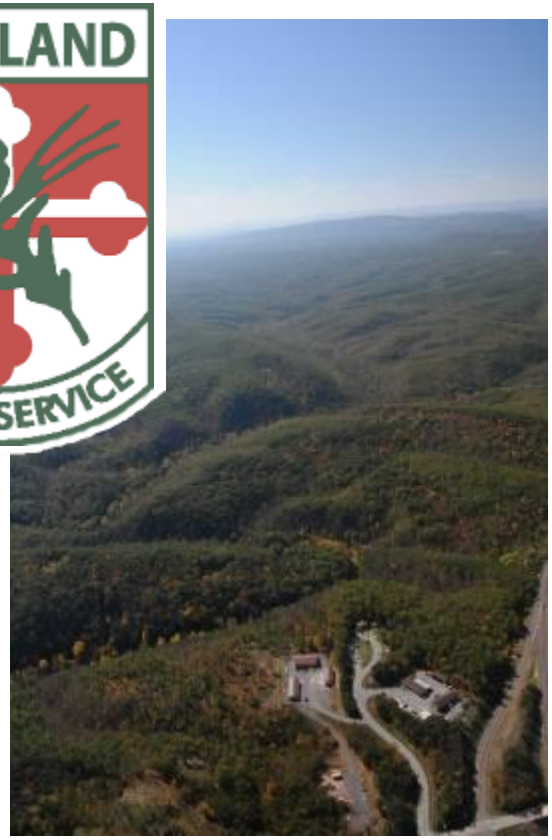
Better Forest Management Decisions Using LiDAR Products

Jack Perdue, MD Forest Service



Mark Beals, MD Forest Service

Presentation to the Chesapeake Bay Program Forestry Work Group
Wednesday, November 5, 2014

A Brief Introduction to Maryland Forests and Forestry

- In 2013, Maryland Forest Cover is estimated at 2,462,473 acres (Pennsylvania has about this much in public ownership alone).
- ~76% of Maryland Forests are privately owned.
- Most common forest type is Oak-Hickory.
- Lost about 300k to 350k acres (gross) of forest since 1970. (about the size of Worcester County, MD)

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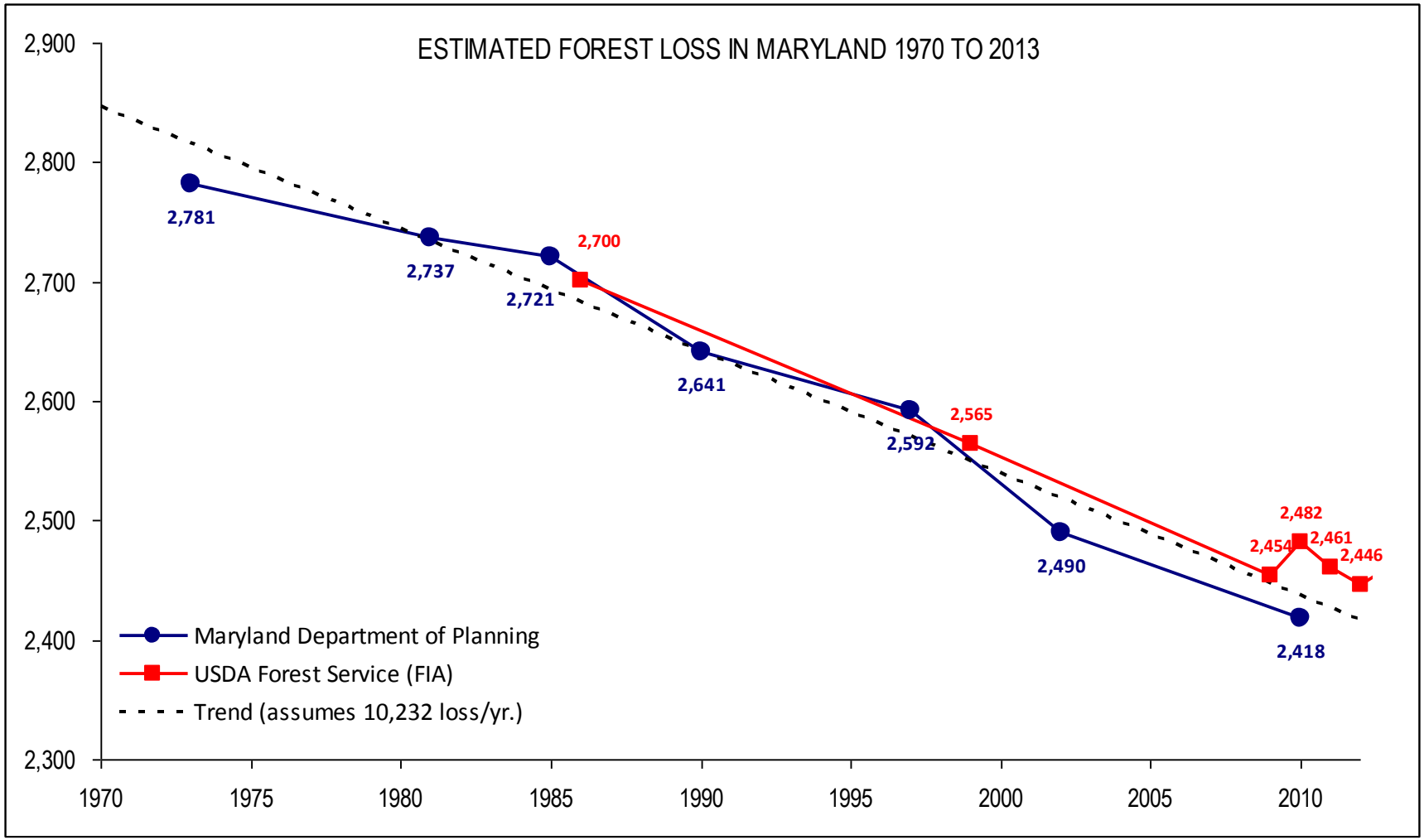
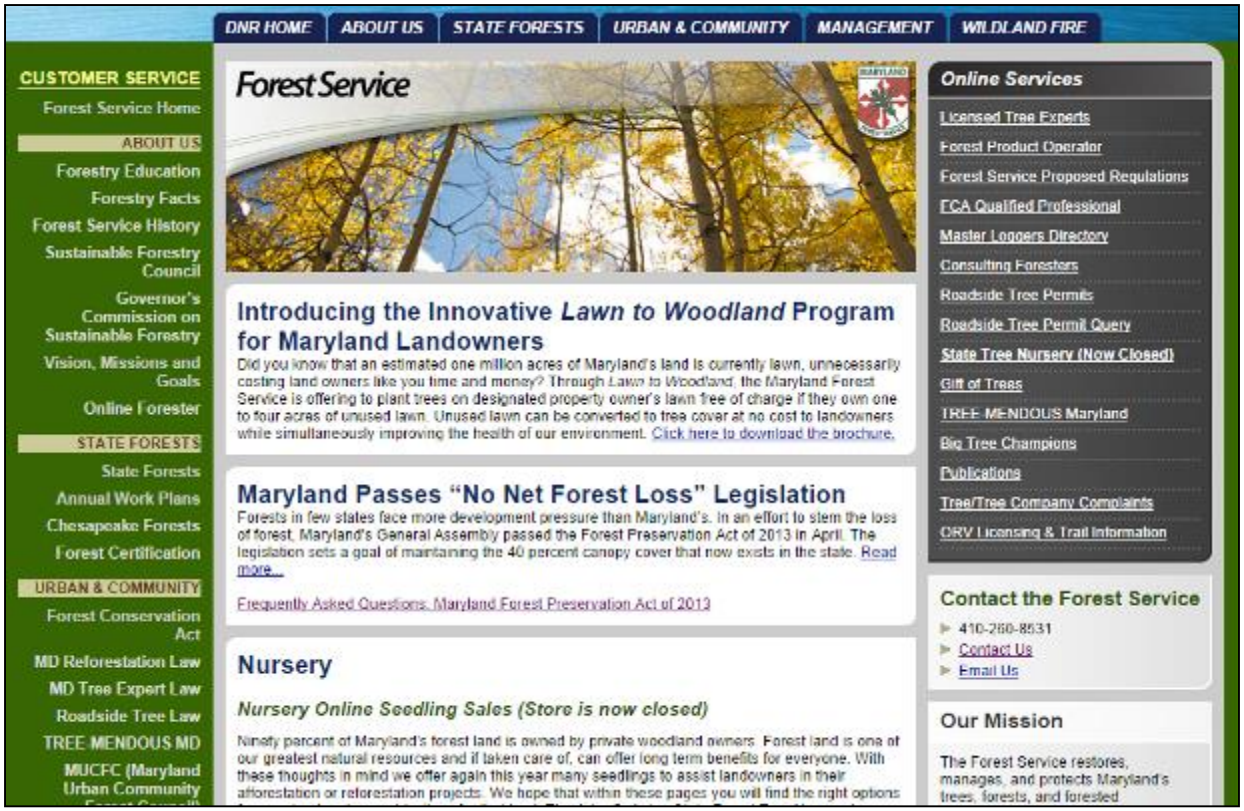


The Forest Preservation Act of 2013

Sets a goal of 40% canopy cover statewide.

How do we do this?



