Grassland	Steppe	
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		Alpine tundra	
		Subalpine	
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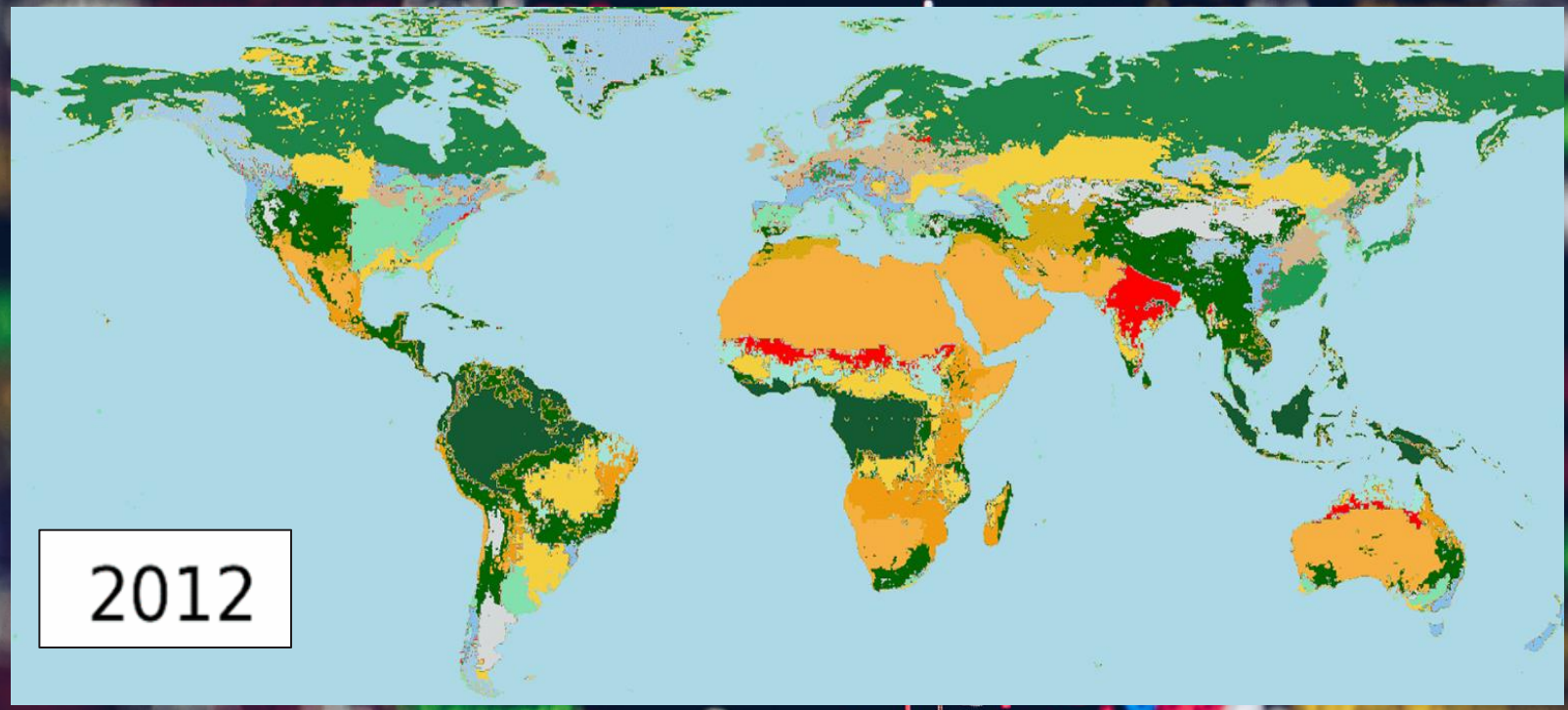
		Hot	

