Mapping Timber Harvest and Natural Succession

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Why Map Timber Harvest and How?

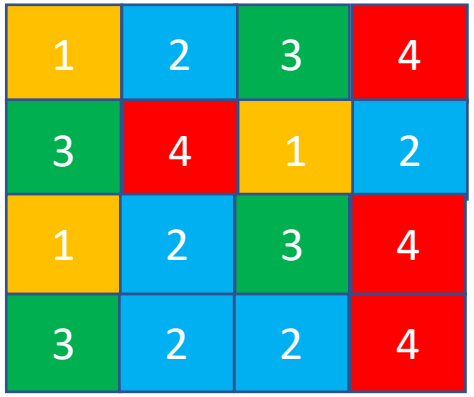
- To produce data to supplement reported timber harvest data
- Timber harvest often mature quicker than natural succession
  - Can producing timber harvest data improve modelling of forest succession?
- USGS Land Change Monitoring, Assessment, and Projection (LCMAP) data can provide a 33-year history of land cover
  - We can use this historical record to detect land cover patterns, such as forest rotation
  - We can count the number of successive years in a vegetative state back through time, starting with 2017

USGS Land Change Monitoring, Assessment, and Projection (LCMAP)

- “LCMAP offers a suite of 10 annual data products that depict land cover and spectral change in the conterminous United States.”
- Products include an annual primary land cover classification and secondary land cover classification
- Produced annually by USGS/EROS dating from 1985 – 2017
- Products are 30 m resolution
- Developed from LANDSAT data
- Learn more at https://www.usgs.gov/land-resources/eros/lcmap

Data Mining LCMAP's Annual Land Cover

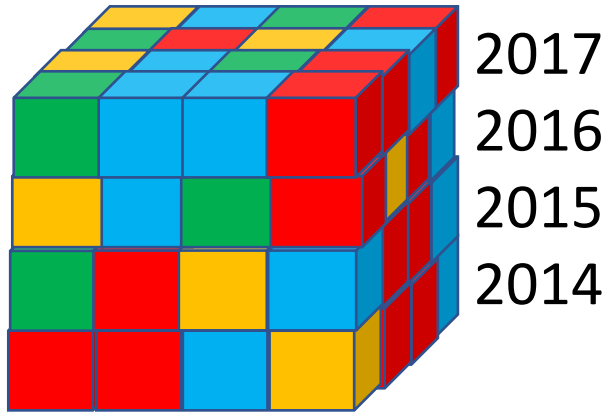
- 1. Read in LCMAP primary land cover rasters for years 1985 through 2017



- 2. Stack the rasters year by year to form a cube

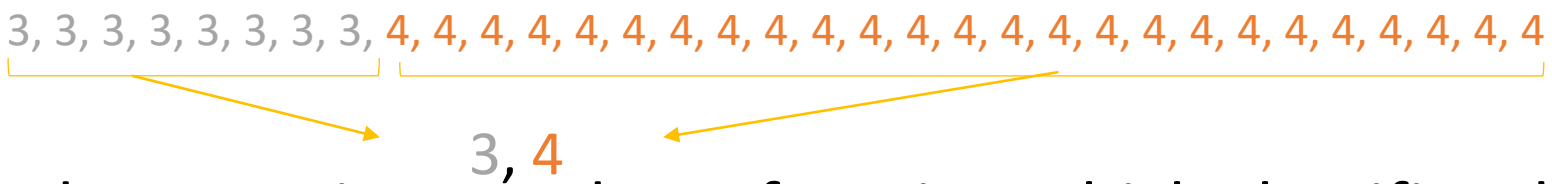
- 3. Drill down at each pixel and pull out pattern

4, 3, 1, 3



Data Mining LCMAP cont.

