Wetland Mapping and Monitoring GIT-funding Proposals

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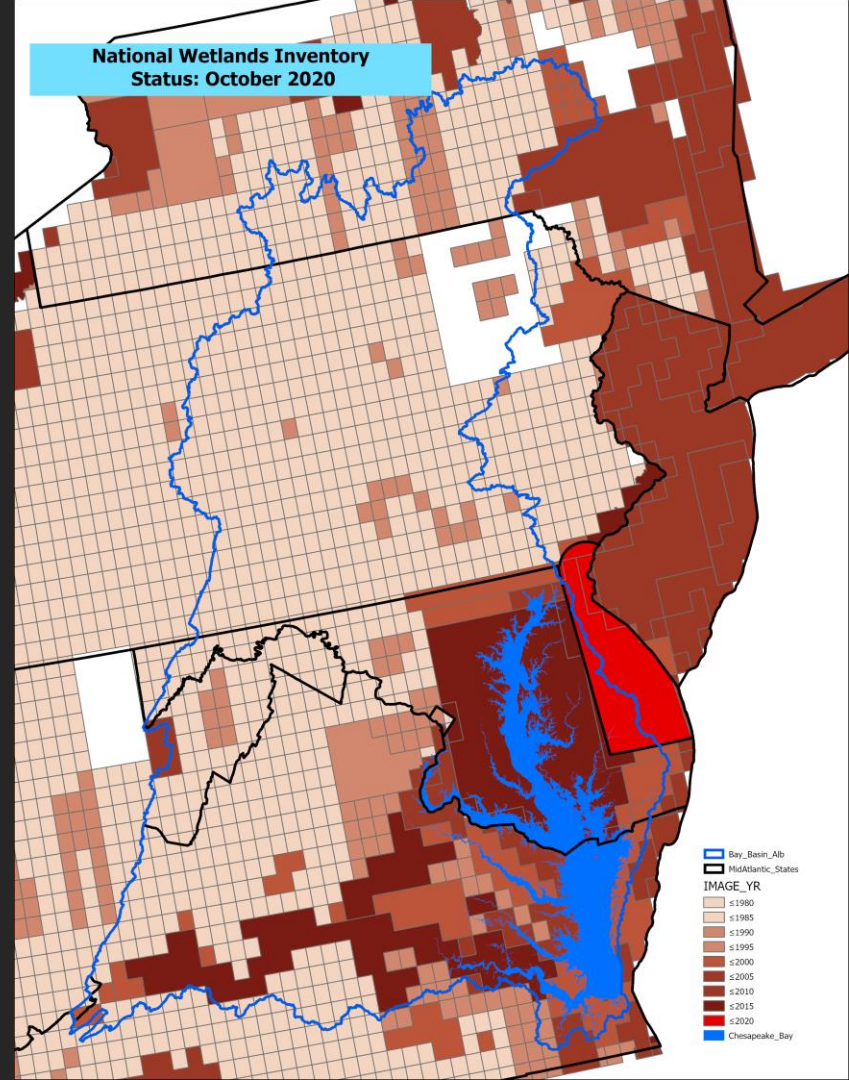
**Wetlands Workgroup**
August 16, 2022

Problem #1: Outdated Wetlands Maps

Status of National Wetlands Inventory as of October 2020

Vintage of the NWI in the majority of watershed is ~1980's

National Wetlands Inventory
Status: October 2020

Bay_Basin_Alb
MidAtlantic_States
IMAGE_YR
≤1980
≤1985
≤1990
≤1995
≤2000
≤2005
≤2010
≤2015
≤2020
Chesapeake_Bay

≋USGS

Solution #1 Project Idea- expanded predictive modeling of wetlands presence/absence