Classification 2012 - 2023

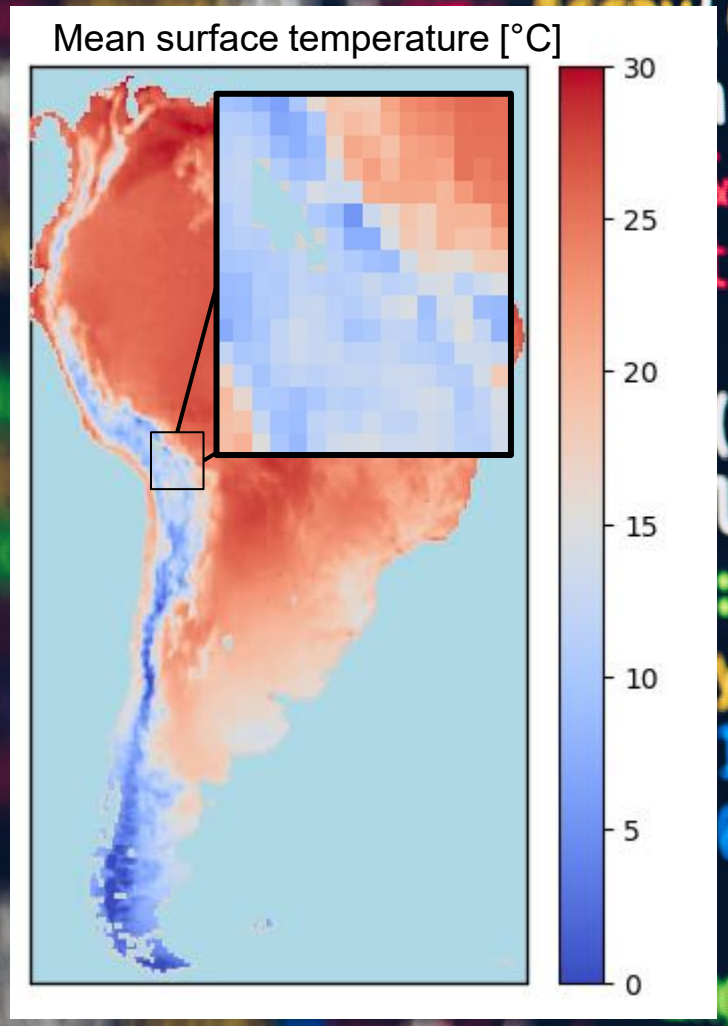


GLOBAL ECOSYSTEM PREDICTIONS

LINEAR REGRESSION

fits a straight line to the data by minimizing the difference between actual and predicted values, modeling the relationship between independent and dependent variables.