- Each pixel has 33 land cover types in its full pattern. This is reduced by:
  - Only including land cover types that occur at least 2 consecutive years
  - Not including patterns with less than 2 unique land cover types
  - Treating agriculture and grass the same, unless they are the only land cover types found in the pattern



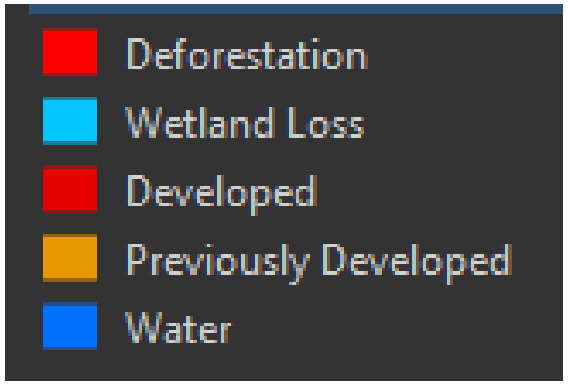
- The reduced pattern is passed to a function which classifies the behavior of the reduced land cover types.
  - Ex: alternating types, transition from one type to another, etc.
  - Builds a value that is assigned to all patterns with the same land cover types and behavior
    - This is the value used in the unique patterns output

Behavior + Set(Reduced Pattern) = Unique Pattern

Classifying Patterns

- Over one thousand unique patterns found for one tile of LCMAP primary cover data
- Grouped these unique patterns into Primary and Secondary Categories:
  - Primary

