Evaluation and Implementation of High-Spatiotemporal-Resolution Vegetation Datasets Fused from VIIRS and Sentinel-2 Satellite Data on Crop Classification

Student: Ryanna Naithram
Mentor: Yuan Zhou

Cooperative Institute for Satellite Earth System Studies

Objectives:

- Evaluate crop classification accuracy using VIIRS data.
- Identify spatial distribution of major crops in Queen Anne's County, MD.

Data Sources:

- VIIRS Vegetation Index (VI) — NASA/NOAA Visible Infrared Imaging Radiometer Suite, 1 km spatial resolution.
- Fused VIIRS–Sentinel-2 datasets — 20 m resolution, generated by fusing VIIRS data with Sentinel-2 imagery.

Results:

- Fused 20 m VI dataset reached 0.92 accuracy, **outperforming** VIIRS 1 km VI (0.68 accuracy).
- Higher resolution **improved** corn/soybean precision and spatial detail.
- VIIRS 1 km VI **underperformed**, especially for winter wheat.

Study Area: Queen Anne's County

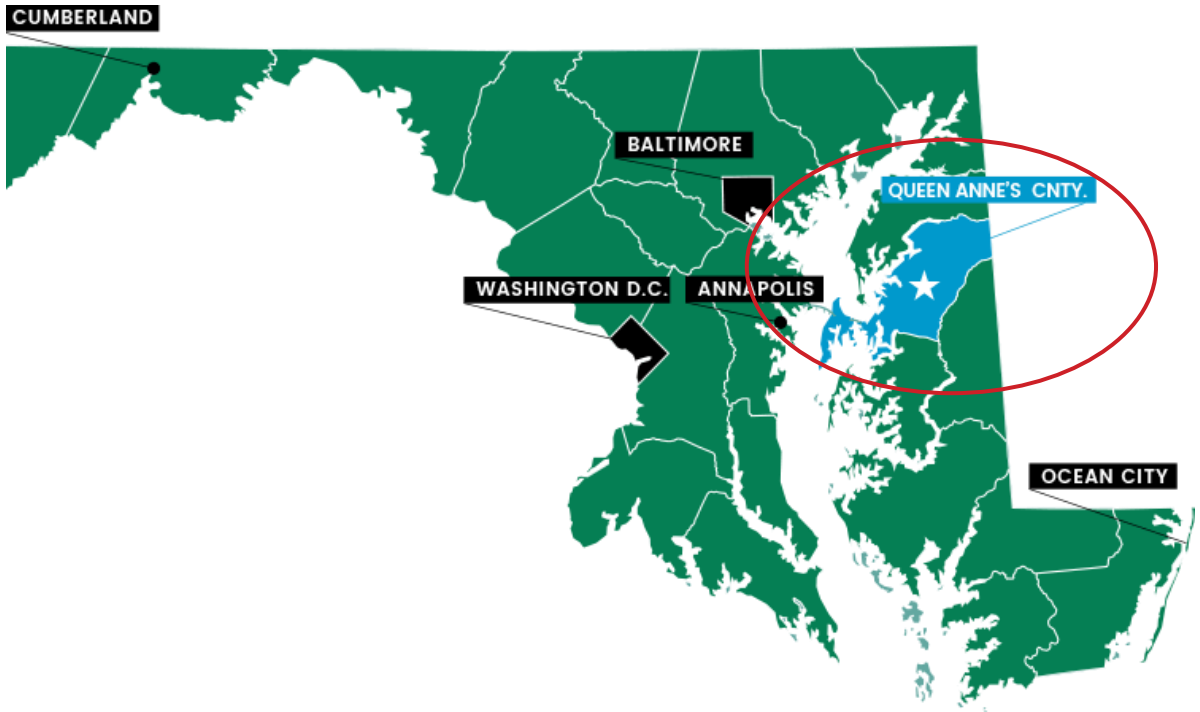
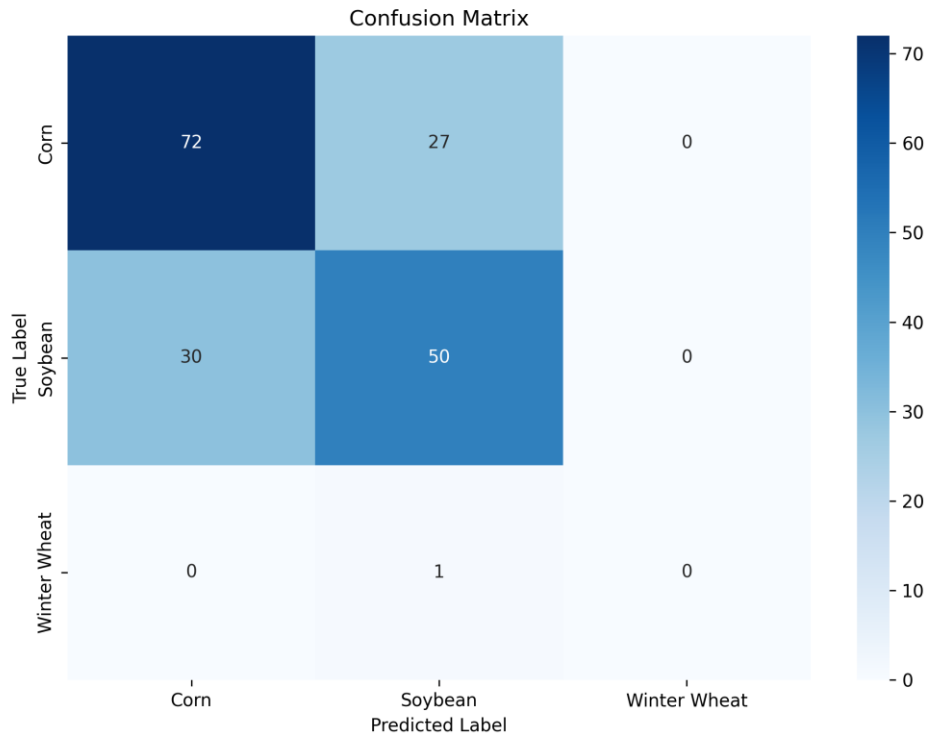
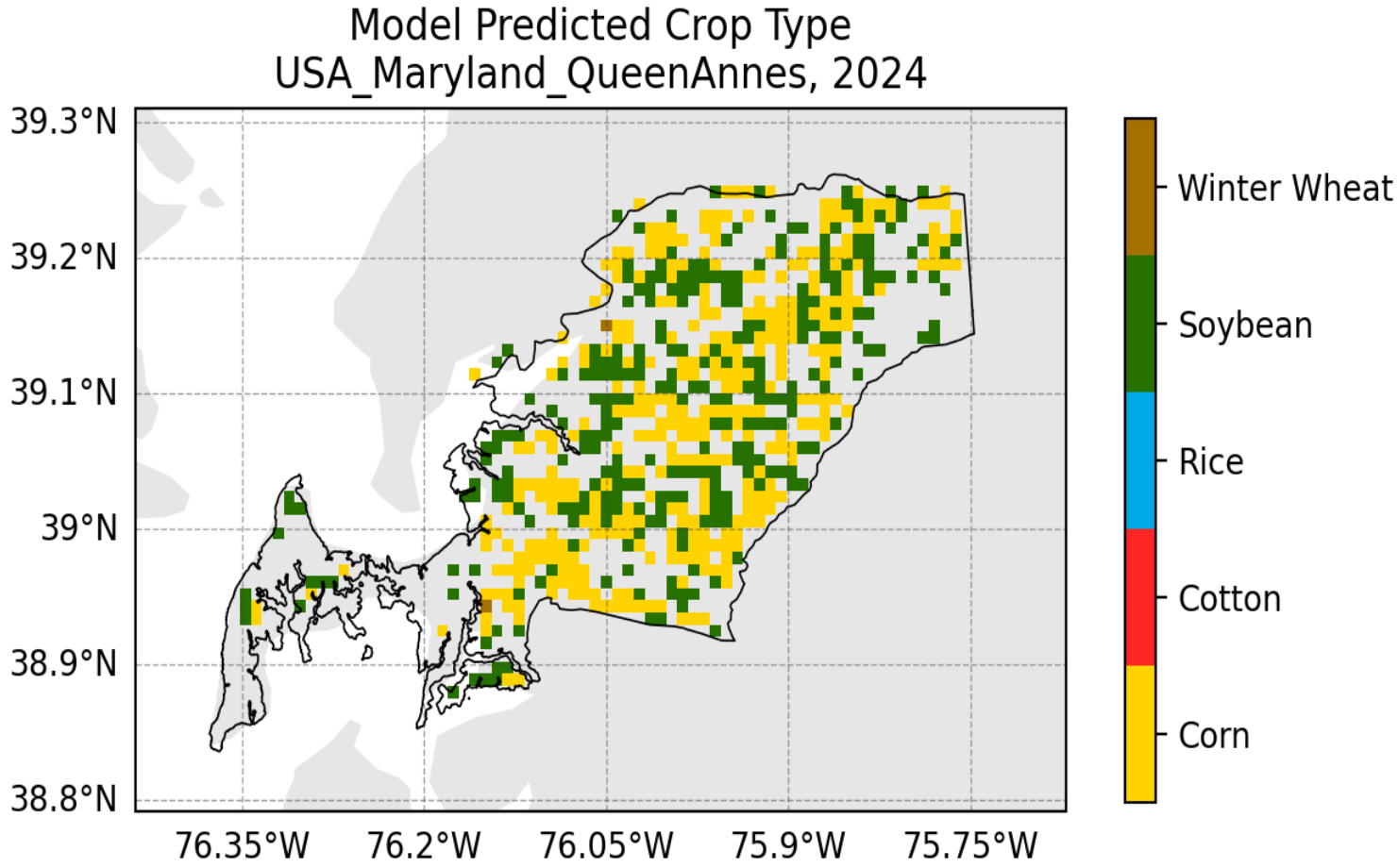


