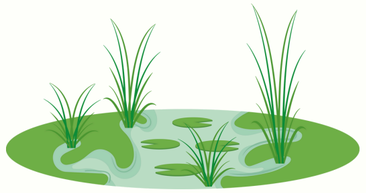
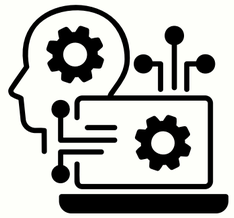
Estimation of Above-Ground Biomass Using Machine Learning from Vegetation Indices

3 App Design Concepts

We’ll be doing 3 different types of things:



Vegetation Indices
(NDVI, SAVI, TNDVI, MSAVI2, SR)



Above Ground Biomass: AGB

Method 1: is the initial approach we'll use in this work. It involves entering the index values into the app and then processing them with the Model Machine to predict the AGB values.

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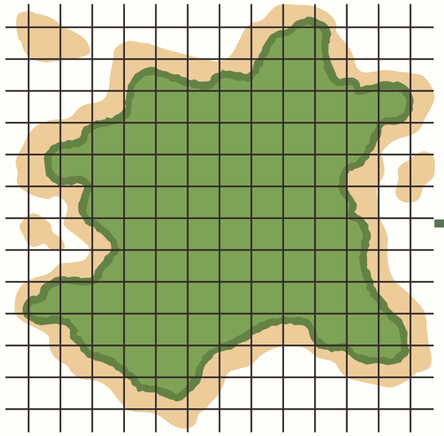
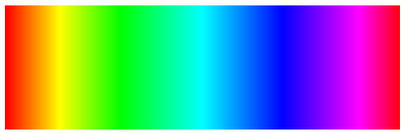
3 App Design Concepts

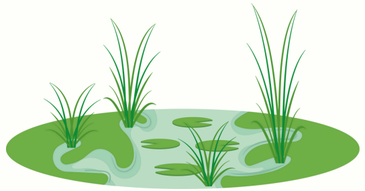
There are three ways we can handle this in the app:



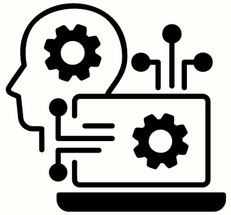
Map



Individual Bands (Blue, Green, Red, NIR)



Vegetation Indices (NDVI, SAVI, TNDVI, MSAVI2, SR)



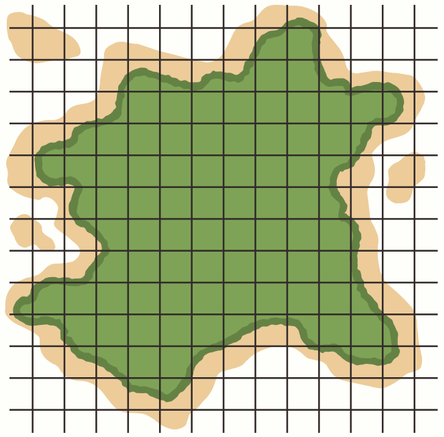
Above Ground Biomass: AGB

Method 2: In this approach, we'll be importing a map. Here's how to do it:

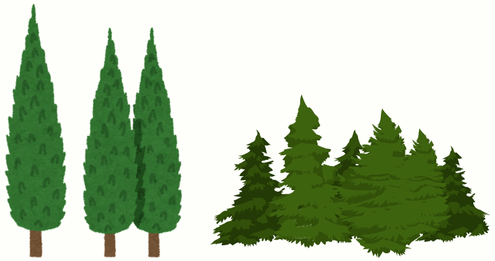
1. Import the map into the app and break it down into pixels. After that, utilize Deep Learning or Neural Networks to pull out the reflectance values for each color, allowing you to obtain the Individual Band values for each color.
2. Once the reflectance values are extracted, the Red and NIR values are plugged into the formula to compute the vegetation index values.
3. Once we have the vegetation index values, we plug those different index values into the model to forecast the AGB values.
4. Next, plug the AGB value into the formula to figure out the Carbon and CO2 values.

3 App Design Concepts

There are three ways we can handle this in the app:



Map



Above Ground Biomass: AGB

Method 3: This approach takes the image down to 1 pixel and uses Deep Learning to pull the AGB value from the map.

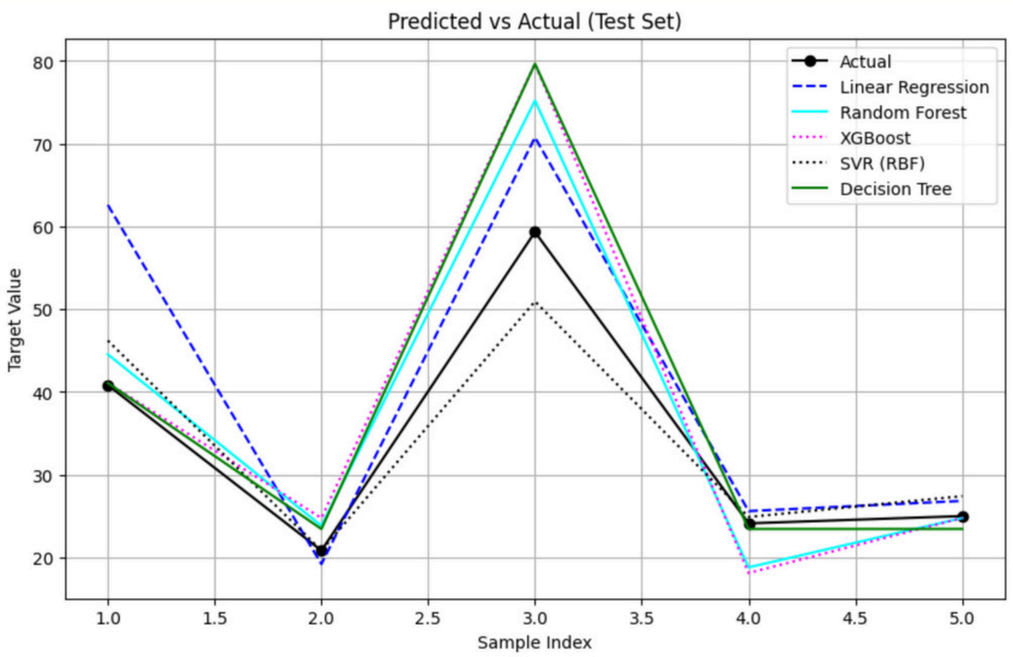
Compare machine learning models

	Model	R^2	RMSE	MAE
0	Linear Regression (All Features)	0.410390	11.075616	7.633421
1	Random Forest Regressor	0.708234	7.791172	5.630508
2	XGBoost Regressor	0.553037	9.643201	6.149083
3	Support Vector Regression (RBF)	0.898362	4.598470	3.390300
4	Decision Tree	0.593202	9.199723	5.084607

Summary of findings

We'll split the data into 50 training sets and 5 testing sets.

- SVR (RBF Kernel) shows an R2 value of 0.898, an RMSE value of 4.598, and an MAE value of 3.390, making it the one with the highest R2 and the lowest error.
- The next model we're looking at is Random Forest, and it has an R2 of 0.708, an RMSE of 7.791, and an MAE of 5.631.
- The other models have values between 0.4 and 0.6, which is decent but not outstanding, especially since there are models that achieve an R2 greater than 0.6.



THANK YOU!