Secondary

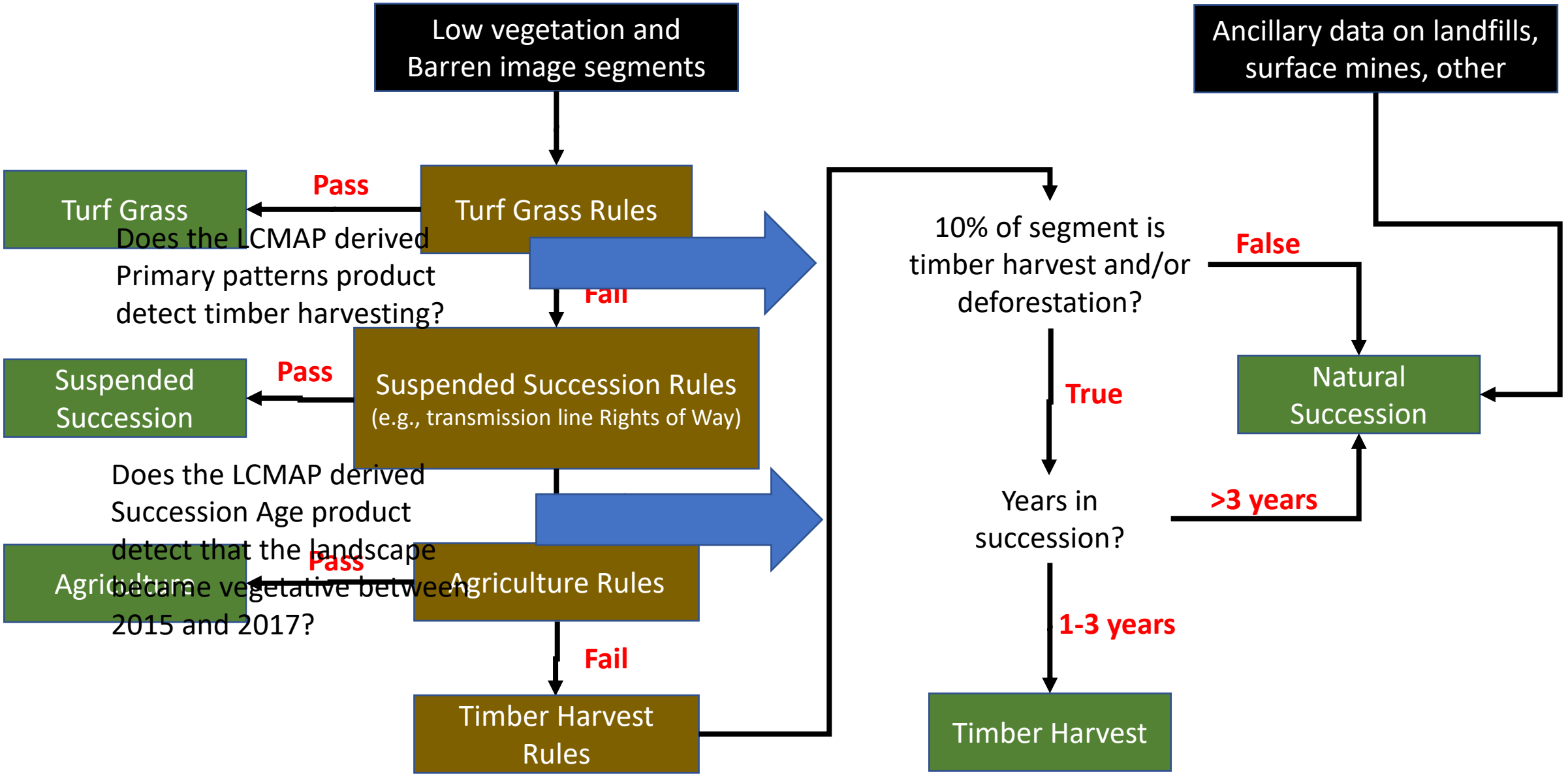


LCMAP Derived Products

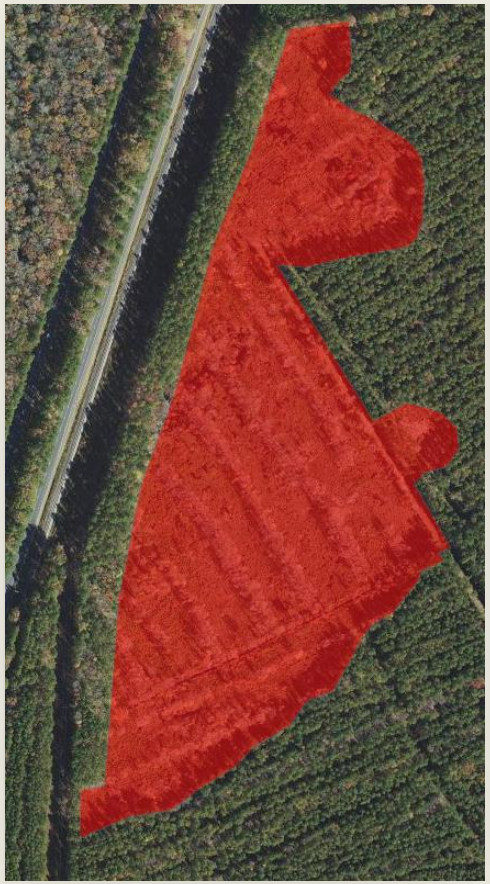
- Primary Patterns
  - Timber Harvest class is split into 2 categories based on its land cover type in 2017 (forested or not forested)
- Succession Age
  - Number of consecutive years moving back in time starting with 2017 that a pixel has the land cover type of grassy/shrub and/or crop

