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Crop Monitoring and Nutrient Prediction Using Satellite Imagery and Soil Data

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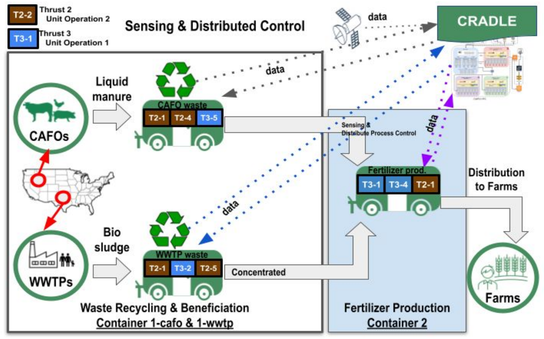
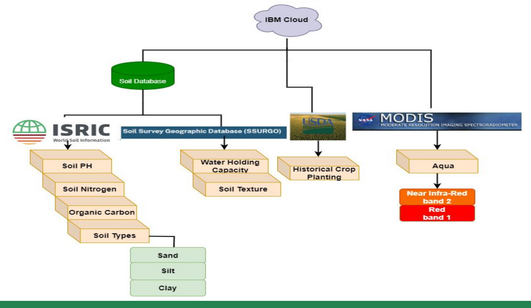
CASFER
An NSF Engineering Research Center

Introduction

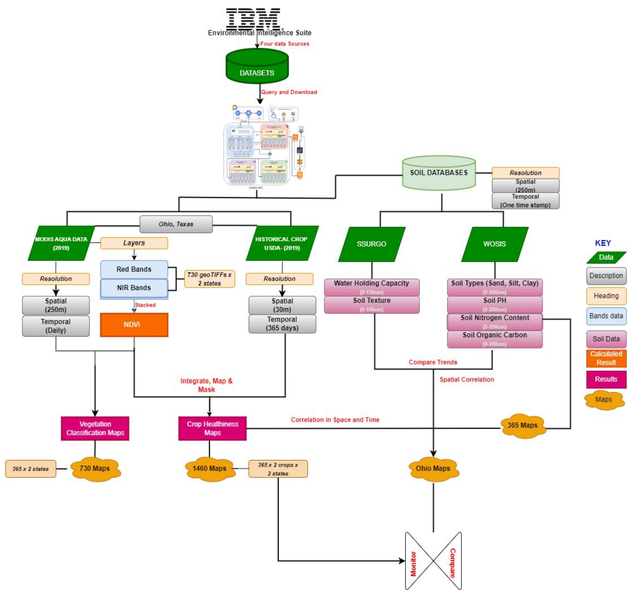


- Aiming to resolve the problem of land application and proper crop planting among farmers
- Mitigate continual runoff from CAFOS/WWTPs into streams.
- Geospatially locate where to position CASFER trailers