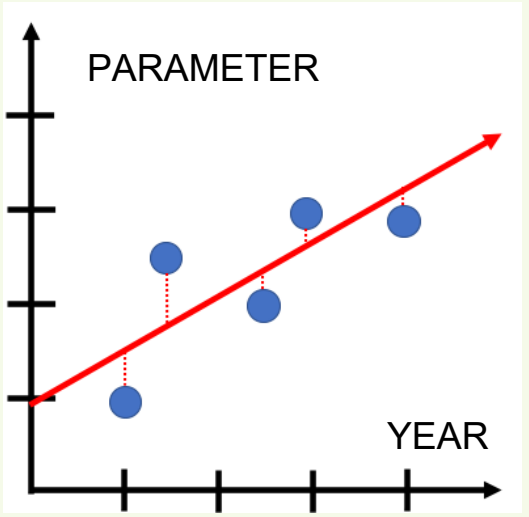
2020



Fetch Parameter per pixel

Linear regression per pixel

Predict values per pixel



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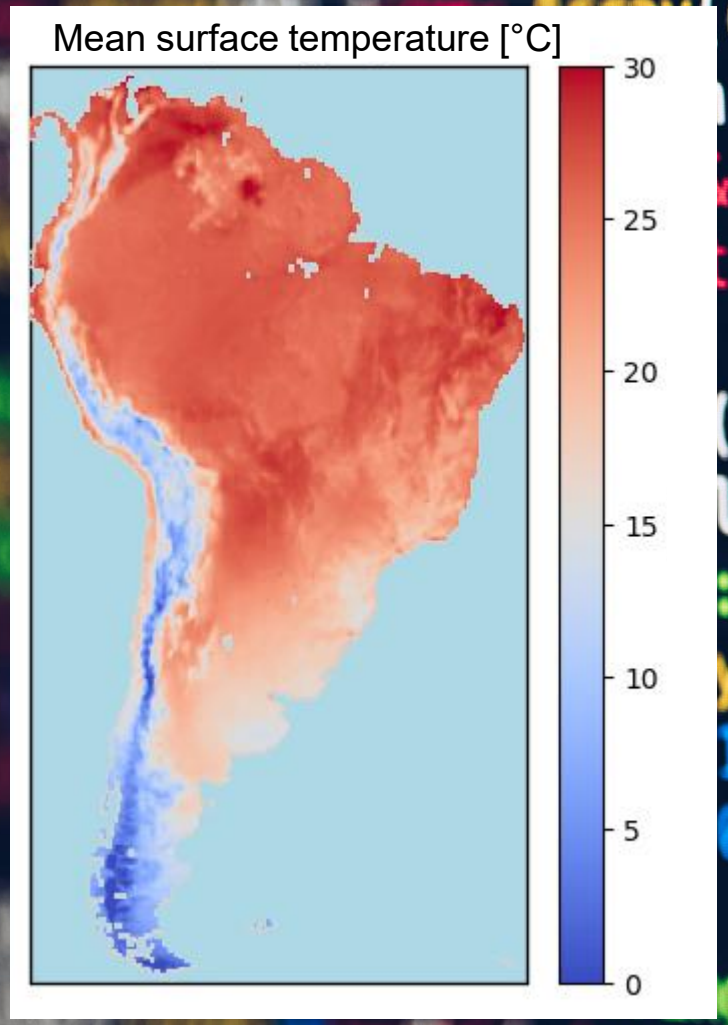
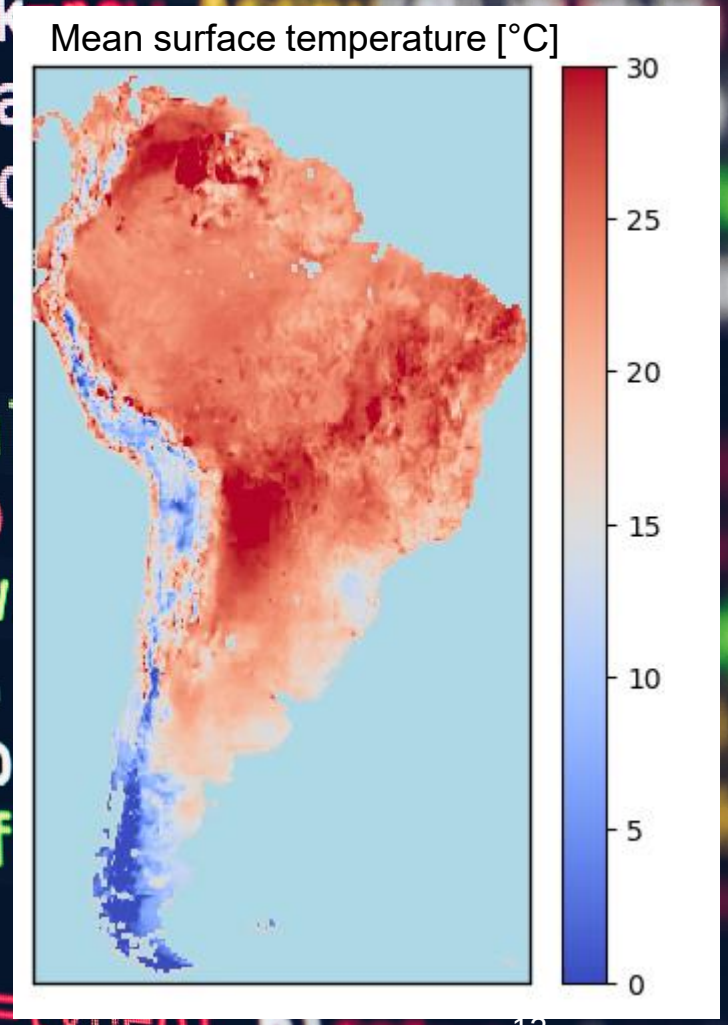