Image Segments

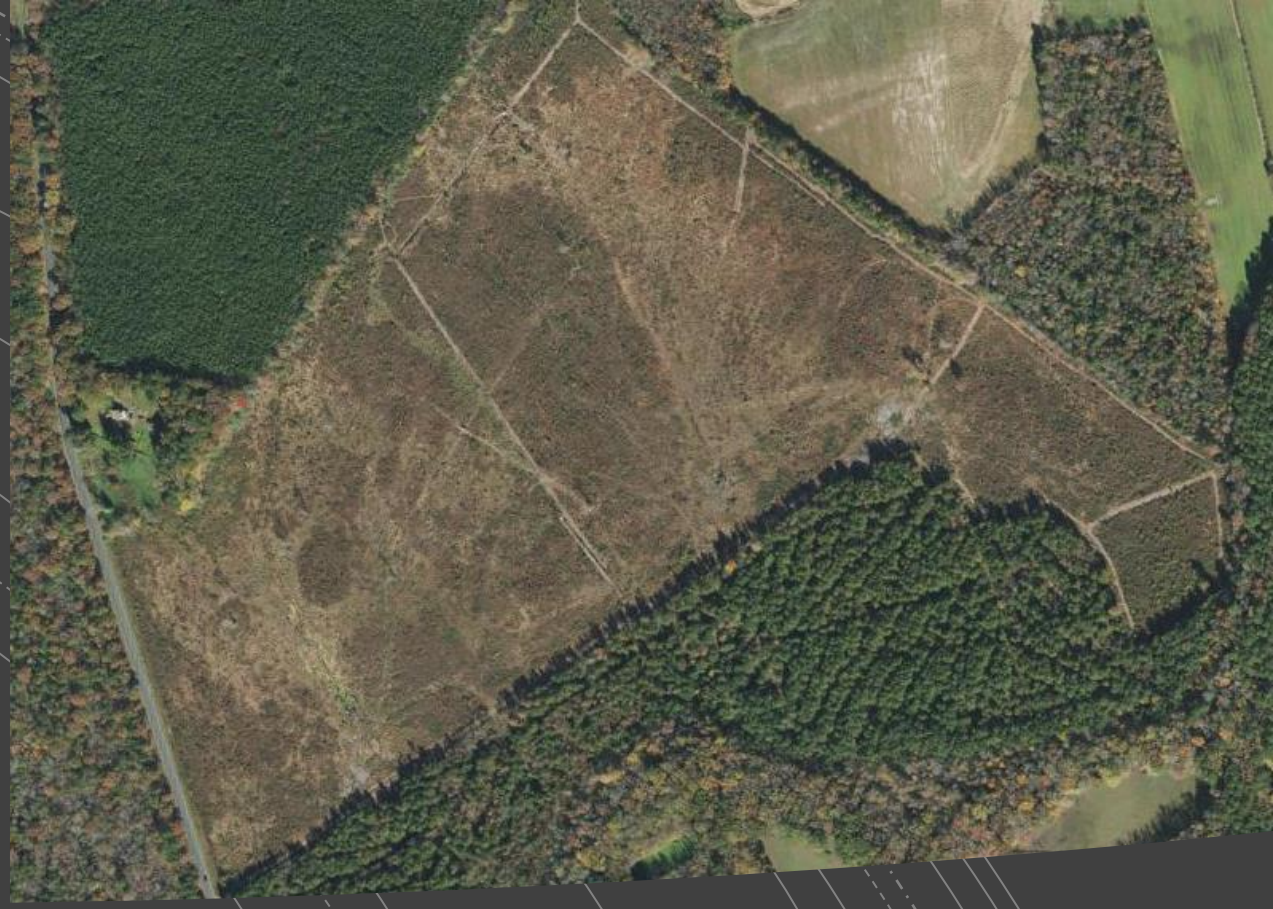
- Vectorized 2017, 1m land cover raster data by land cover type
  - Low Vegetation
  - Barren
  - Scrub/Shrub
  - Tree Canopy
- Provided by the University of Vermont


Low vegetation and Barren image segments
Turf Grass Rules
Pass
Turf Grass
Does the LCMAP derived Primary patterns product detect timber harvesting?
Fail
Suspended Succession Rules
(e.g., transmission line Rights of Way)
Pass
Suspended Succession
Does the LCMAP derived Succession Age product detect that the landscape became vegetative between 2015 and 2017?
Pass
Agriculture
Agriculture Rules
Fail
Timber Harvest Rules
Ancillary data on landfills, surface mines, other
10% of segment is timber harvest and/or deforestation?
False
Natural Succession
True
Years in succession?
>3 years
1-3 years
Timber Harvest

