

# Land Cover and Land Use Monitoring with AI

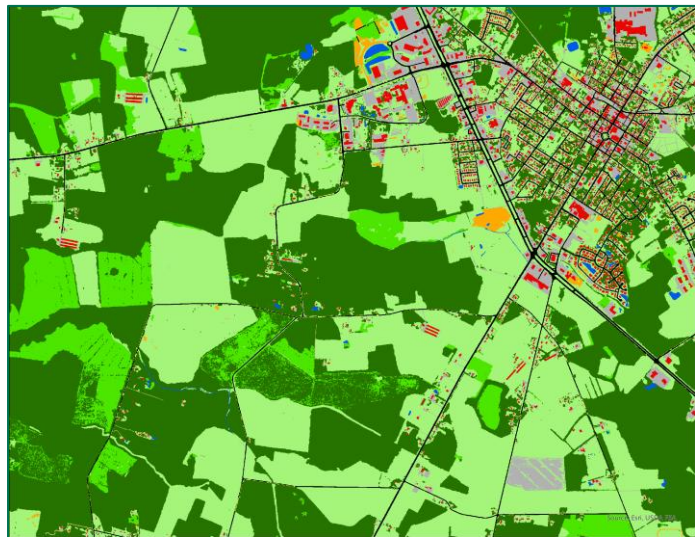
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**Scientific and Technical Advisory Committee**  
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# What is Land Cover (LC) and Land Use (LU) and How is it Used?

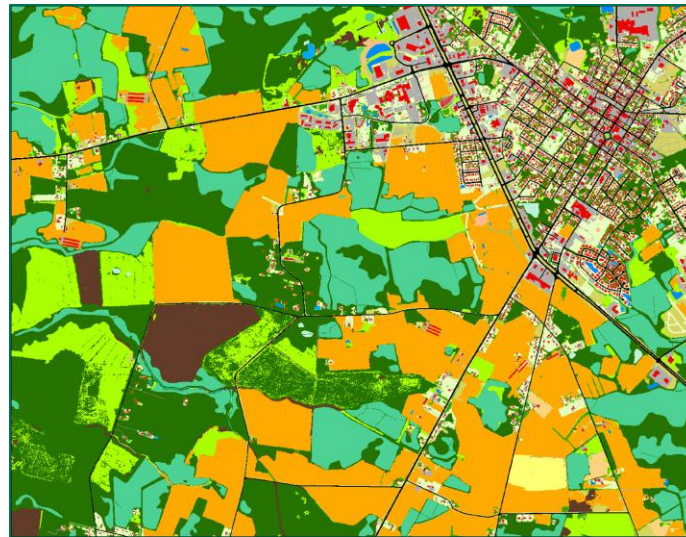
## Land Cover (LC)

The physical characteristics of the land surface (e.g., impervious, tree canopy, herbaceous)



## Land Use (LU)

How humans use the land (e.g., residential, agriculture, recreation)



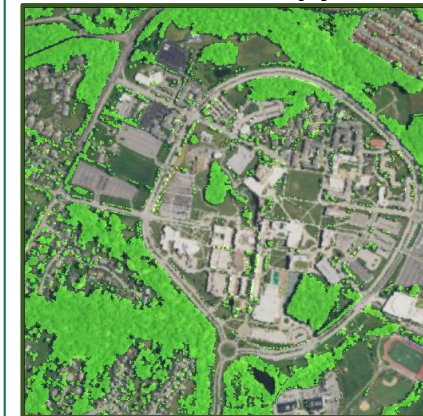
Examples of land uses that are herbaceous land cover



## Land Cover and Land Use Applications

- Monitoring loads via the Chesapeake Assessment Scenario Tool (CAST) and the Chesapeake Bay Program's watershed model
- Reporting progress towards many Chesapeake Bay Program outcomes
- Provides a "starting point" for planning conservation and restoration activities