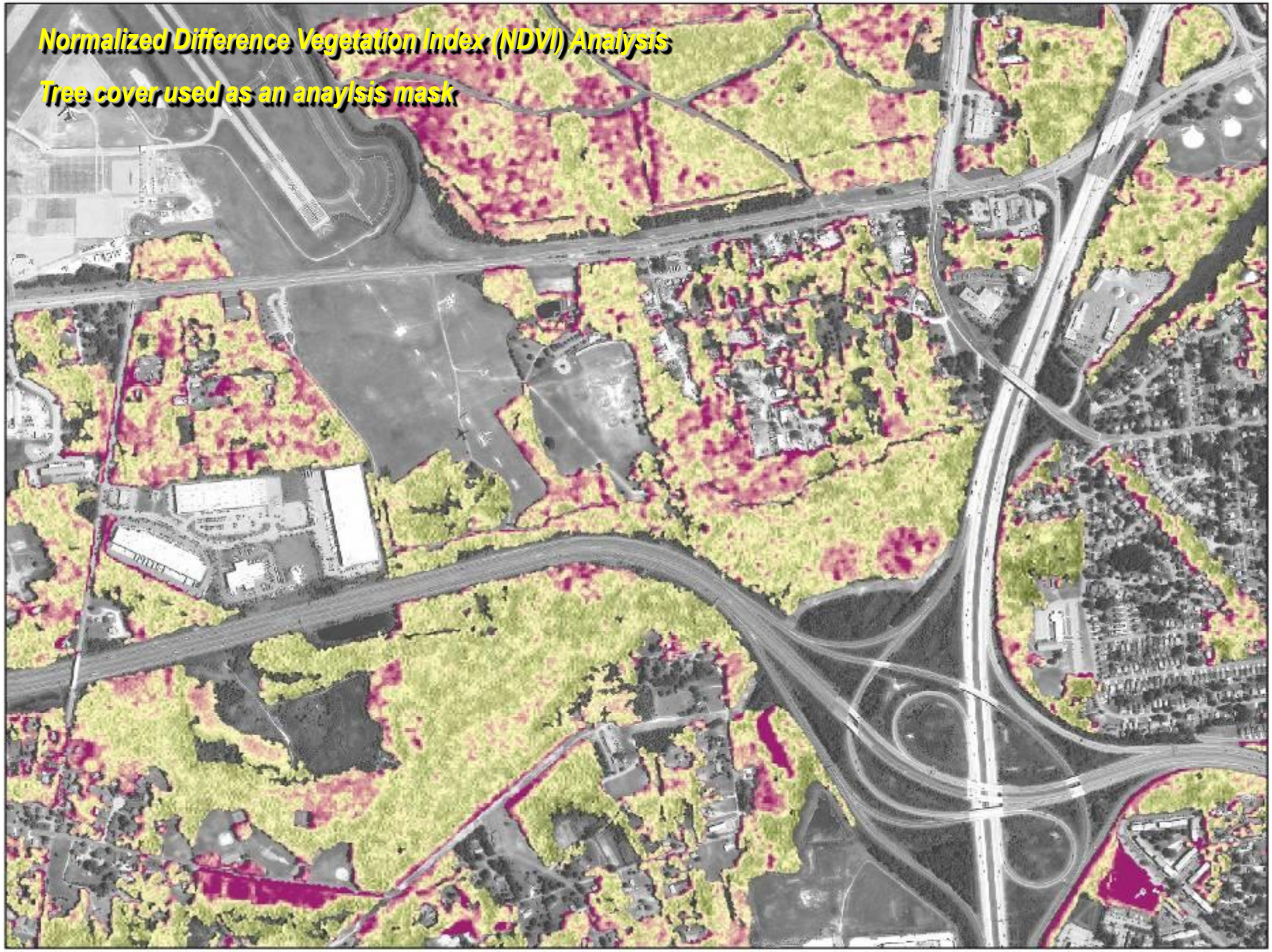
NASA Carbon Monitoring System (CMS) funded program

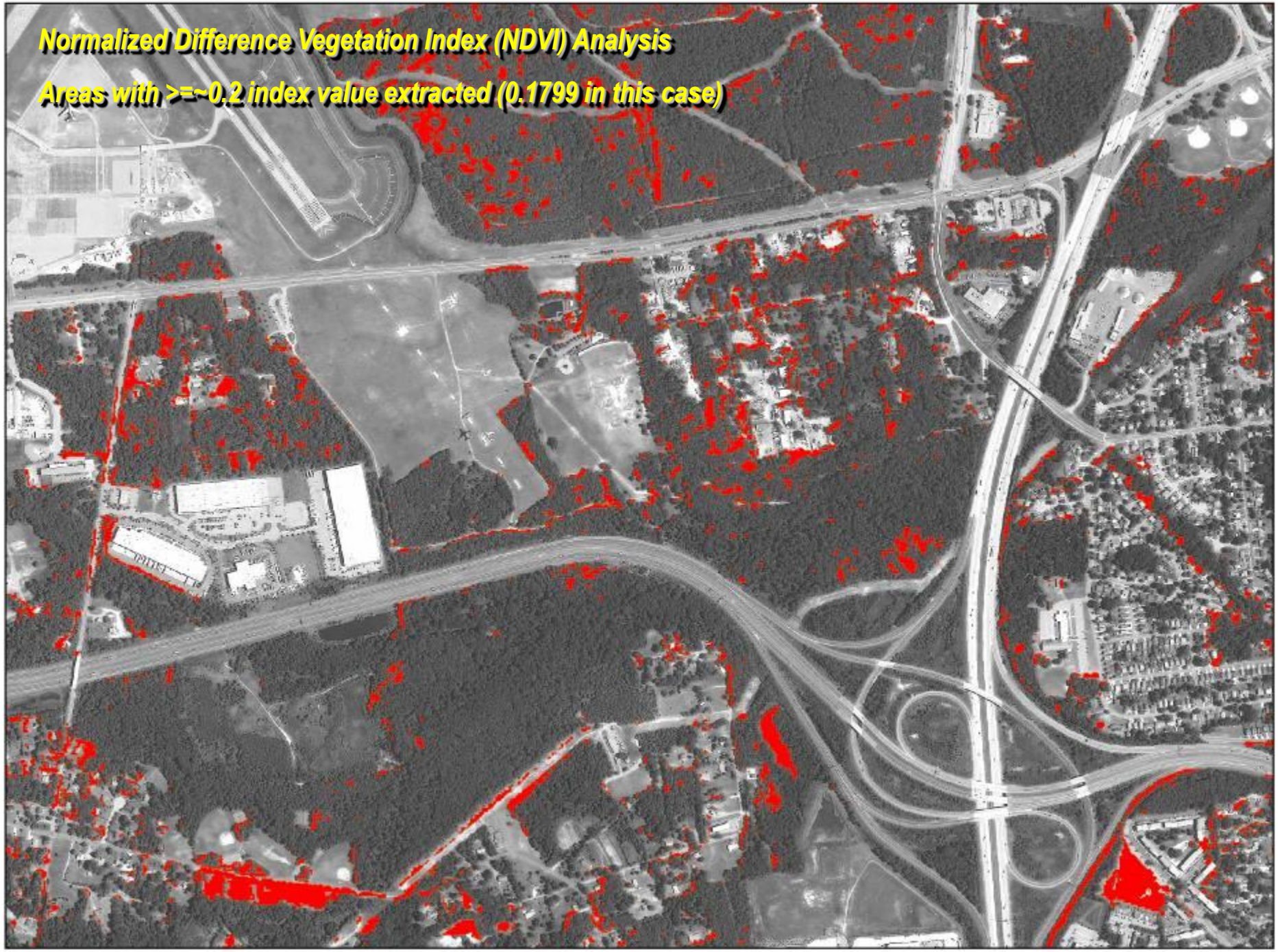
Objectives were to: "*Produce a framework for estimating local-scale carbon stocks and future carbon sequestration potential for the State of Maryland using remote sensing and ecosystem modeling.*"

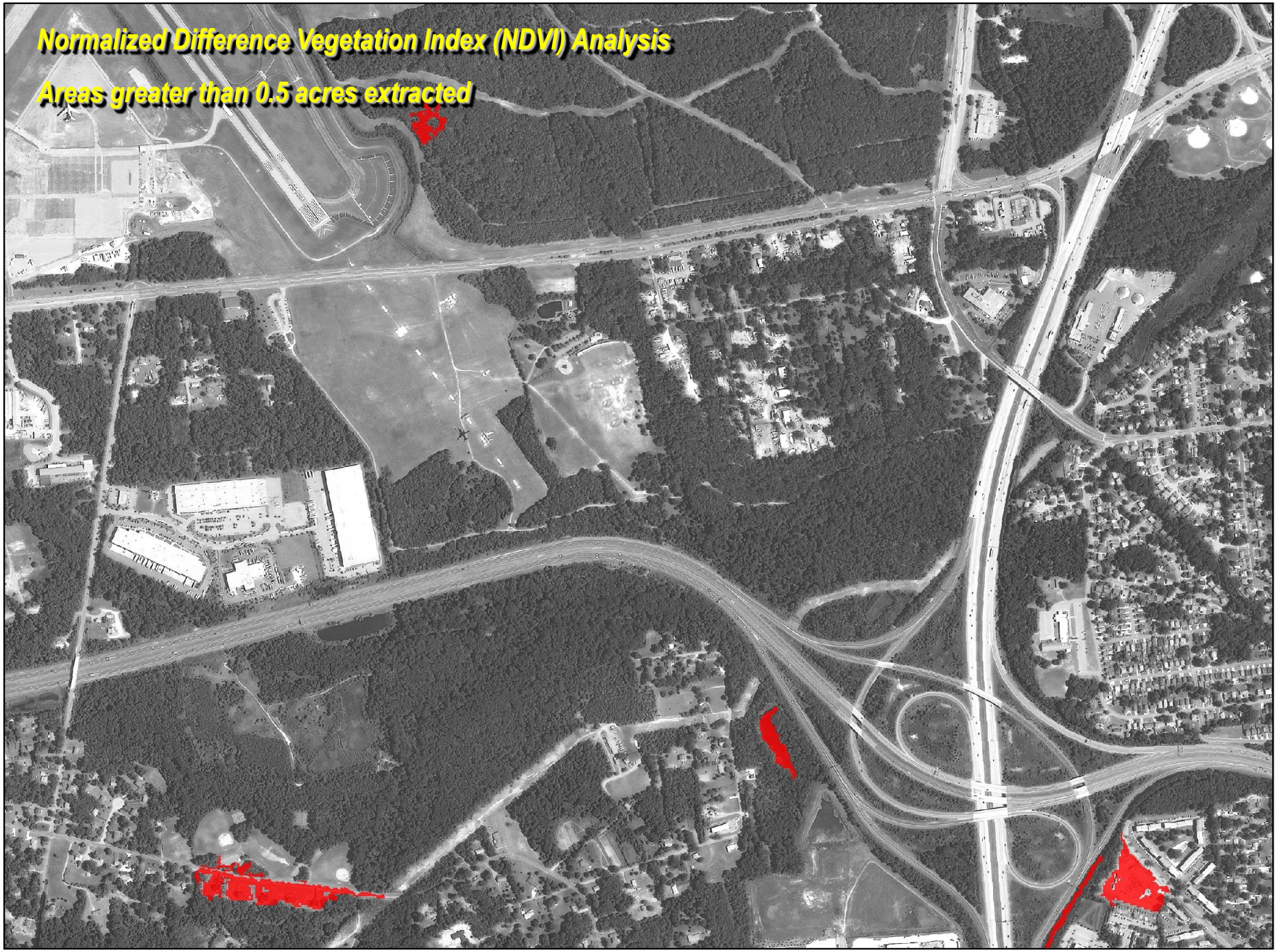
Deliverables were:

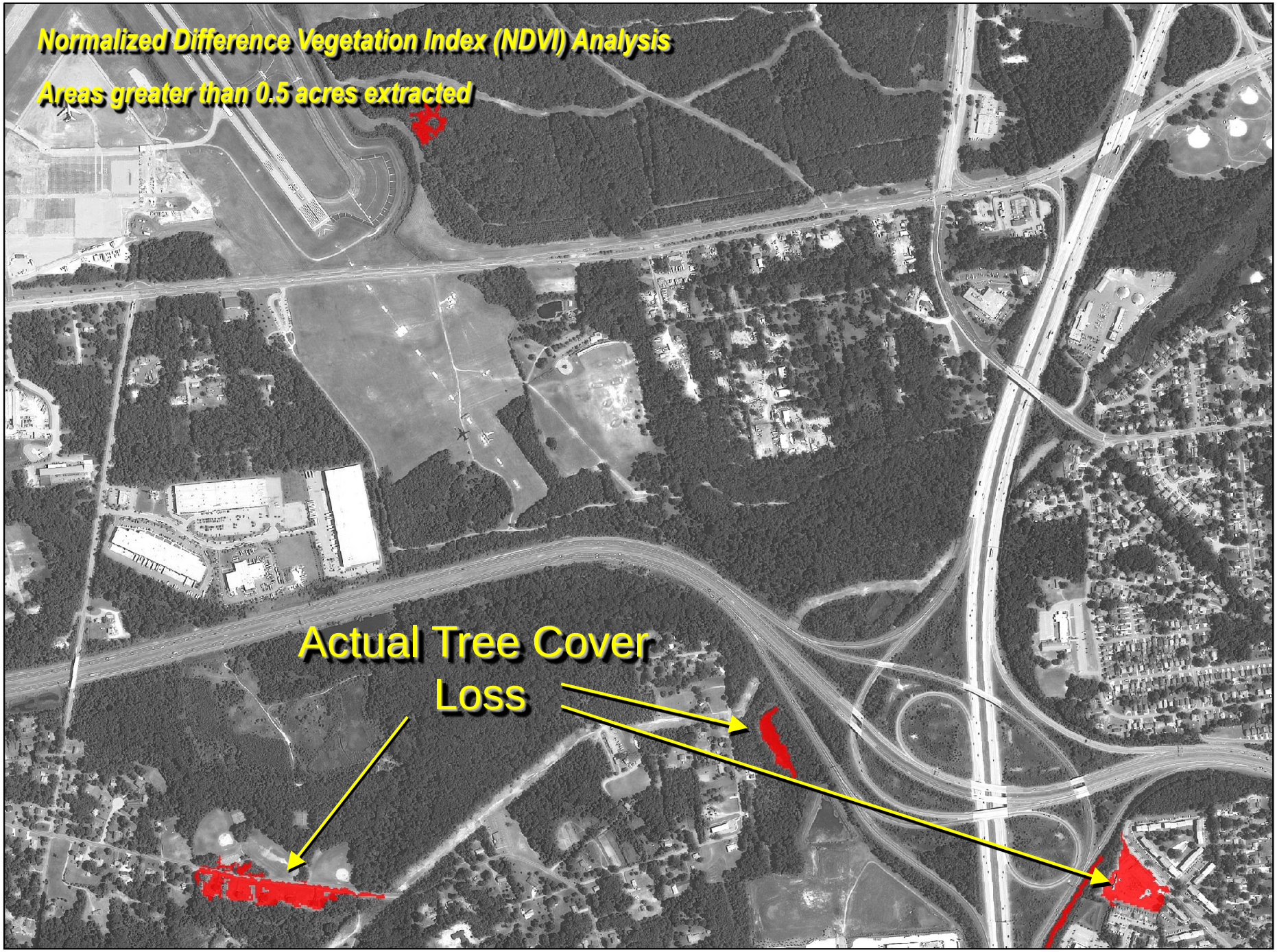
1. High resolution forest/non forest, canopy height (1m) and above ground biomass (30m) over Maryland.
2. ED model based biomass and carbon sequestration potential (90m).
3. Single Photon Counting Laser (SPL) canopy height and biomass maps for Garrett County.

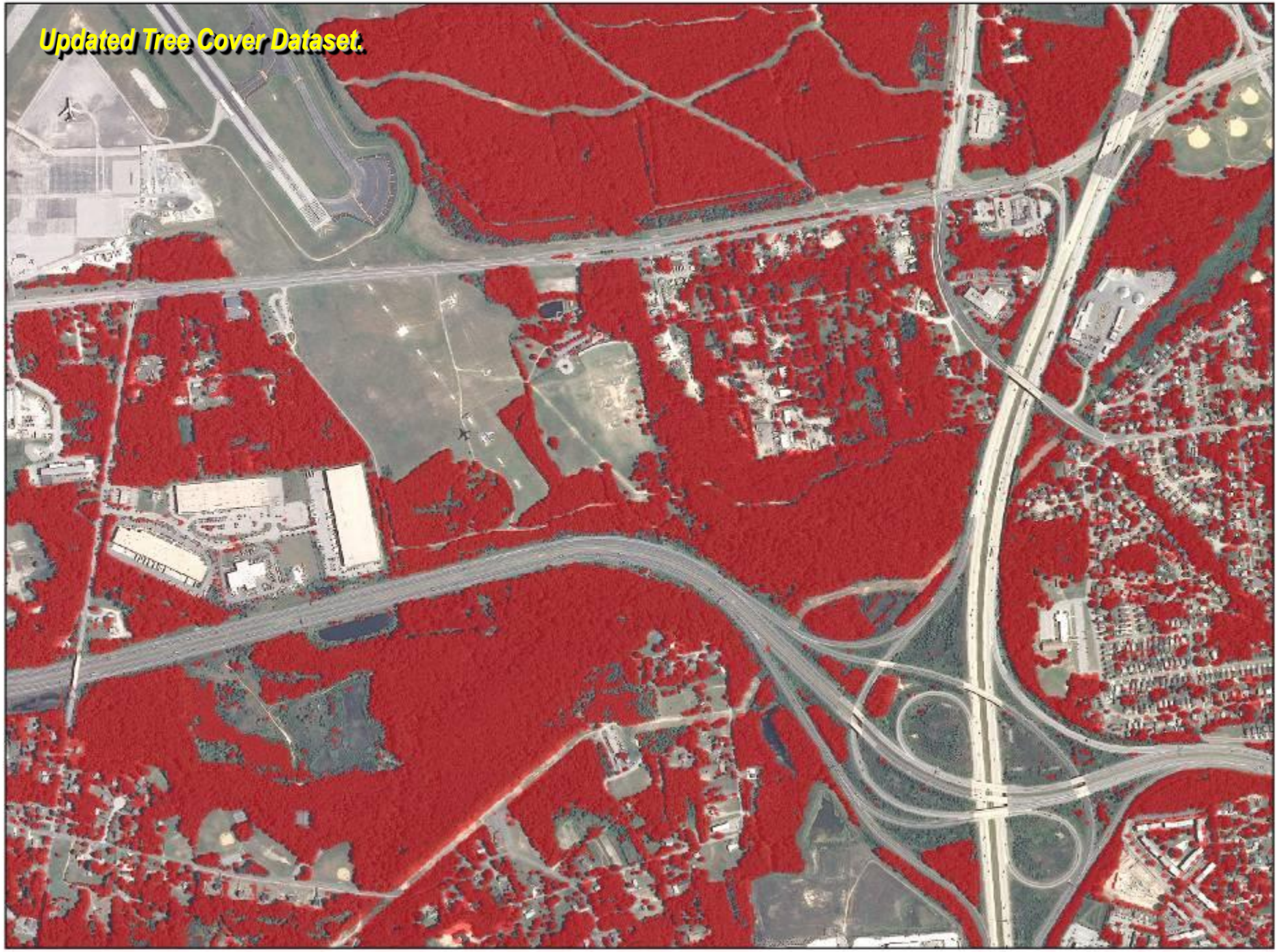

UMD delivered tree cover (red) – Anne Arundel County, MD - ca. 2004
LiDAR data with 2011 National Agricultural Imagery Program (NAIP)
Imagery


Normalized Difference Vegetation Index (NDVI) Analysis
Tree cover used as an anaylsis mask


Normalized Difference Vegetation Index (NDVI) Analysis
Areas with >=~0.2 index value extracted (0.1799 in this case)


Normalized Difference Vegetation Index (NDVI) Analysis
Areas greater than 0.5 acres extracted


Normalized Difference Vegetation Index (NDVI) Analysis
Areas greater than 0.5 acres extracted
Actual Tree Cover Loss