Develop machine-learning methods to better map potential wetlands with aerial imagery and landforms derived from LiDAR.
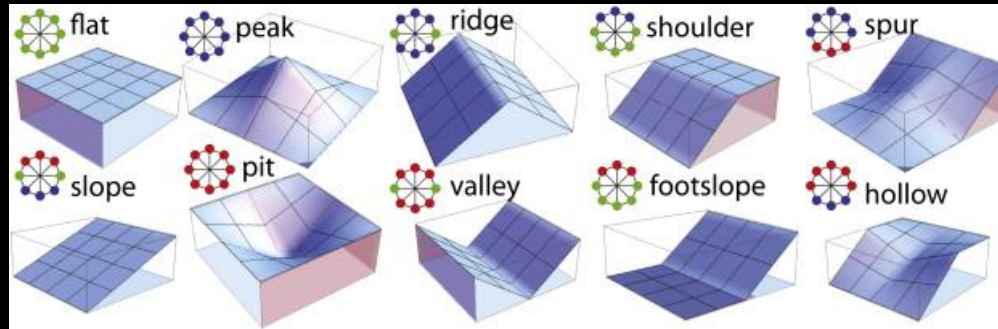
Solution #1 Project Idea- expanded predictive modeling of wetlands presence/absence

Expands on the mapping of potential wetlands produced for the Pennsylvania portion of the watershed by the University of Vermont to the Virginia portion of the watershed, leveraging the use of machine learning techniques and fusion of moderate and high-resolution imagery.

NWI

UVM
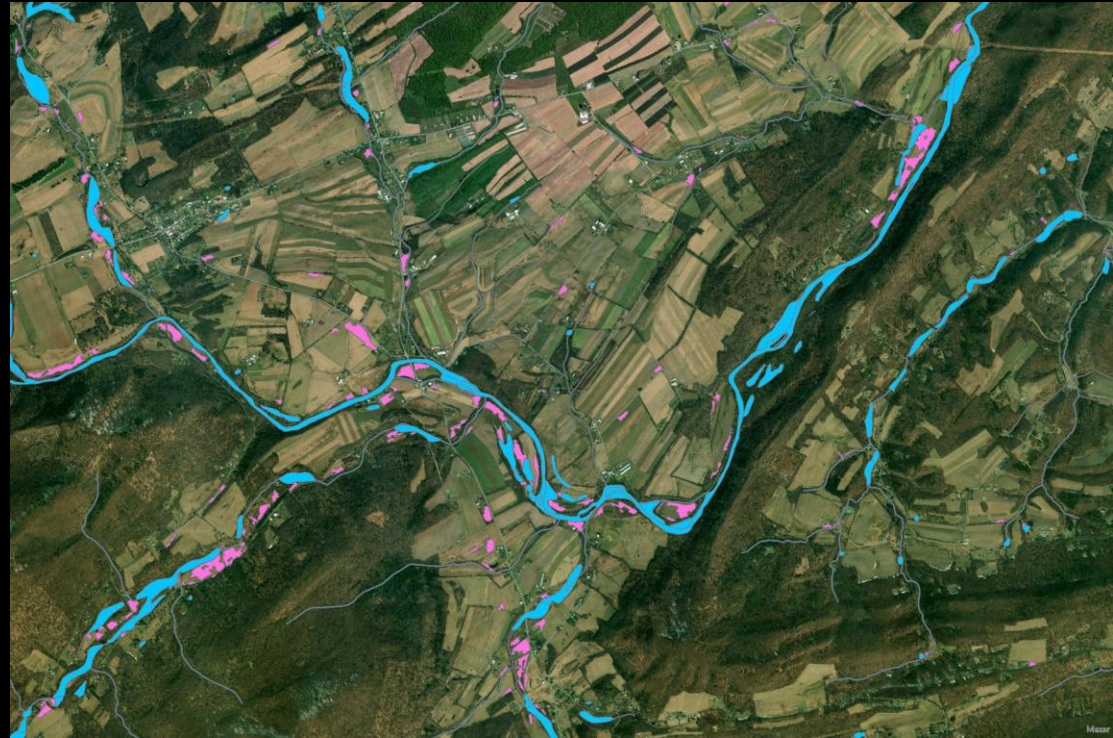
CBP Complete Land Use/Cover Classification (62 classes)