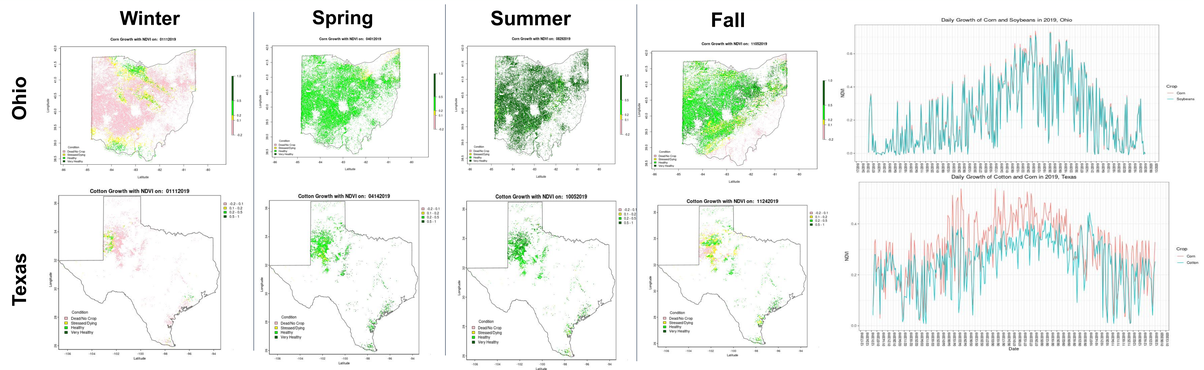
Datasets



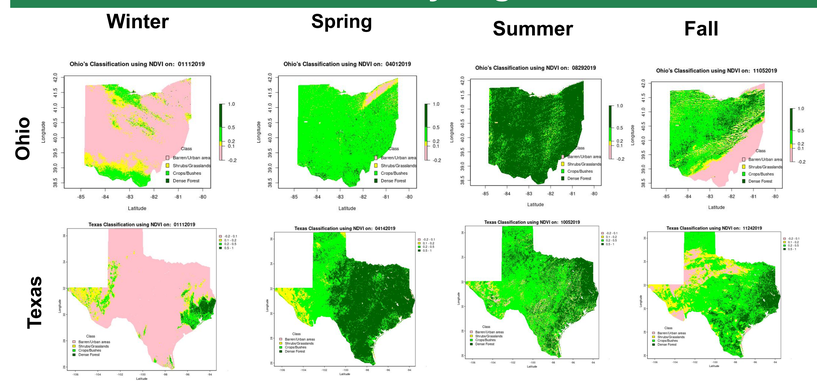
Methodology



Daily Crop Heathiness



Daily Vegetation Classification



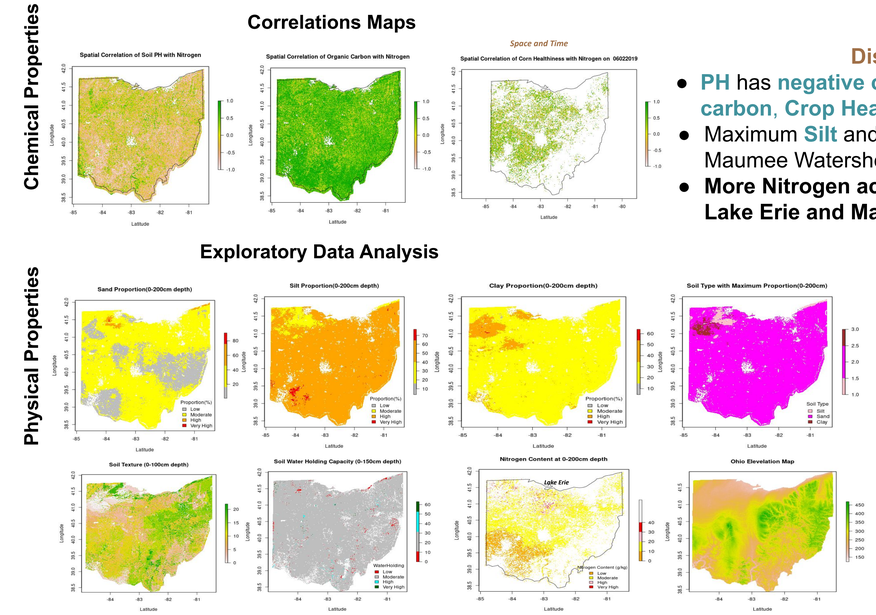
Vegetation Index

- MODIS Aqua(red and NIR bands) were used to classify **Ohio and Texas**
- Classification is done with the calculated NDVI.

Normalized Difference Vegetation Index $NDVI = \frac{NIR - Red}{NIR + Red}$

- **Ohio**: Corn and Soybeans we
- **Texas**: Cotton and Corn
- The greenness of the crops vary with seasons, location and crop type.

Nutrient Distribution



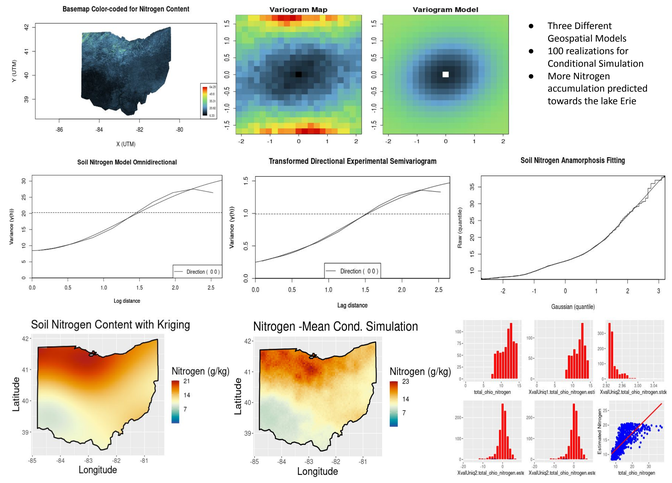
Discoveries

- PH has negative correlation with Organic carbon, Crop Healthiness and Nitrogen
- Maximum Silt and Clay towards the Maumee Watershed
- **More Nitrogen accumulation towards Lake Erie and Maumee Watersheds**

Nutrients Flow

- Relatively low texture towards Lake Erie correlates with silt and clay available in that area
- Moderate Holding of water/nutrient across the state
- High Nitrogen accumulation in low elevation area

Predictive Model



- Three Different Geospatial Models
- 100 realizations for Conditional Simulation
- More Nitrogen accumulation predicted towards the lake Erie

Takeaways

- **Gains**
  - Recommendation for farmers on crops planting and getting the locations where crops are planted.
  - Monitoring metrics is needed in land application in pursuit of the nitrogen circular economy
  - More nitrogen accumulation/contamination in known areas (help to know where to position CASFER trailers)
  - Soil Nutrient Distribution:
    - Useful on when land application is appropriate
    - Knowing right crop, best soil and time to plant
    - Soil properties correlate with nutrient flow
- **Next**
  - Integrate weather, CAFOS, water and elevation data
  - Explore other soil properties

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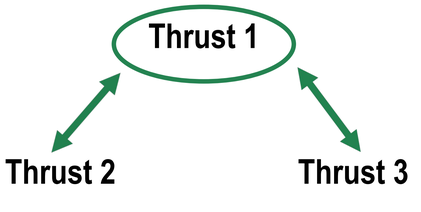
Thrust Interactions



Animations