DNR Data and LCMAP reports Timber Harvest since 2015



- Left (Pink): LCMAP
- Center: NAIP imagery
- Right (Red): DNR

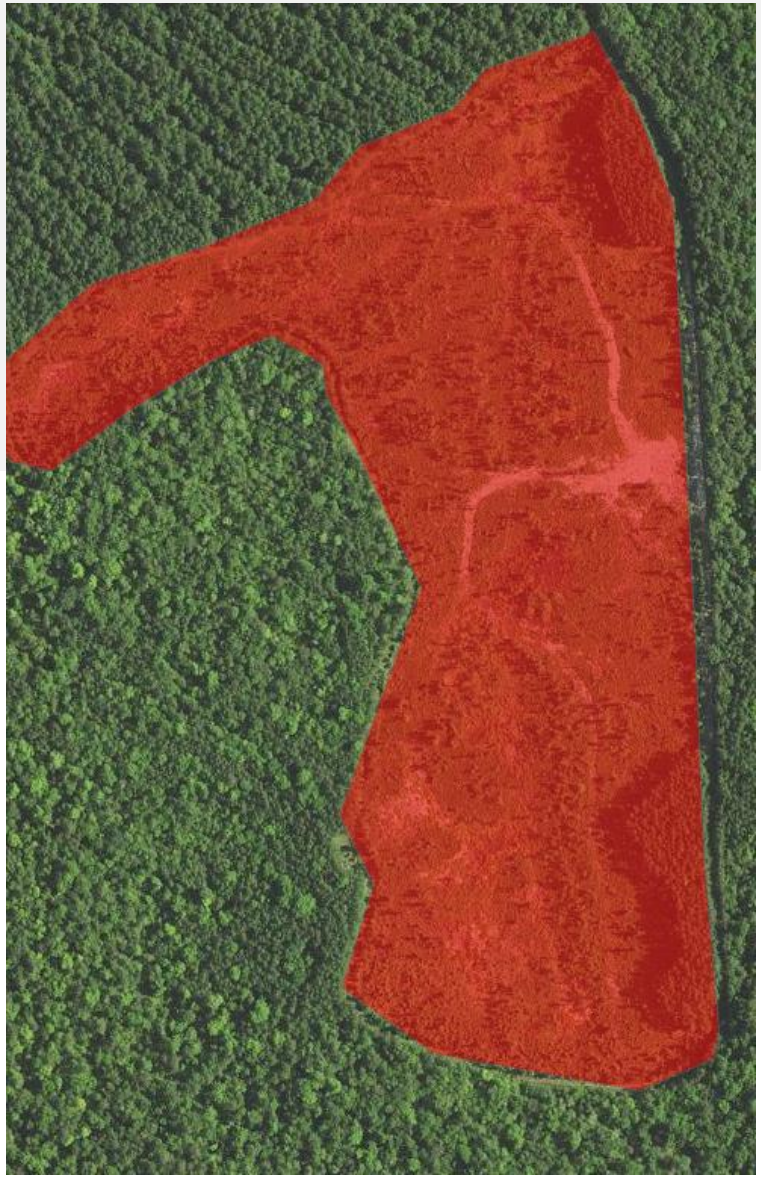


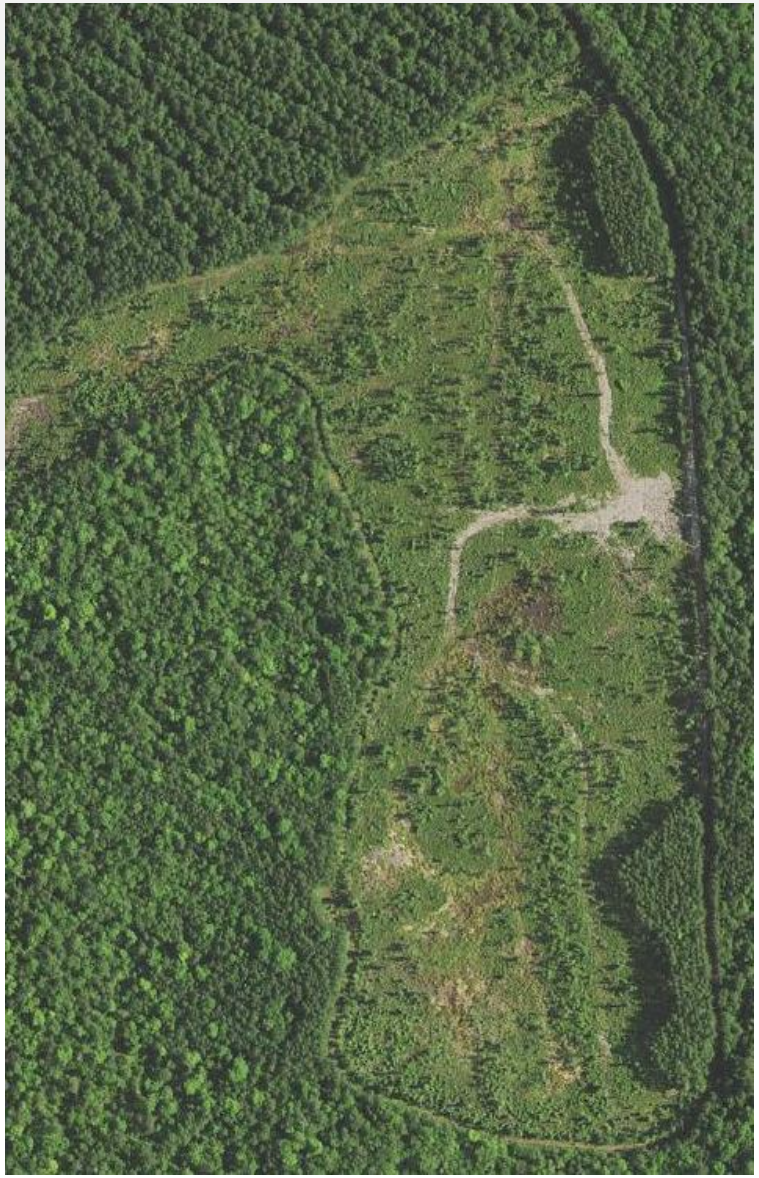
LCMAP Detects Timber Harvest not present in DNR Data

- Left (Pink): LCMAP detected Timber Harvest
- Right: NAIP imagery
- Wicomico, MD

DNR Data reports Timber Harvest in 2015 Not Detected by LCMAP

- Left (Red): MD DNR Timber Harvest
- Right: NAIP imagery
- Wicomico, MD





Timber Harvest in the Chesapeake Bay Watershed Model

- CBP relies on reported, county-level, timber harvest permit data for Maryland, Pennsylvania, Virginia, and West Virginia.
- For Delaware and New York, we assume that 1.5% of “True Forest” (class FORE) in 2013 land use data is harvested in any given year.

Timber Harvest in the Chesapeake Bay Watershed Model Cont.