Figure 1. Map of Maryland highlighting focus area, Queen Anne's County.
https://choosequeenannes.com/wp-content/uploads/2018/12/map2.png

Coarse-Resolution (1km) VIIRS VI Data: Lower Accuracy & Spatial Detail

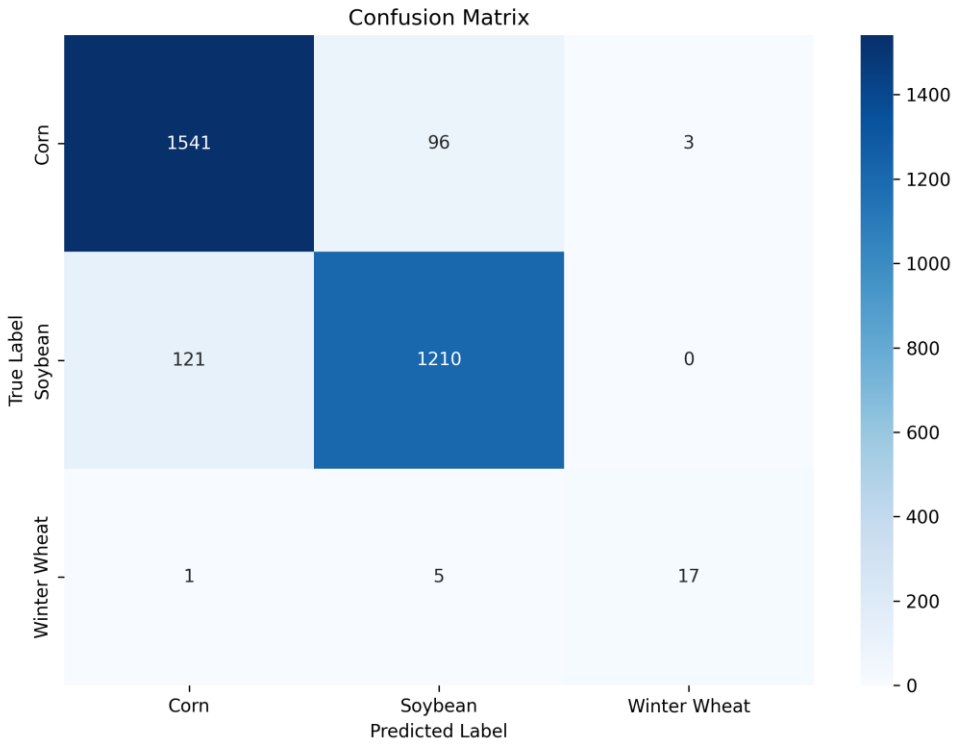


Class	Precision	Recall	F1-Score	Support
Corn	0.71	0.73	0.72	99
Soybean	0.64	0.62	0.63	80
Winter Wheat	0.00	0.00	0.00	1
Accuracy			0.68	180
Macro Avg.	0.45	0.45	0.45	180
Weighted Avg.	0.67	0.68	0.68	180