Tree Canopy



Riparian Forest



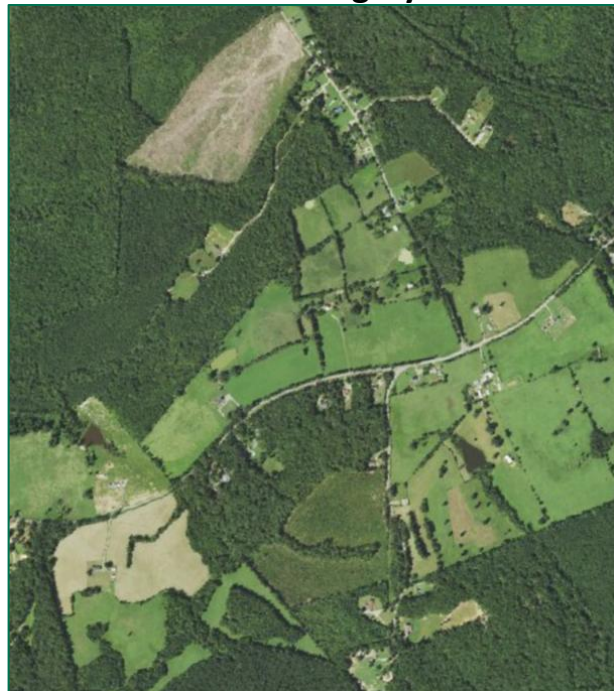


# Where is AI Most Promising to Monitor LC and LU in the Chesapeake?

## Land Use: Differentiating Vegetation Types

- Vegetation is often represented as a single land cover, but contains many land uses
- Target classes to separate crop, pasture, hay, harvested forest, turf

NAIP Imagery

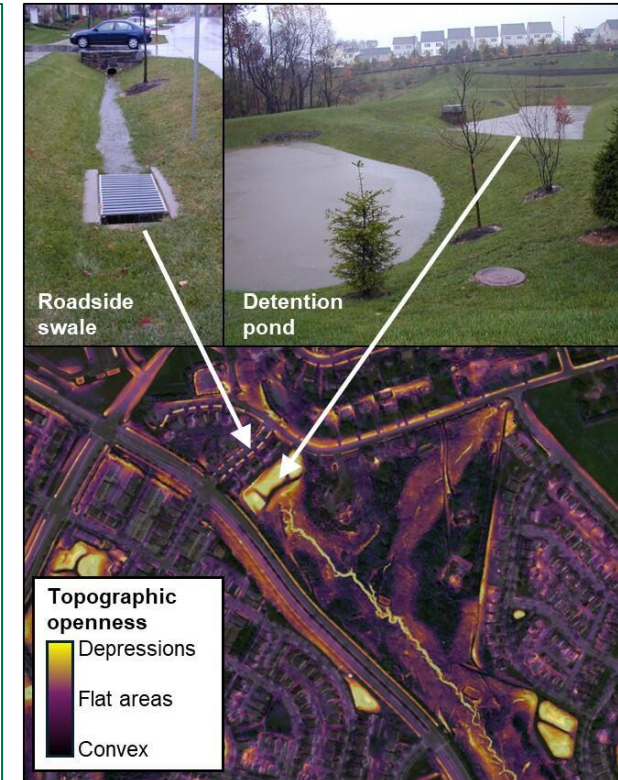


Low Vegetation Land Cover



## Best Management Practices (BMPs)

- Scaling the detection of BMPs from pilot projects to the watershed
  - Stormwater facility footprints and storage volumes (Metes et al., 2026)
  - Cover crops – Chesapeake Bay Foundation in collaboration with Dean Hively (USGS)
  - Riparian Forest Buffers – Alex Gunnerson (Koniag Government Services)



<https://www.usgs.gov/media/images/stormwater-follows-through-a-roadside-swale-and-stormwater-detention-pond-clarksburg>

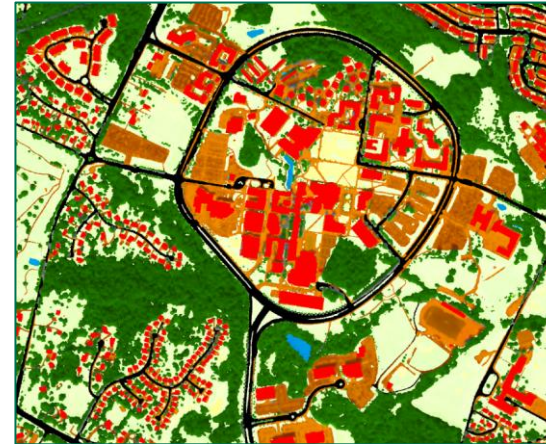
# Where is the Value of AI in Monitoring LC and LU Uncertain?