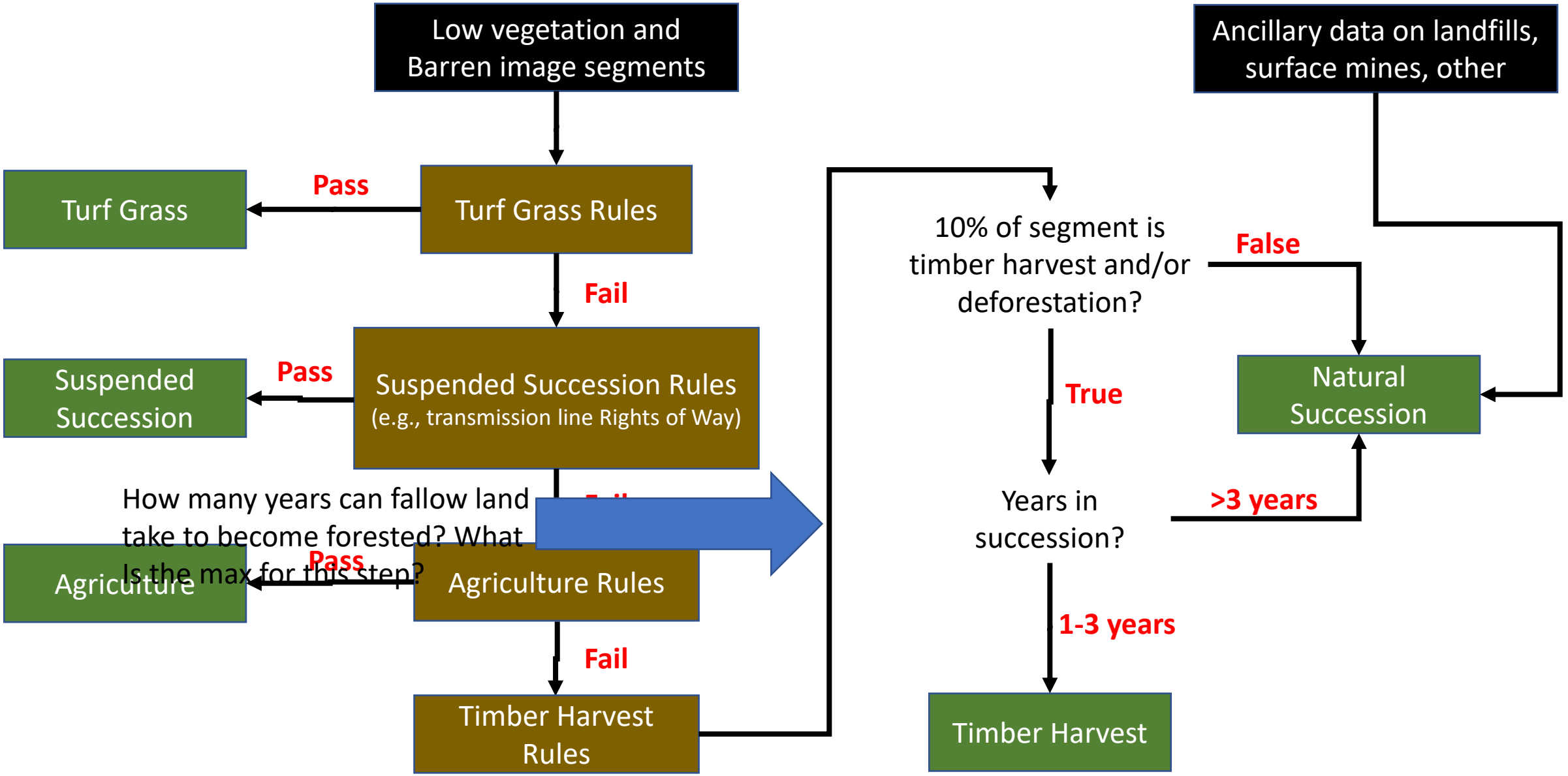
County	LCMAP Derived Timber Harvest Area 2015-2017 (Acres)	"True Forest" Calculation of Timber Harvest Area 2015-2017 (Acres)
Wicomico, MD	528.5 (0.78%)	3,038.7 (4.5%)
Carroll County, MD	0 (0%)	3,747.3 (4.5%)
Cecil, MD	219.5 (0.25%)	4,015.9 (4.5%)

- LCMAP detects less clearings for timber harvest than the current CBP method
  - Does forest thinning and selective cuts increase the % of harvested forest by ~3.72% for Wicomico?