1. Water (11)
1.1 Estuarine/ Marine
1.2 Lentic (fresh)
    1.2.1 Lakes and reservoirs
    1.2.2 Riverine ponds
    1.2.3 Terrene ponds
1.3 Lotic
    1.3.1 Channels
        1.3.1.1 Open Channel
        1.3.1.2 Tree Canopy over Channel
        1.3.1.3 Culverted
    1.3.2.Ditches
        1.3.2.1 Open Ditch
        1.3.2.2 Tree Canopy over Ditch
        1.3.2.3 Culverted

2. Development (12)
2.1 Impervious
    2.1.1 Roads
    2.1.2 Structures
    2.1.3 Other Impervious
    2.1.4 Tree Canopy (TC) over Impervious
        2.1.4.1 TC over Roads
        2.1.4.2 TC over Structures
        2.1.4.3 TC over Other Impervious
2.2 Pervious
    2.2.1 Turf Grass
    2.2.2 Transitional- barren

2.2.3 Suspended Succession
    2.2.3.1 Barren
    2.2.3.2 Herbaceous
    2.2.3.3 Scrub-shrub
2.2.4 Tree Canopy over Turf Grass

3. Natural (forest-related) (7)
3.1 Forest (>= 1 acre, 240-ft width)
3.2 Other Tree Canopy
3.3 Harvested Forest (<= 3 years)
    3.3.1 Barren
    3.3.2 Herbaceous
3.4 Natural Succession (> 3 years)
    3.4.1 Barren
    3.4.2 Herbaceous
    3.4.3 Scrub-shrub

4. Production (17)
4.1 Agriculture
    4.1.1 Cropland
        4.1.1.1 Barren
        4.1.1.2 Herbaceous
    4.1.2 Pasture/Hay
        4.1.2.1 Barren
        4.1.2.2 Herbaceous
        4.1.2.3 Scrub-shrub
    4.1.3 Orchard/vineyard
        4.1.3.1 Barren
        4.1.3.2 Herbaceous
        4.1.3.3 Scrub-shrub

4.1.4 Animal Operations
    4.1.4.1 Impervious
    4.1.4.2 Barren
    4.1.4.3 Herbaceous
4.2 Solar fields
    4.2.1 Impervious
    4.2.2 Pervious
        4.2.2.1 Barren
        4.2.2.2 Herbaceous
        4.2.2.3 Scrub-shrub
4.3 Extractive (active mines)
    4.3.1 Barren
    4.3.2 Impervious

