



*Jack Perdue, MD Forest Service*



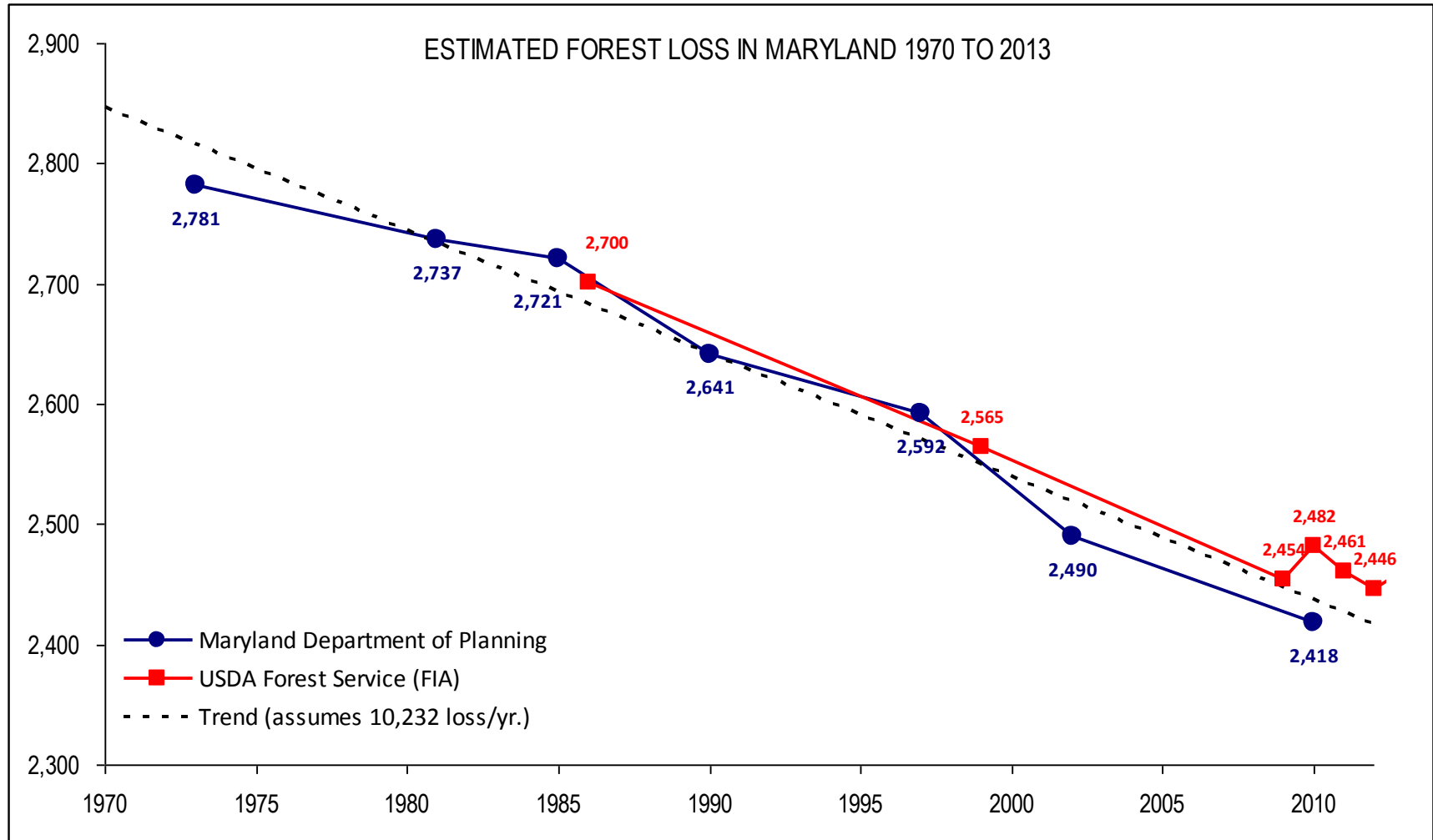
*Mark Beals, MD Forest Service*

**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)



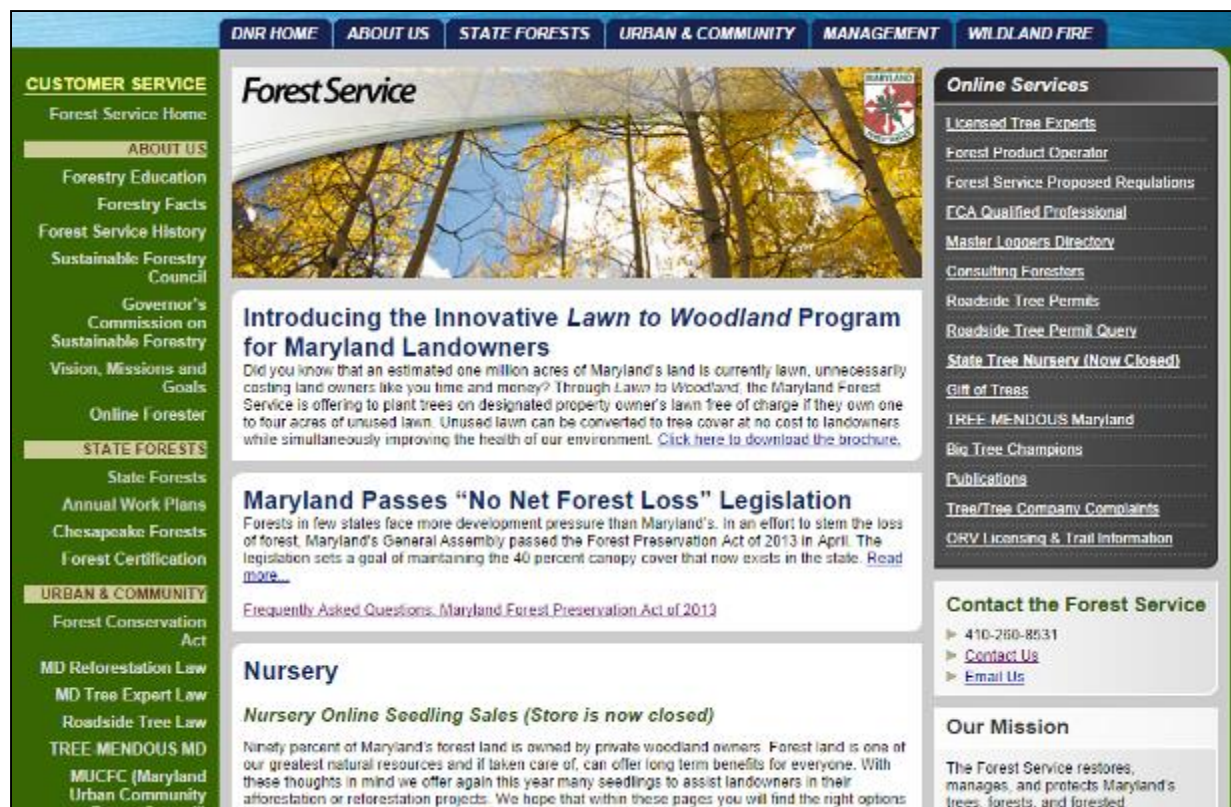




### The Forest Preservation Act of 2013

Sets a goal of 40% canopy cover statewide.

How do we do this?



The screenshot shows the Maryland Department of Natural Resources Forest Service website. The navigation bar includes links for DNR HOME, ABOUT US, STATE FORESTS, URBAN & COMMUNITY, MANAGEMENT, and WILDLAND FIRE. The left sidebar lists various services and programs, including Forest Service Home, ABOUT US, FORESTRY EDUCATION, FORESTRY FACTS, FOREST SERVICE HISTORY, SUSTAINABLE FORESTRY COUNCIL, GOVERNOR'S COMMISSION ON SUSTAINABLE FORESTRY, VISION, MISSIONS AND GOALS, ONLINE FORESTER, STATE FORESTS, ANNUAL WORK PLANS, CHESAPEAKE FORESTS, FOREST CERTIFICATION, URBAN & COMMUNITY, FOREST CONSERVATION ACT, MD REFORESTATION LAW, MD TREE EXPERT LAW, ROADSIDE TREE LAW, TREE MENDOUS MD, and MUCFC (Maryland Urban Community Forest Council). The main content area features a large image of trees with the heading "Forest Service" and a subheading "Introducing the Innovative Lawn to Woodland Program for Maryland Landowners". Below this is a paragraph explaining the program and a link to download a brochure. Another section titled "Maryland Passes 'No Net Forest Loss' Legislation" provides details about the Forest Preservation Act of 2013 and a link to read more. A "Nursery" section mentions that the nursery is now closed. The right sidebar lists online services such as Licensed Tree Experts, Forest Product Operator, Forest Service Proposed Regulations, FCA Qualified Professional, Master Loggers Directory, Consulting Foresters, Roadside Tree Permits, Roadside Tree Permit Query, State Tree Nursery (Now Closed), Gift of Trees, TREE MENDOUS Maryland, Big Tree Champions, Publications, Tree/Tree Company Complaints, and ORV Licensing & Trail Information. At the bottom of the right sidebar, there is a "Contact the Forest Service" section with a phone number, contact us link, and email us link, and an "Our Mission" section stating that the Forest Service restores, manages, and protects Maryland's trees, forests, and forested lands.