2050



ECOSYSTEM

Artificial	Urban	Buildings	
	Agriculture	Fields	
Natural	Grassland	Steppe	
		Savannah	
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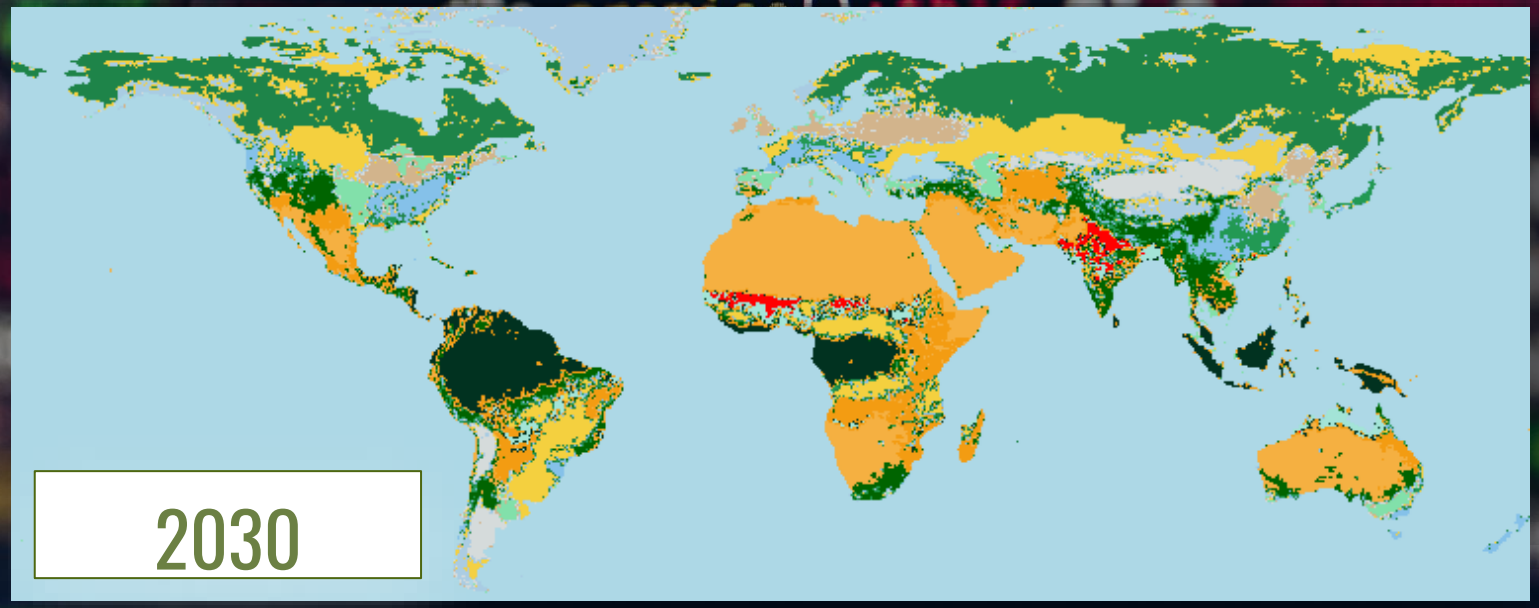
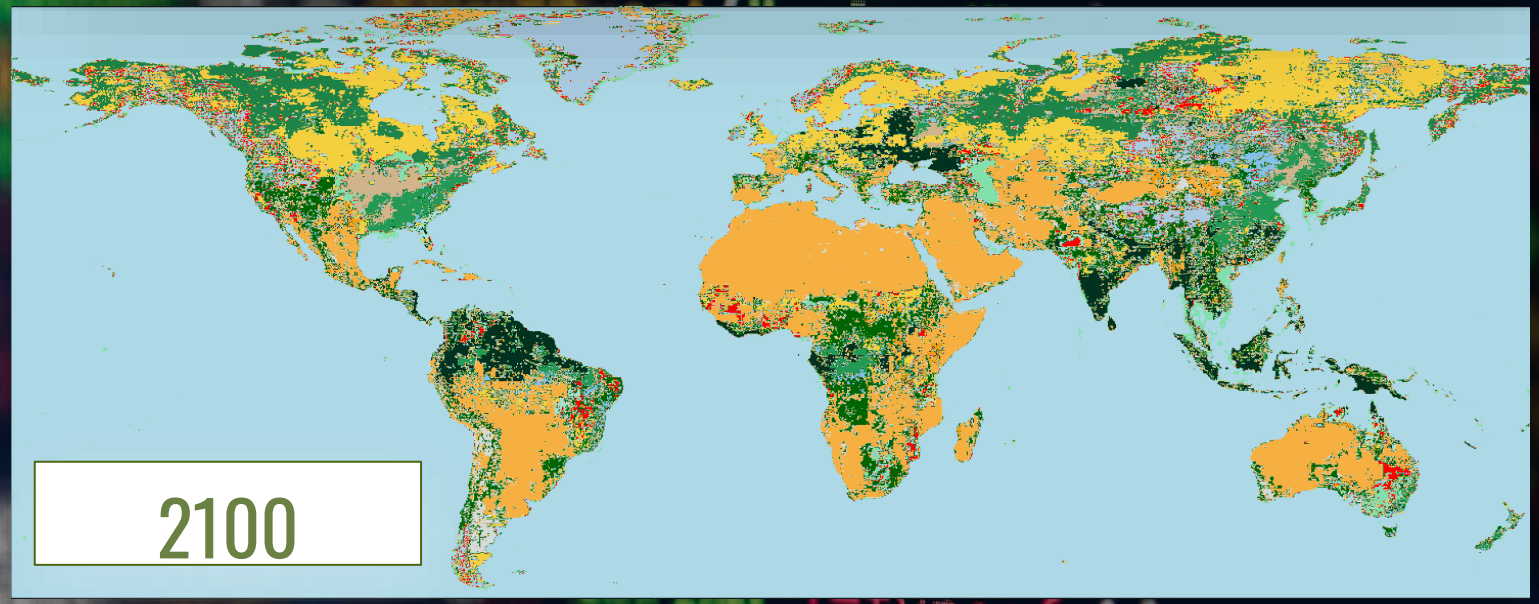