- Total Timber Harvest (including thinning and selective cuts) between 2015 and 2017 using DNR polygons is ~1,033.4 acres (1.5%) of total forest in Wicomico, MD
  - This assumes that thinned forests are full clearings

Timber Harvest Decision

- Should there be a minimum area threshold for timber harvest clearings?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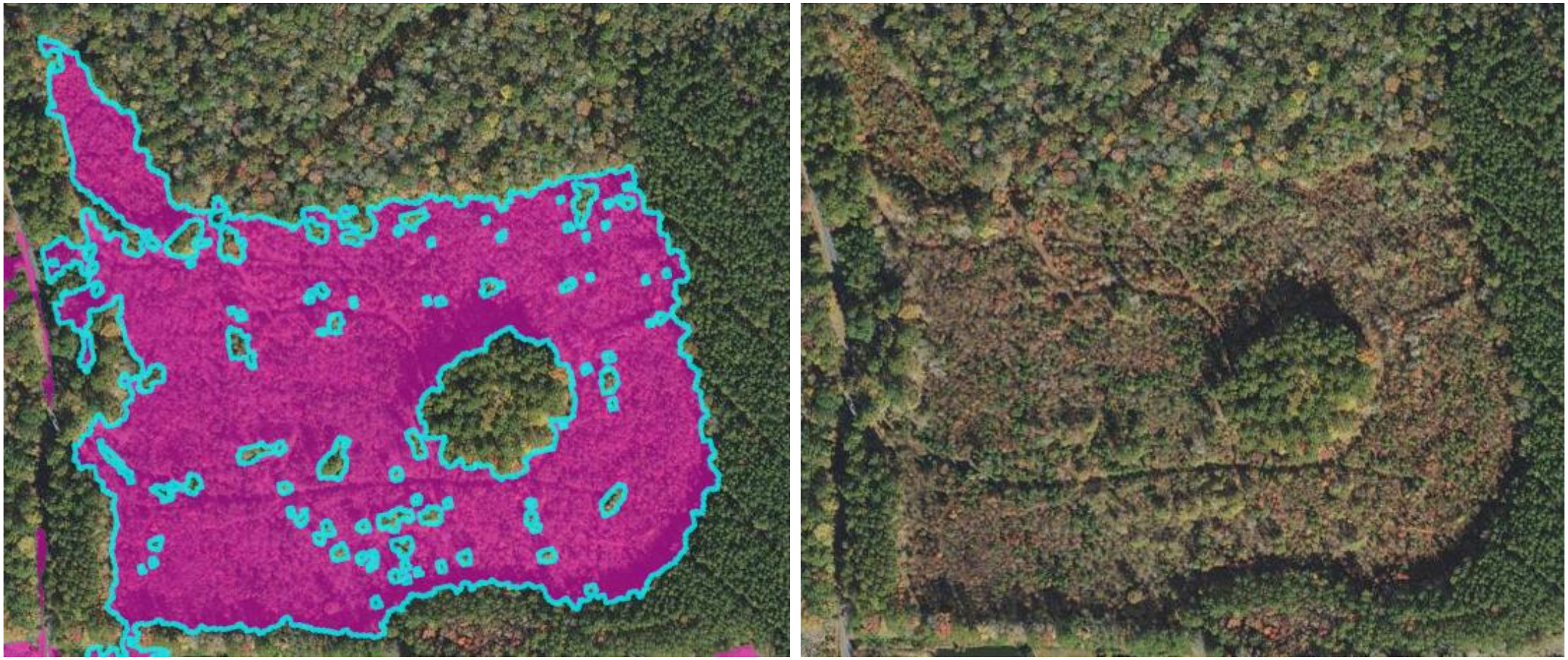
Timber Harvest

Natural Succession Example: Timber Harvest prior to 2015

- Left (Pink): LCMAP
- Center: NAIP
- Right (Purple): MD DNR

Natural Succession Example: Vegetative State since 2010 (No timber harvesting present)



Natural Succession Decision

- How many years does it take for fallow land to become forested?

Questions?

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