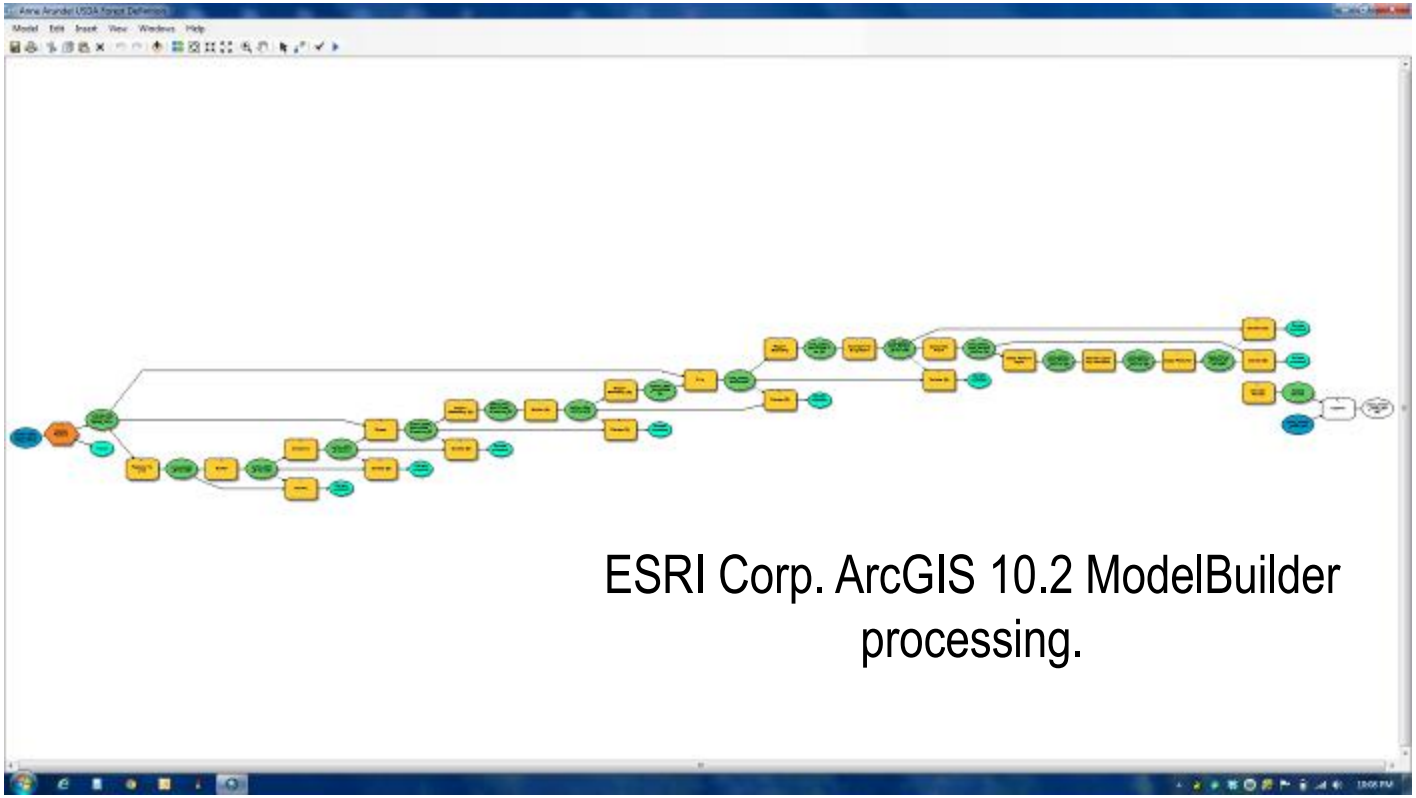

Updated Tree Cover Dataset.

Forest vs. Tree Cover

USDA Forest Service, Forest Inventory and Analysis (FIA) Definition of Forest: *An area of trees with at least 10% tree cover and at least 1.0 acre in size and 120.0 feet wide measured stem-to-stem from the outer-most edge. Forested strips must be 120.0 feet wide for a continuous length of at least 363.0 feet in order to meet the acre threshold.*

--National Core Field Guide, Version 6.0, October, 2012

Where is Forest on the Landscape?



ESRI Corp. ArcGIS 10.2 ModelBuilder processing.