5. Wetlands and Water Margins (16)
5.1 Tidal
    5.1.1 Barren
    5.1.2 Herbaceous
    5.1.3 Scrub-shrub
    5.1.4 Other Tree Canopy
    5.1.5 Forest
5.2 Riverine (Non-tidal)
    5.2.1 Barren
    5.2.2 Herbaceous
    5.2.3 Scrub-shrub
    5.2.4 Other Tree Canopy
    5.2.5 Forest
5.3 Terrene/Isolated (Non-tidal)
    5.3.1 Barren
    5.3.2 Herbaceous
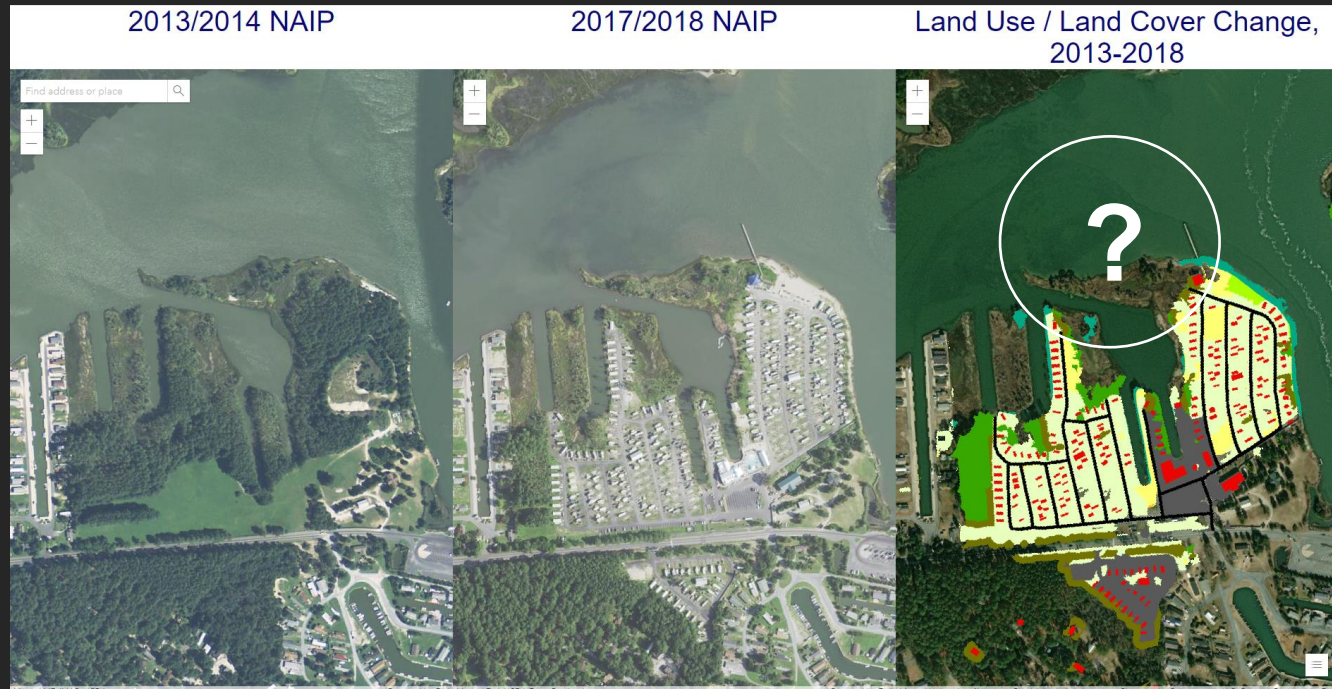   5.3.3 Scrub-shrub
    5.3.4 Other Tree Canopy
    5.3.5 Forest
5.4 Bare shore

Note: White, yellow, and blue classes are mapped for 2017/18. Grey classes will be added to all years with the production of the 2021/22 LULC.
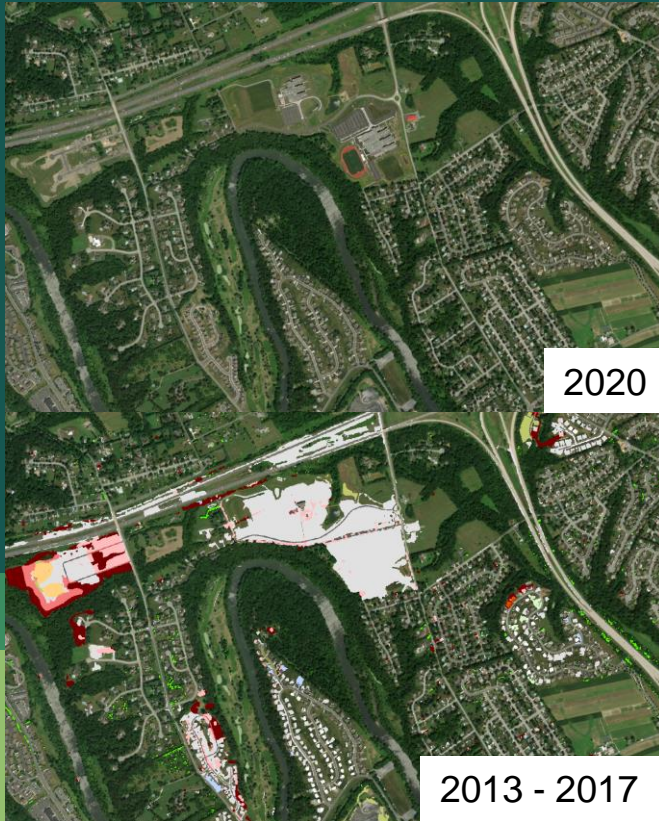
Problem #2: Monitoring change in wetland condition is difficult

- Available LiDAR and aerial image acquisition are not coordinated with tidal stage.