EcoVerse

Frontend:

- 🛠️ React: Dynamic, responsive UI.
- 🎨 HTML5 & CSS3

Backend:

- ⚙️ Node.js & Express
- 💾 PostgreSQL

Interface:

- 🔗 REST APIs: JSON over HTTPS

Hosting & Deployment:

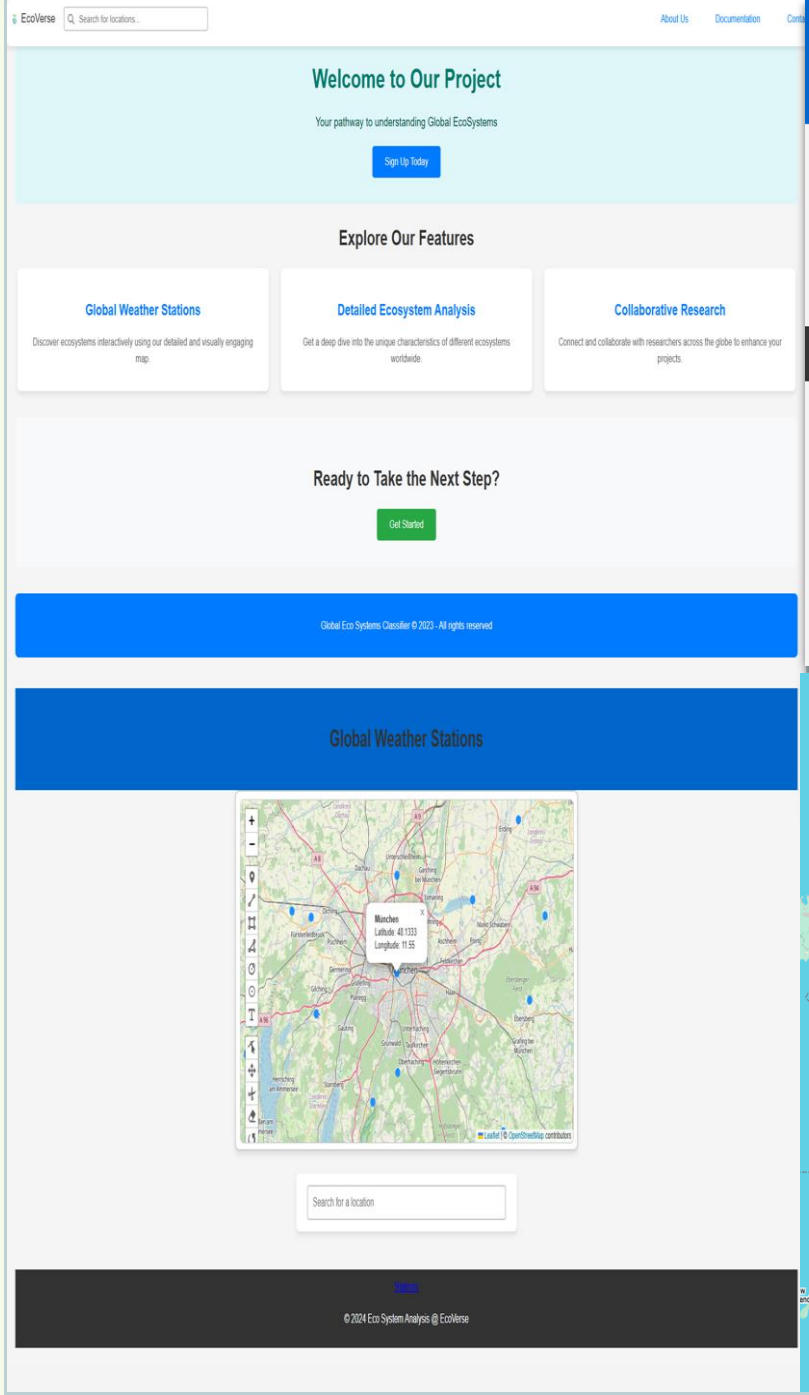
- ☁️ AWS

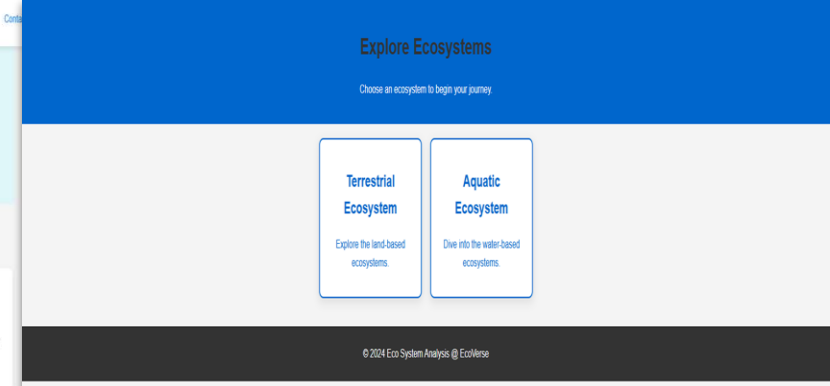
Authentication & Security:

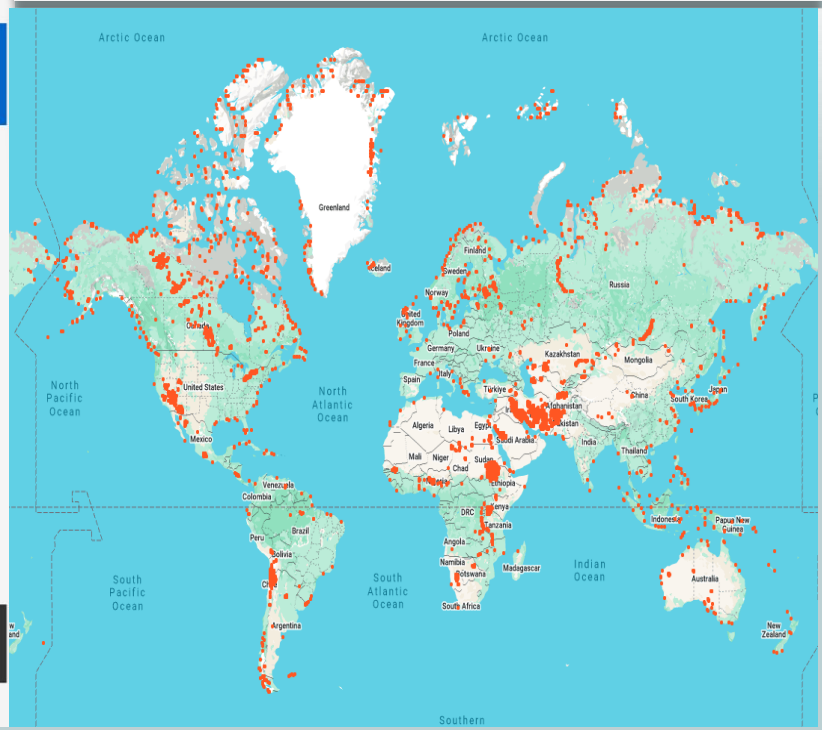
- 🔐 Data Encryption
- 🔑 EcoVerse-Key
- 🔑 EcoVerse-Nonce

Map Component:

- 📍 Leaflet:
- 🌎 Google Maps:







GLOBAL ECOSYSTEM CLASSIFIER

RECAP

- Global ecosystem visualisation and classification
- Validate and improve our model
- Implement predictions into webpage

Thank you
for your attention!

Capstone Project 18.11.2024

“Data Analyst bootcamp” @neuefische

by **Alexander** Schmidt, **Noah** Kürtös, **Soma** Pasumarthy & **Heiko** Främbs

https://github.com/NoahKuertoes/global_ecosystem_classifier

Sources:

https://ladsweb.modaps.eosdis.nasa.gov/missions-and-measurements/viirs/
https://ldas.gsfc.nasa.gov/
https://modis.gsfc.nasa.gov/

Pictures:

Sustainable Investing - Evidence Based Investing
https://www.istockphoto.com/
https://thaddeus-segura.com/linear-regression/
Peru Andes: Lea Graafen & Nawid Albinger