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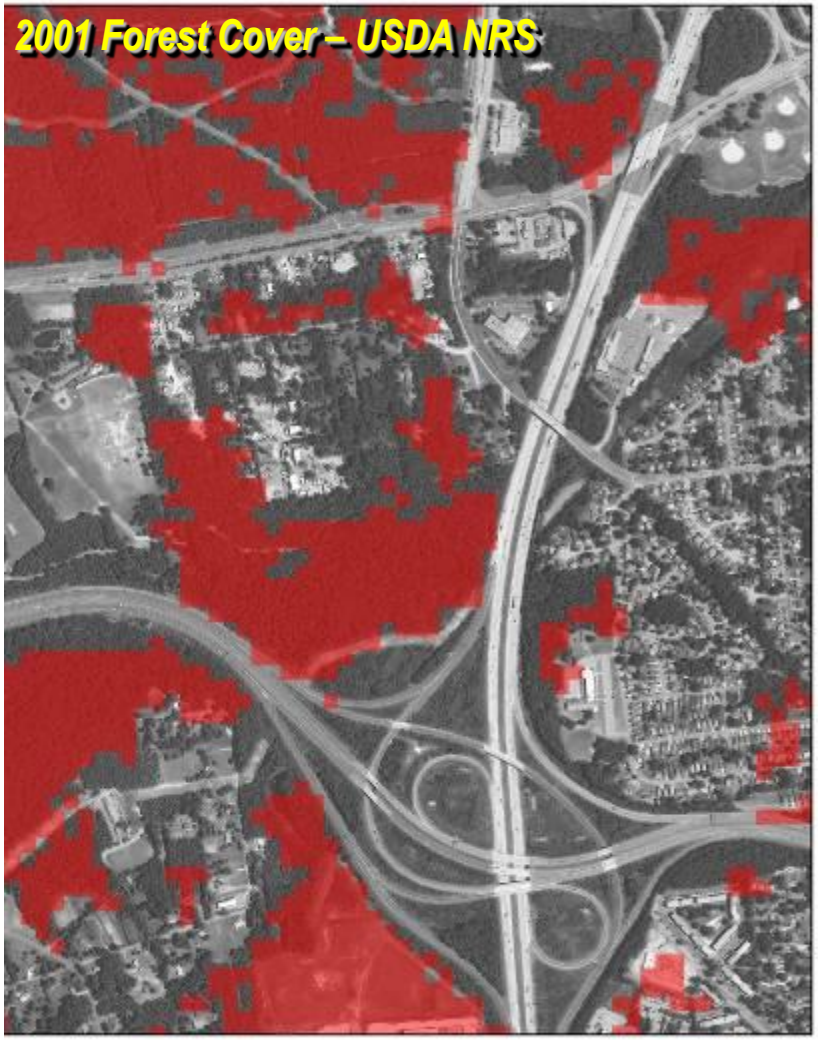
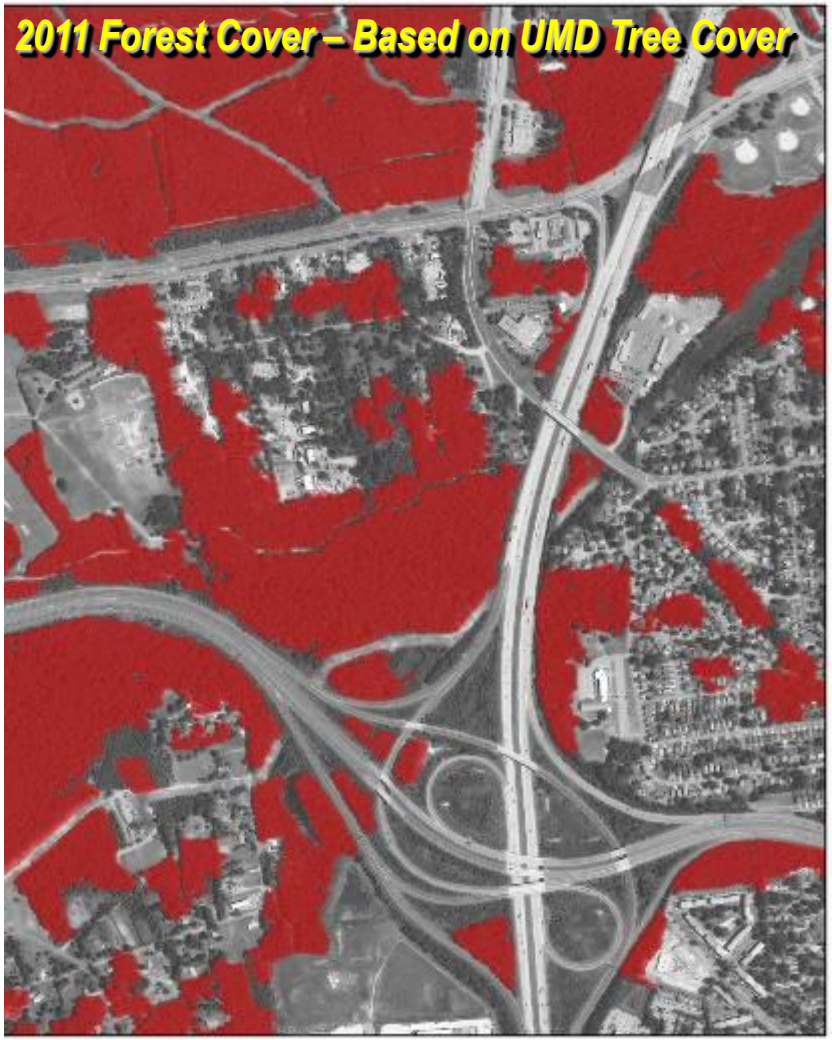
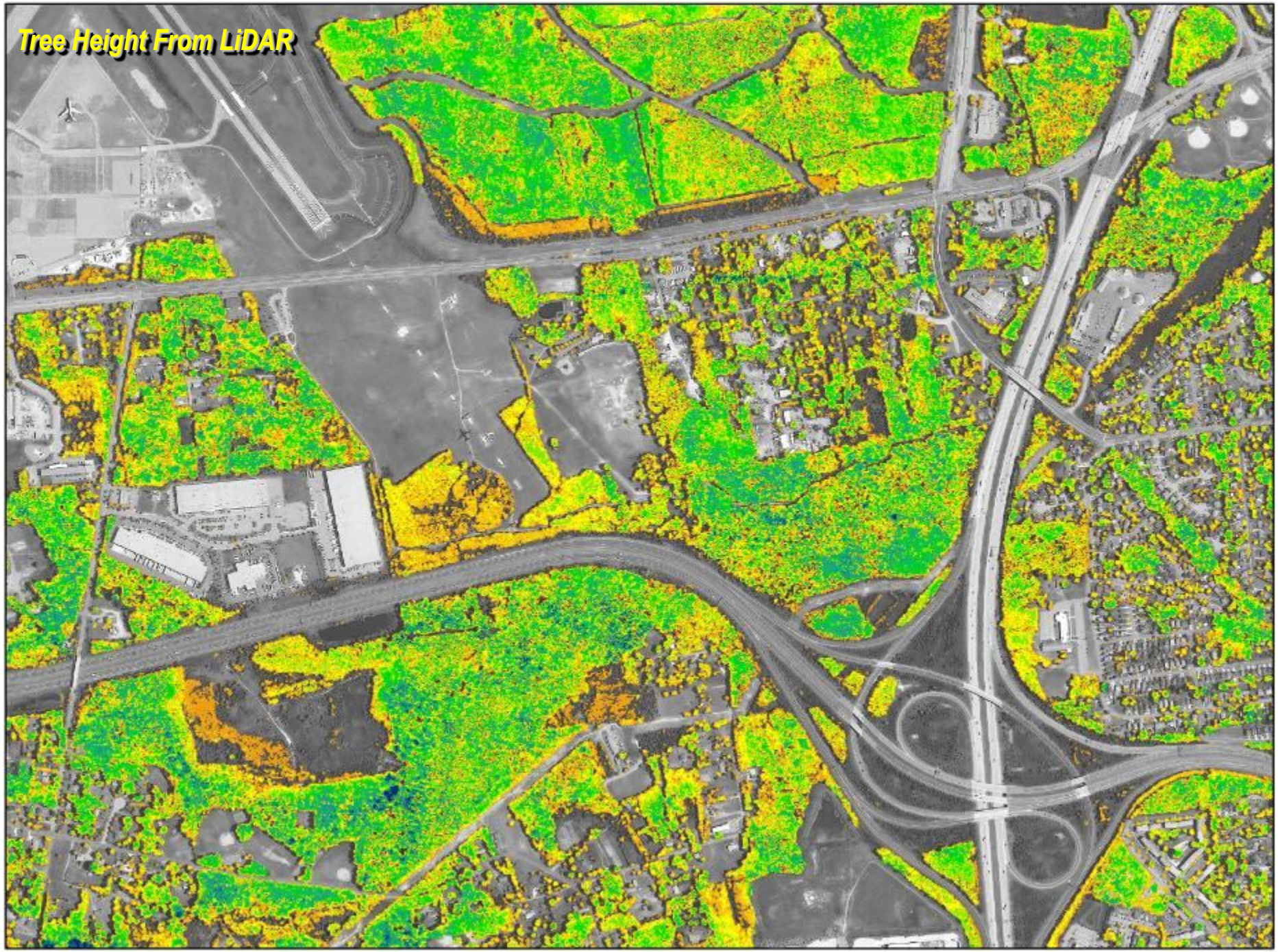
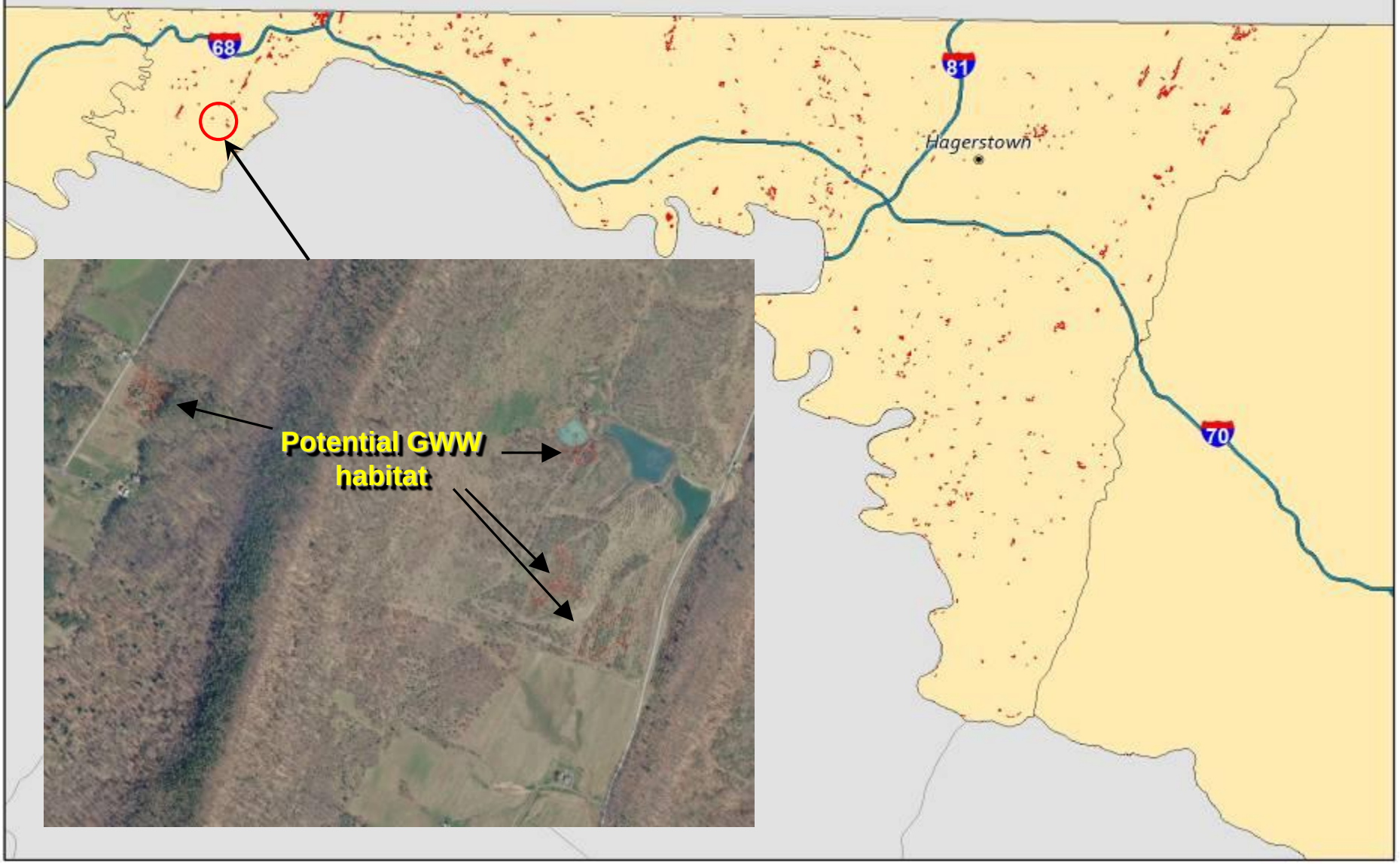