- Wetland functions can be altered and impaired due to hydrologic and vegetation changes that may not be apparent in available imagery.

- Wetland functions can also be altered and impaired due to land use changes adjacent to and/or upslope of wetlands.

http://lulc-1718.cicapps.org/

2013/2014 NAIP   2017/2018 NAIP   Land Use / Land Cover Change, 2013-2018

USGS

Problem #2 Monitoring Wetland Change: Land Use Methods and Metrics Outcome
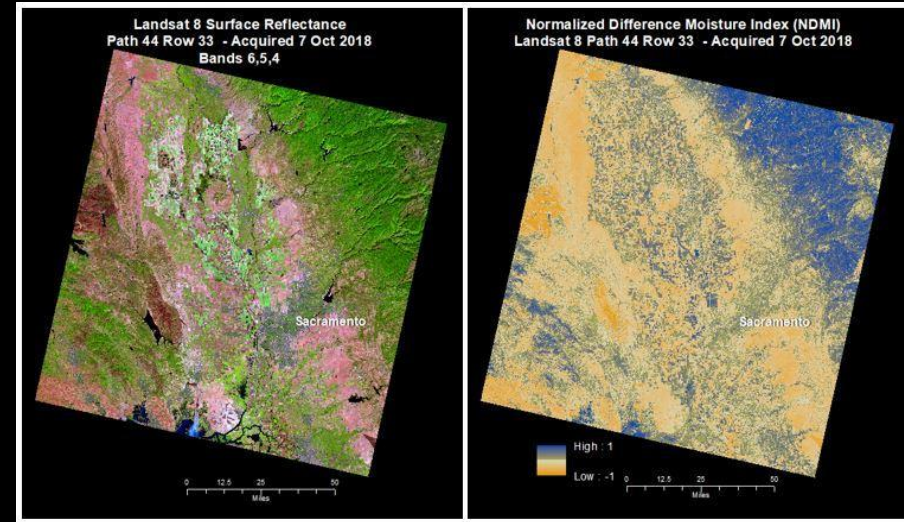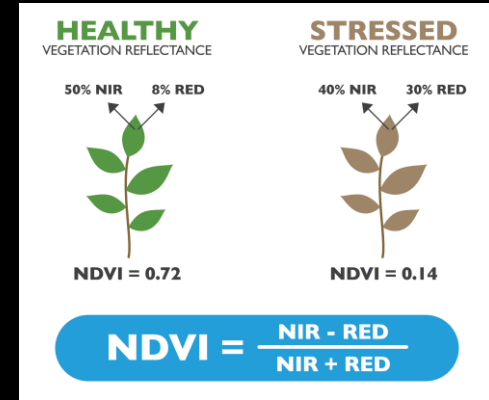
2020

2013 - 2017

1. Measure rate of farmland, forest and **wetland conversion**, and the extent and rate of change in impervious surface coverage.