### 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.





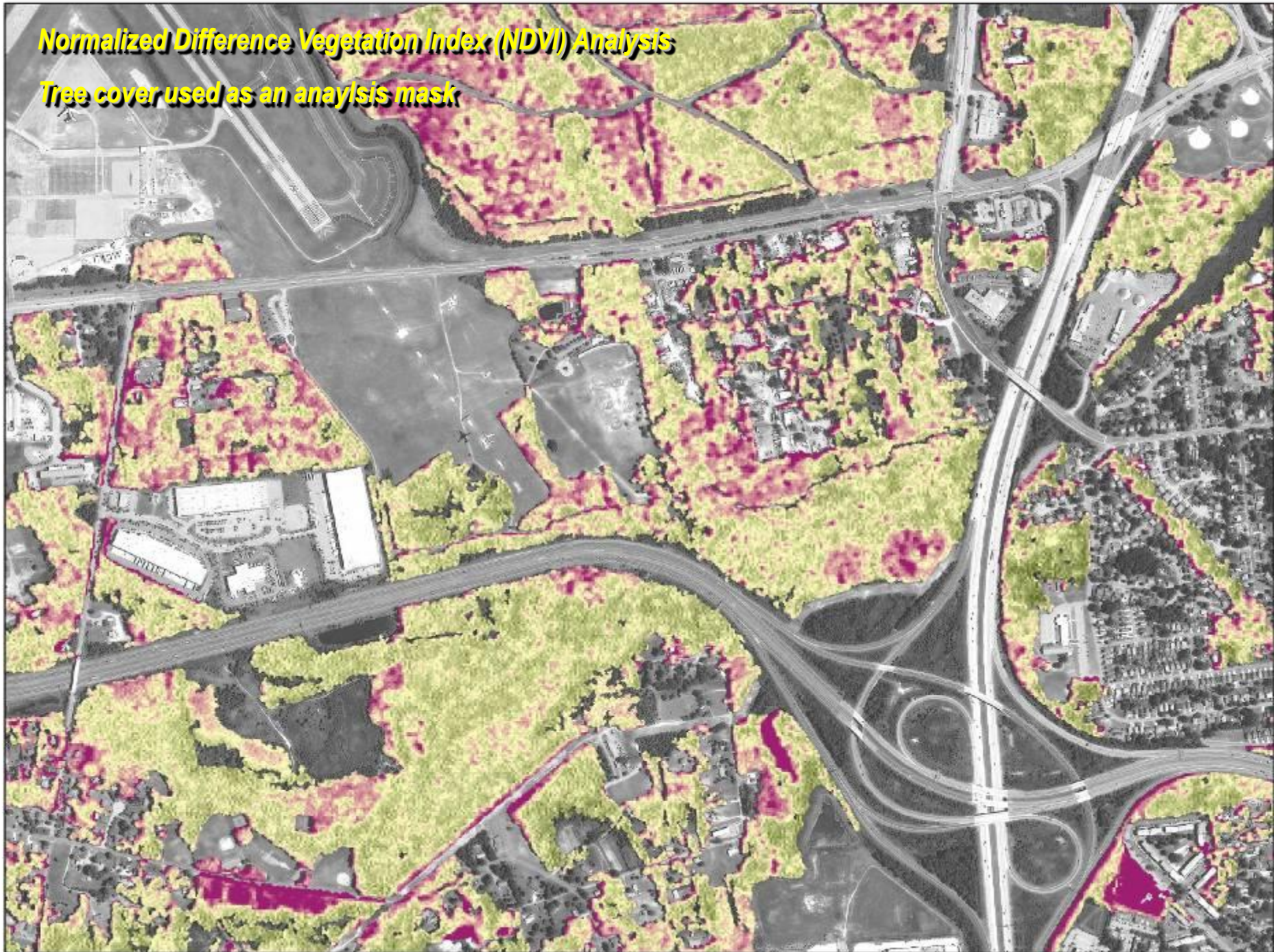
**UMD delivered tree cover (red) – Anne Arundel County, MD - ca. 2004  
LiDAR data with 2011 National Agricultural Imagery Program (NAIP)  
Imagery**