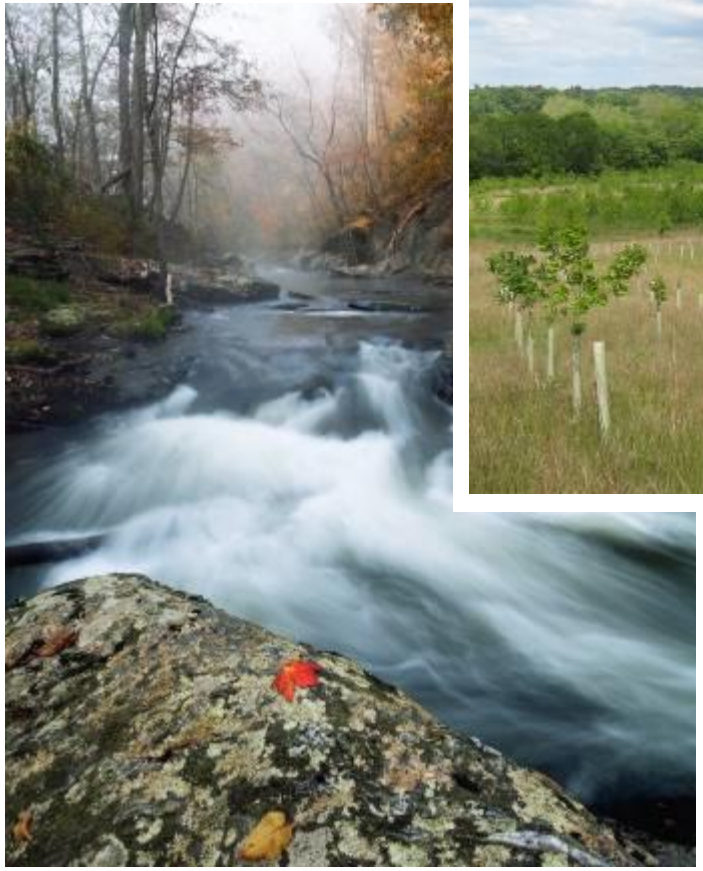


Example: Golden Winged Warbler Habitat Location


Tree Height From LiDAR

Analysis of Tree Heights using LiDAR Tree Height Data - 2014

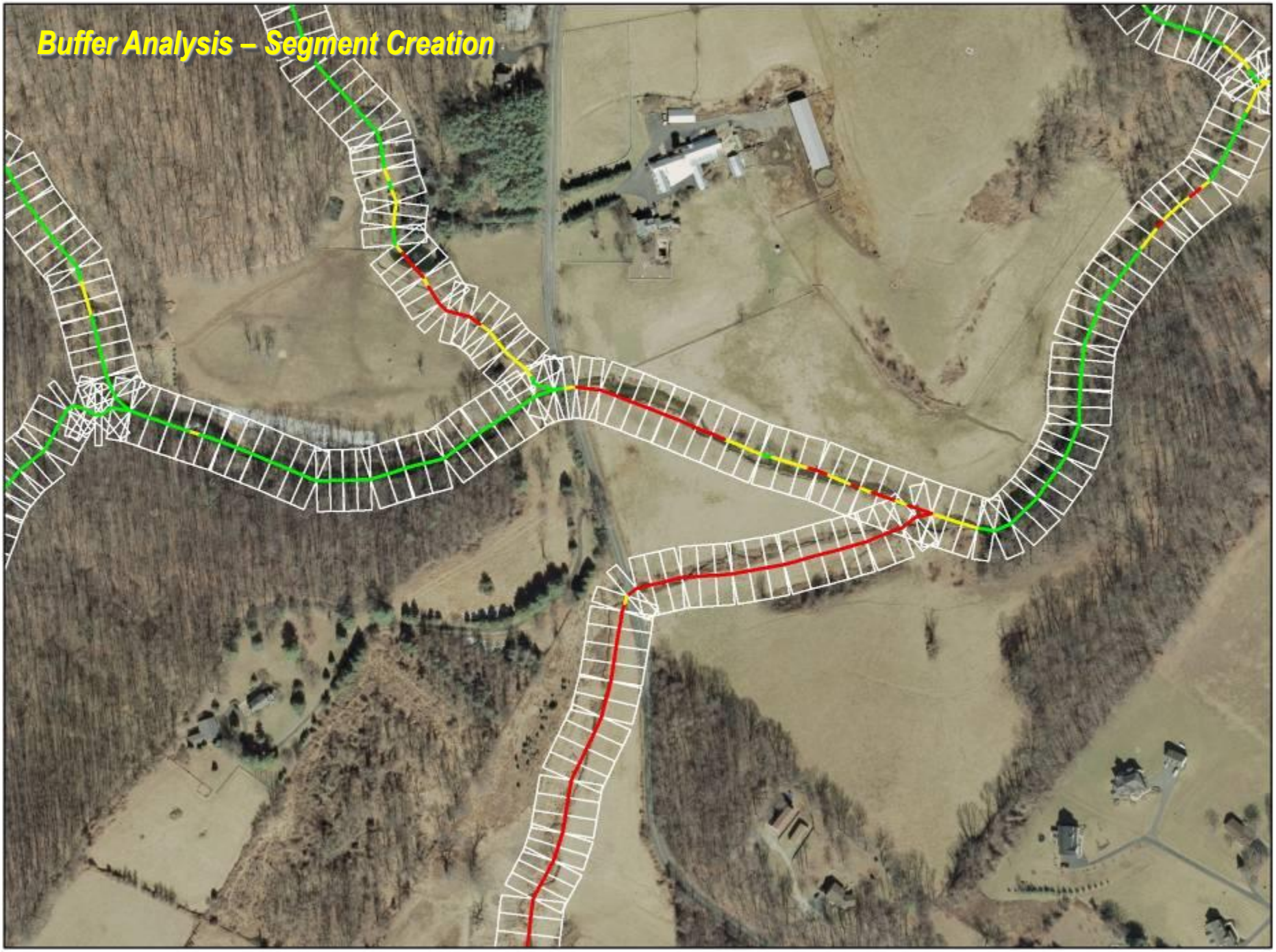


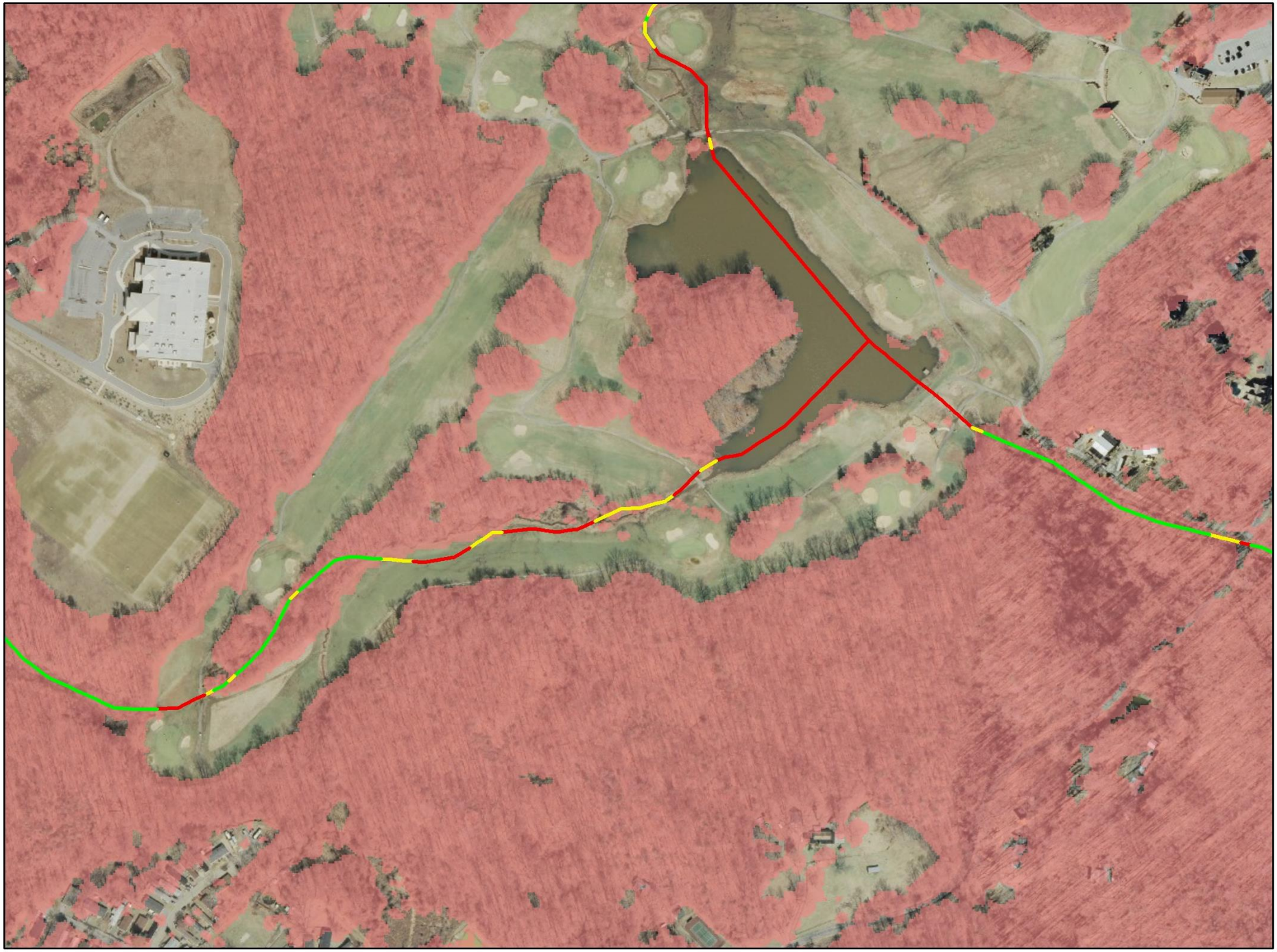


James Stimpert

Riparian Forest Buffer Locations


New LiDAR Tree Cover Finding Areas to Improve Stream Buffers
Carroll County (SE of Taneytown, MD)
10 Meter Segments, 35 Foot Buffer
Red – mostly Unbuffered (<20%)
Yellow – Particially Buffered
Green – Mostly Buffered (>80%)


Buffer Analysis – Segment Creation




Tree cover is accurate
and precise, but
stream lines…meh

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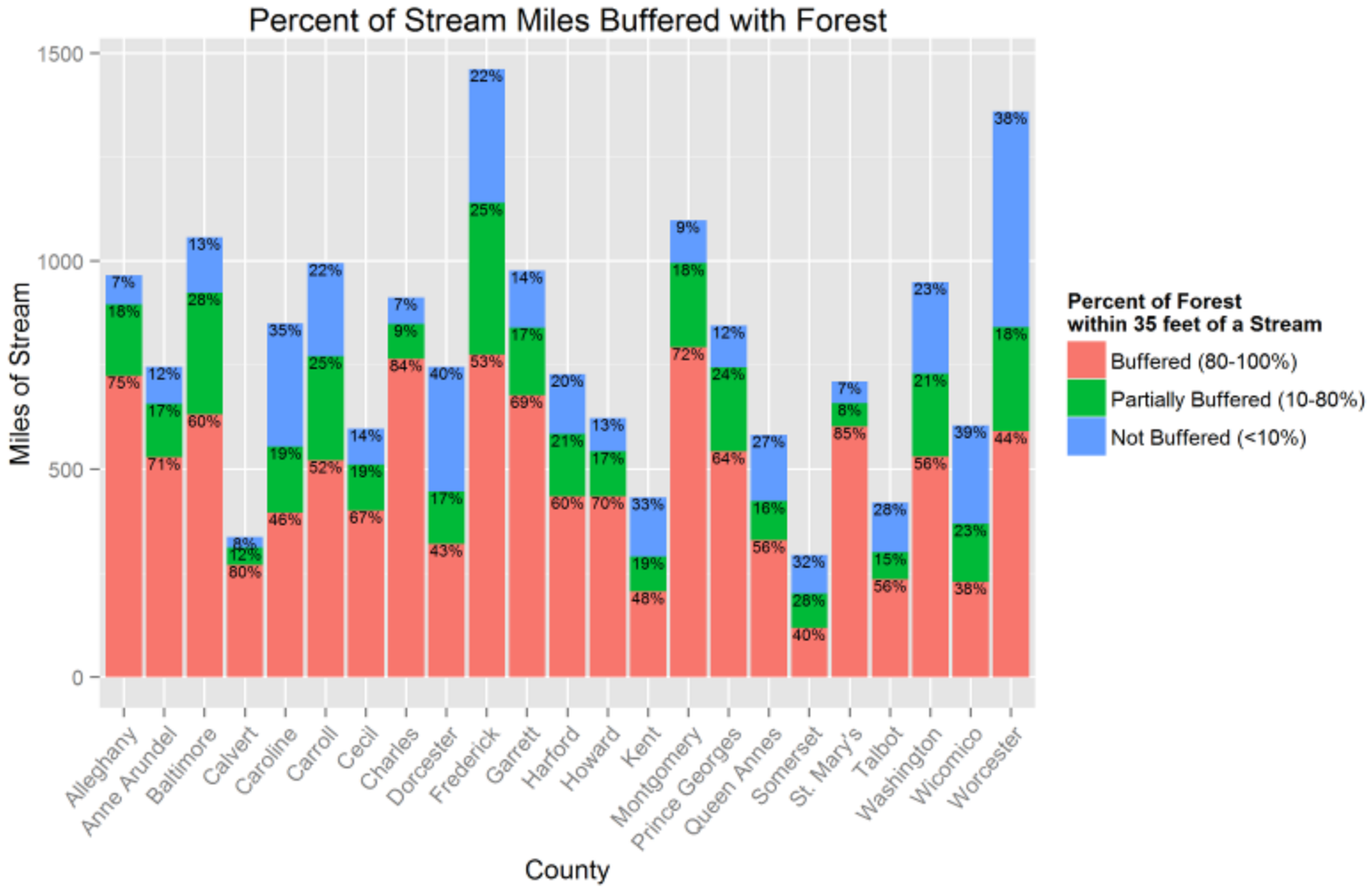