## Accurate Mapping of Land Cover Change (LCC)

- Monitoring the landscape with high accuracy means correctly capturing how and where the landscape is changing
- There are many change detection algorithms that aim to map these changes, but this has yet to be explored with AI/ML (Artificial Intelligence/Machine Learning)
- Current AI/ML change approach is to map two dates of Land Cover (with high accuracy), and then difference them
- However, this results in a “change” map filled with noise
- Post processing methods are used to try to “filter” out the noise, but often remove real change with it

**What's real and what's noise?**

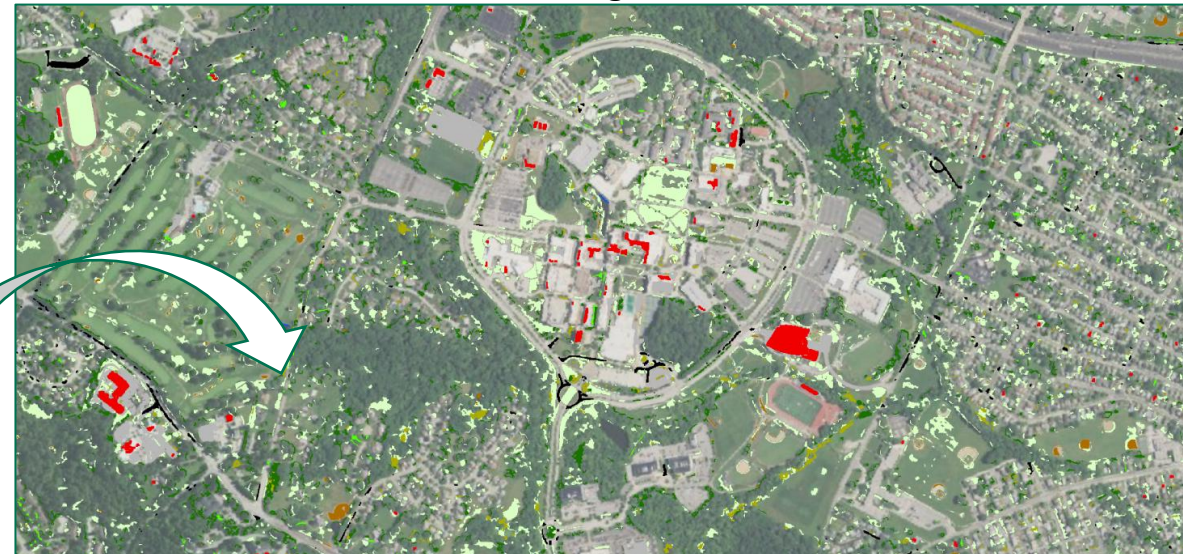
Land Cover: 2013



Land Cover: 2021



Land Cover Change: 2013 - 2021



# Closing Thoughts

**AI is a powerful tool for monitoring land cover with promise for discerning land uses, BUT...**

**Manual QA is needed to ensure accuracy of land cover data**

Common land cover accuracy assessments miss errors in AI-derived land cover products that can only be identified by a human looking at the data

**High-quality and abundant training data is required for AI applications to be useful**

AI results will only be as good as its training data.

Collection of high-quality and abundant in-field data should be prioritized.

**Continued investment in field data is necessary for keeping AI-derived products relevant**

Continued investment in training data over time is needed for AI results to improve.

If future AI models and current AI models train on the same data, what will we be learning?

# Citations

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