2. Quantify the potential impacts of land conversion to water quality, healthy watersheds and communities.

3. Launch a public awareness campaign to share this information with citizens, local governments, elected officials and stakeholders.
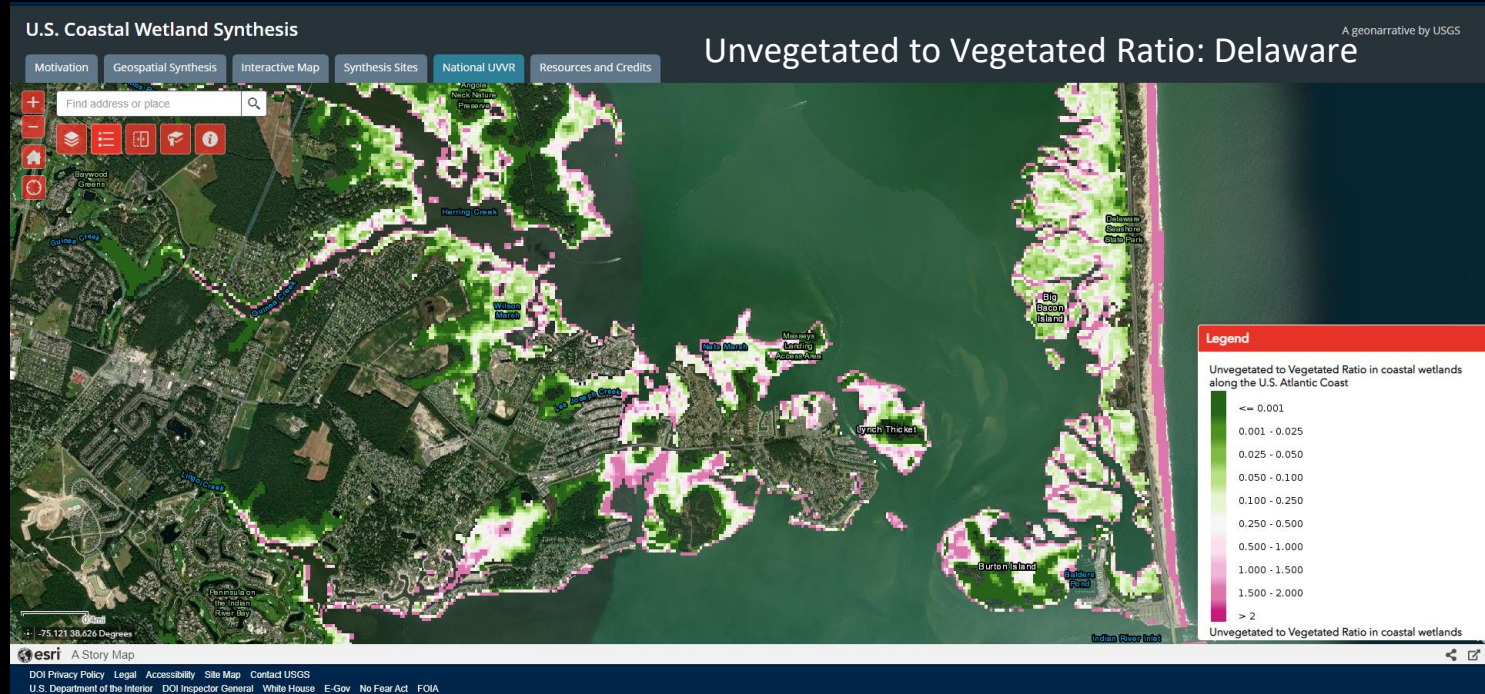
Solution #2 Project Idea- monitor changes in wetland condition and function

- Survey wetland scientists to identify key remotely-sensed variables related to wetland health and function (e.g., greenness (NDVI) and soil moisture (NDMI) that can be tracked with available hyper-temporal satellite imagery (e.g., Landsat and/or Sentinel).

- Develop automated workflows to generate and track changes in the remotely-sensed metrics on a sub-monthly basis from the early 2000's to present.

- Analyze the data to detect trends in wetland condition.

- Use these data to assess wetland vulnerability, inform updates to the high-res land use/land cover maps, and to prioritize field campaign locations.

HEALTHY VEGETATION REFLECTANCE   STRESSED VEGETATION REFLECTANCE

50% NIR   8% RED   40% NIR   30% RED

NDVI = 0.72   NDVI = 0.14

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

Landsat 8 Surface Reflectance
Path 44 Row 33 - Acquired 7 Oct 2018
Bands 6,5,4

Sacramento

Normalized Difference Moisture Index (NDMI)
Landsat 8 Path 44 Row 33 - Acquired 7 Oct 2018

Sacramento

High : 1
Low : -1

Solution #2 Project Idea- monitor changes in wetland condition and function

Ganju, N.K., Couvillion, B.R., Defne, Z. *et al.* Development and Application of Landsat-Based Wetland Vegetation Cover and UnVegetated-Vegetated Marsh Ratio (UVVR) for the Conterminous United States. *Estuaries and Coasts* (2022). https://doi.org/10.1007/s12237-022-01081-x

https://wim.usgs.gov/geonarrative/uscoastalwetlandsynthesis/

USGS

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