Data Source: Maryland DNR Forest Service. 2014.

We've identified them, now what?

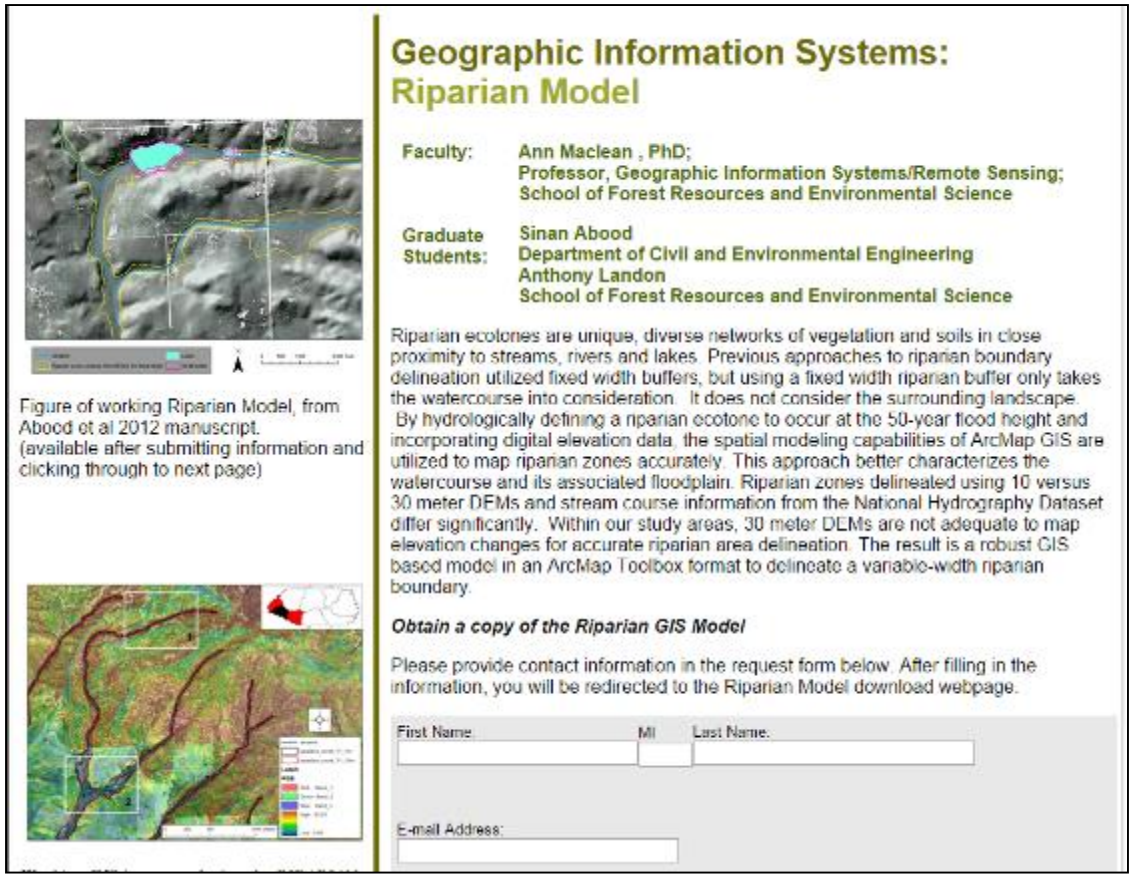


Figure of working Riparian Model, from Abood et al 2012 manuscript. (available after submitting information and clicking through to next page)

Geographic Information Systems: Riparian Model

Faculty: Ann Maclean , PhD;
Professor, Geographic Information Systems/Remote Sensing;
School of Forest Resources and Environmental Science

Graduate Students: Sinan Abood
Department of Civil and Environmental Engineering
Anthony Landon
School of Forest Resources and Environmental Science

Riparian ecotones are unique, diverse networks of vegetation and soils in close proximity to streams, rivers and lakes. Previous approaches to riparian boundary delineation utilized fixed width buffers, but using a fixed width riparian buffer only takes the watercourse into consideration. It does not consider the surrounding landscape. By hydrologically defining a riparian ecotone to occur at the 50-year flood height and incorporating digital elevation data, the spatial modeling capabilities of ArcMap GIS are utilized to map riparian zones accurately. This approach better characterizes the watercourse and its associated floodplain. Riparian zones delineated using 10 versus 30 meter DEMs and stream course information from the National Hydrography Dataset differ significantly. Within our study areas, 30 meter DEMs are not adequate to map elevation changes for accurate riparian area delineation. The result is a robust GIS based model in an ArcMap Toolbox format to delineate a variable-width riparian boundary.

Obtain a copy of the Riparian GIS Model

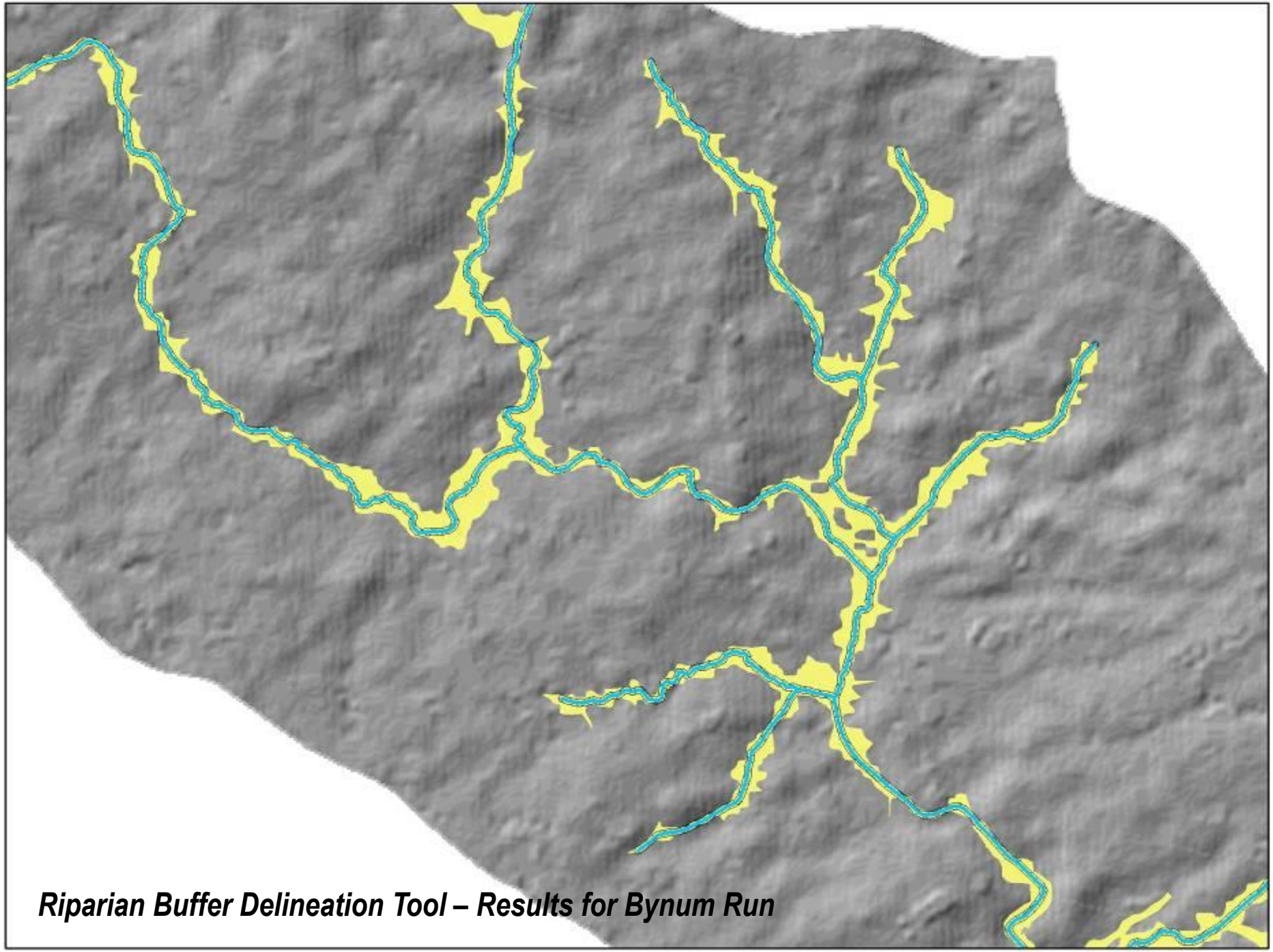
Please provide contact information in the request form below. After filling in the information, you will be redirected to the Riparian Model download webpage.