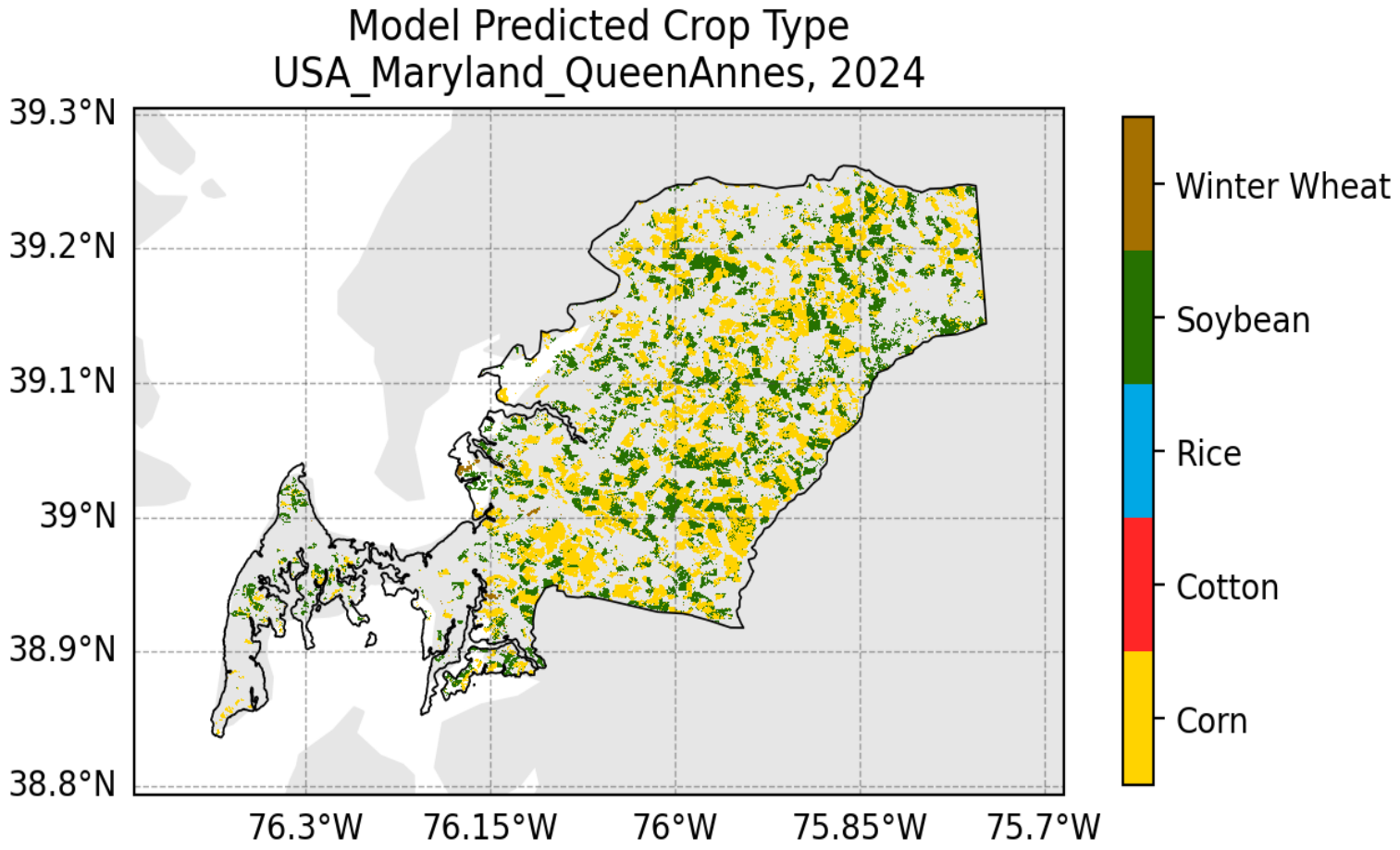


- VIIRS 1 km VI overall accuracy: **0.68** — lower precision/recall for corn and soybean, **minimal detection** of winter wheat.
- Coarse 1 km resolution likely mixed crops in single pixels and **reduced** classification performance.
- Crop zones **less distinct** compared to **higher-resolution** results.

Higher-Resolution (20m) Fused VI Data: Improved Classification Accuracy



Class	Precision	Recall	F1-Score	Support
Corn	0.93	0.94	0.93	1640
Soybean	0.92	0.91	0.92	1331
Winter Wheat	0.85	0.74	0.79	23
Accuracy				2994
Macro Avg.	0.90	0.86	0.88	2994
Weighted Avg.	0.92	0.92	0.92	2994



- Fused 20 m VI overall accuracy: **0.92** — high precision/recall for corn and soybean (>0.91).
- Winter wheat performance **improved** (0.79 F1) despite smaller sample size.
- Compared to VIIRS 1 km results, the 20 m fused data shows **notably higher accuracy and finer spatial detail** in crop distribution.