First Name: MI: Last Name:

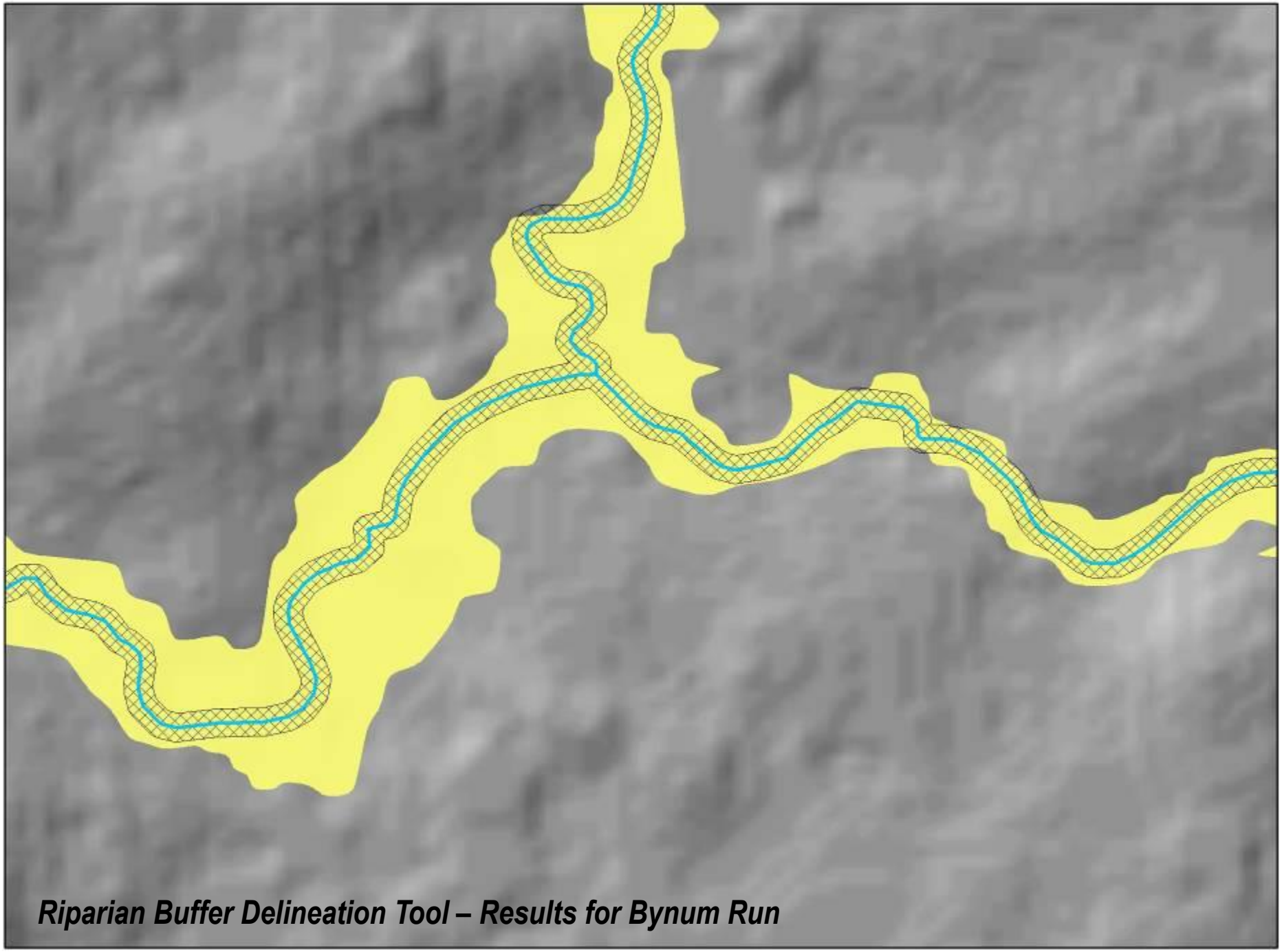
E-mail Address:

- Incorporates soils information and USGS stream data
- Fairly easy to run
- "Some assembly required" stream calculations required.

Michigan Tech



Riparian Buffer Delineation Tool – Results for Bynum Run



Riparian Buffer Delineation Tool – Results for Bynum Run

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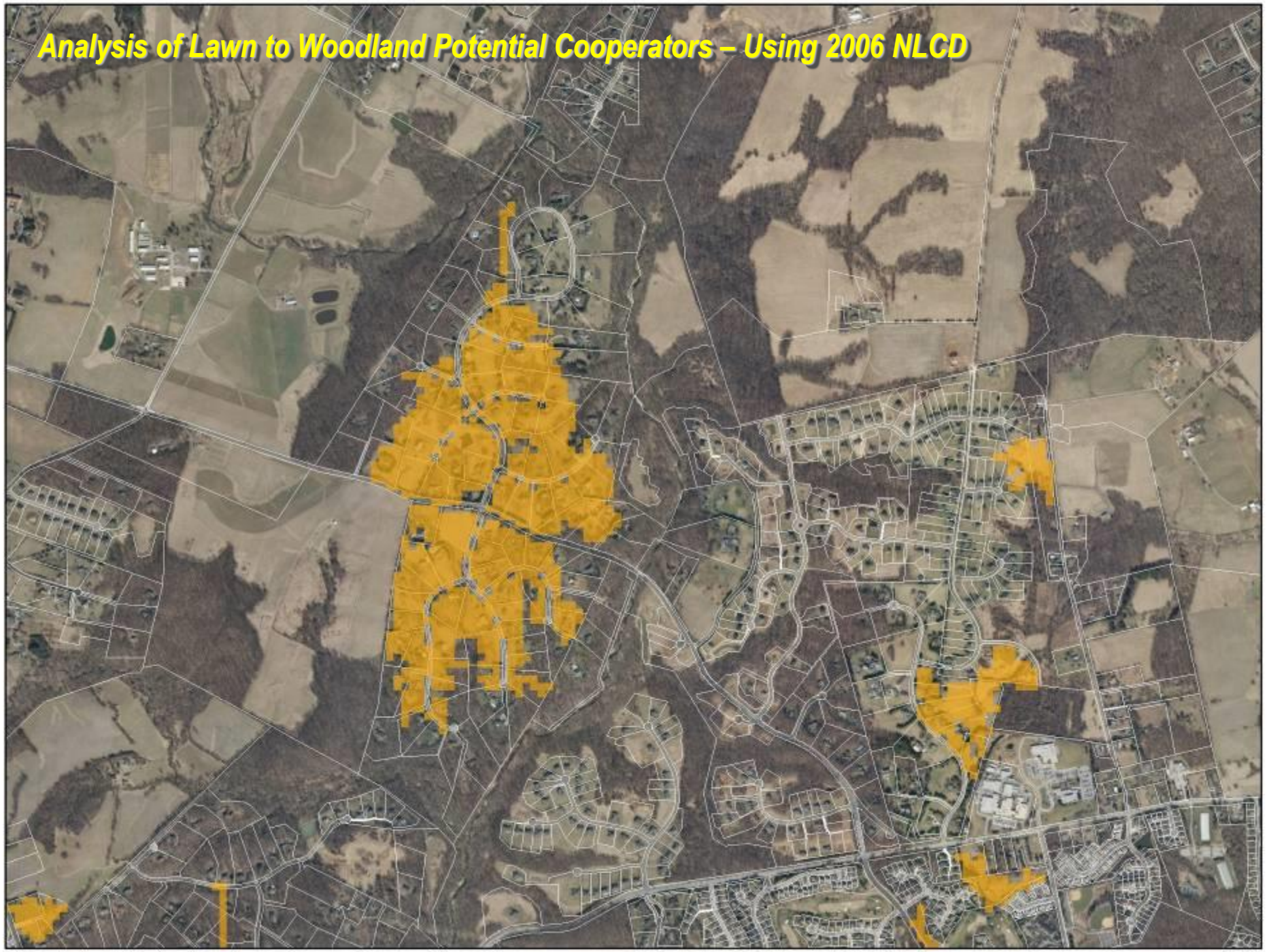
- Indentify landowners appropriate for the program
- 2 to 10 acres no tree cover (turf)
- Used NLCD 2006 landcover dataset.


Analysis of Lawn to Woodland Potential Cooperators – Using 2006 NLCD

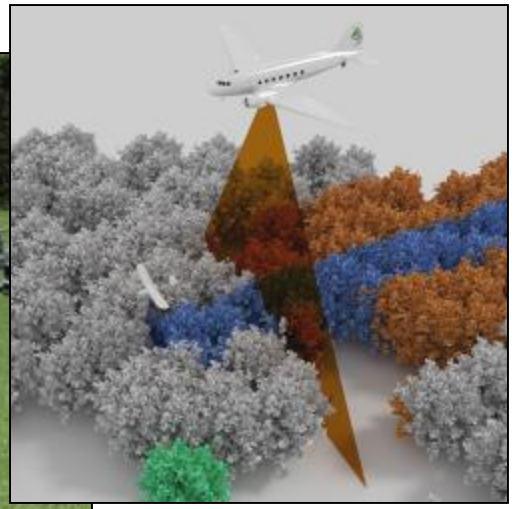
A Forest Planner's Wish List:

- We have great tree/forest cover, now we need precision streams
- Can identify tree cover, now can you tell me what kind of tree species?
- Affordable updates to LiDAR coverage at regular intervals (3 to 5 years)– Improves estimates of in-growth.

Future Data Collection of LiDAR for Forestry:

Drones?

By Flying Eye (Own work) [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons



https://carbomap.wordpress.com/tag/forest-ecosystems/

- Small Flash LiDAR sensors
- How frequently do we need to collect data?
- State forest level projects, but is it practical at state or even county level?
- 1 space based sensor or a gazillion drones?

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