## **Normalized Difference Vegetation Index (NDVI) Analysis**

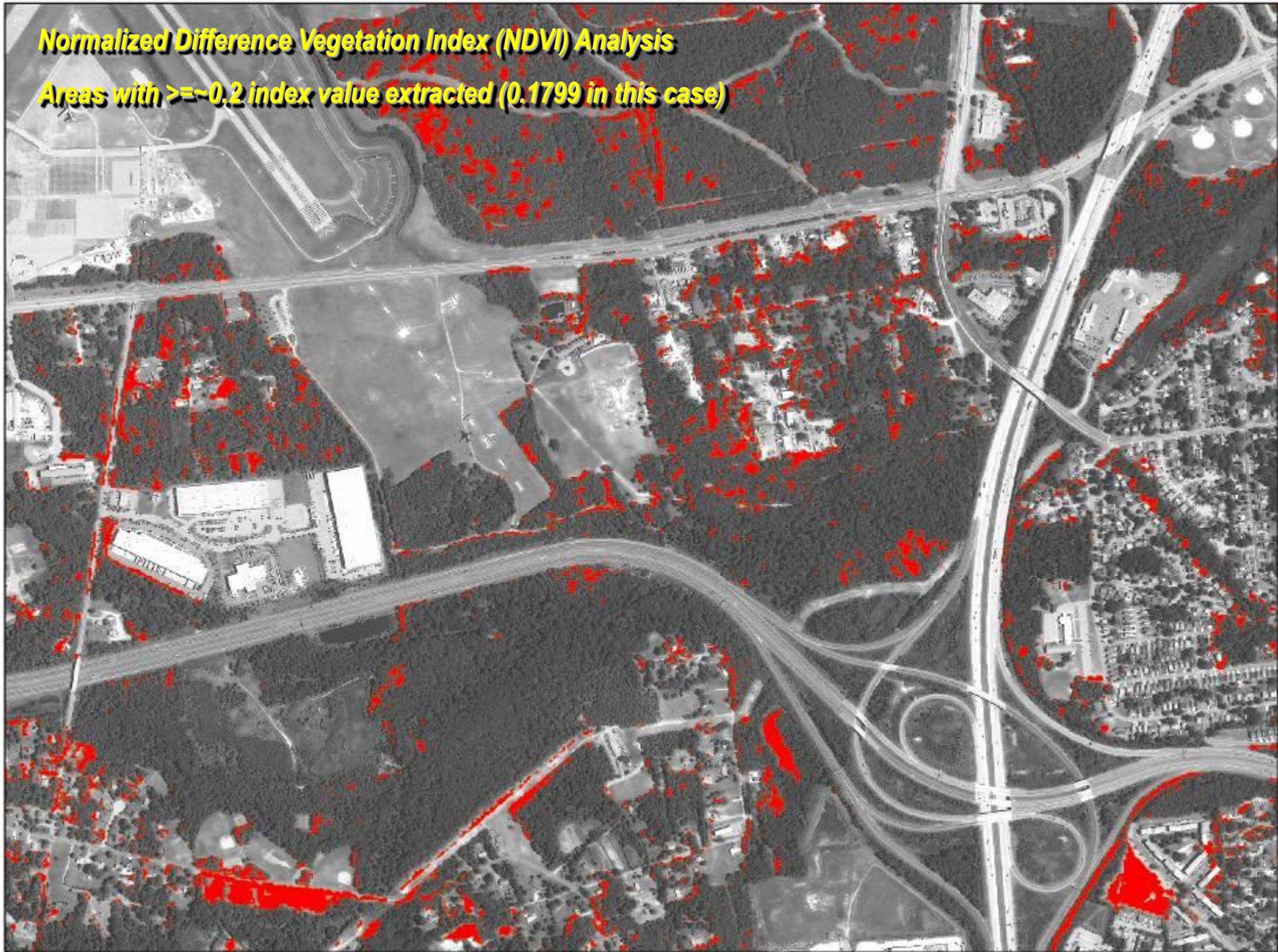
**Tree cover used as an analysis mask**





## **Normalized Difference Vegetation Index (NDVI) Analysis**

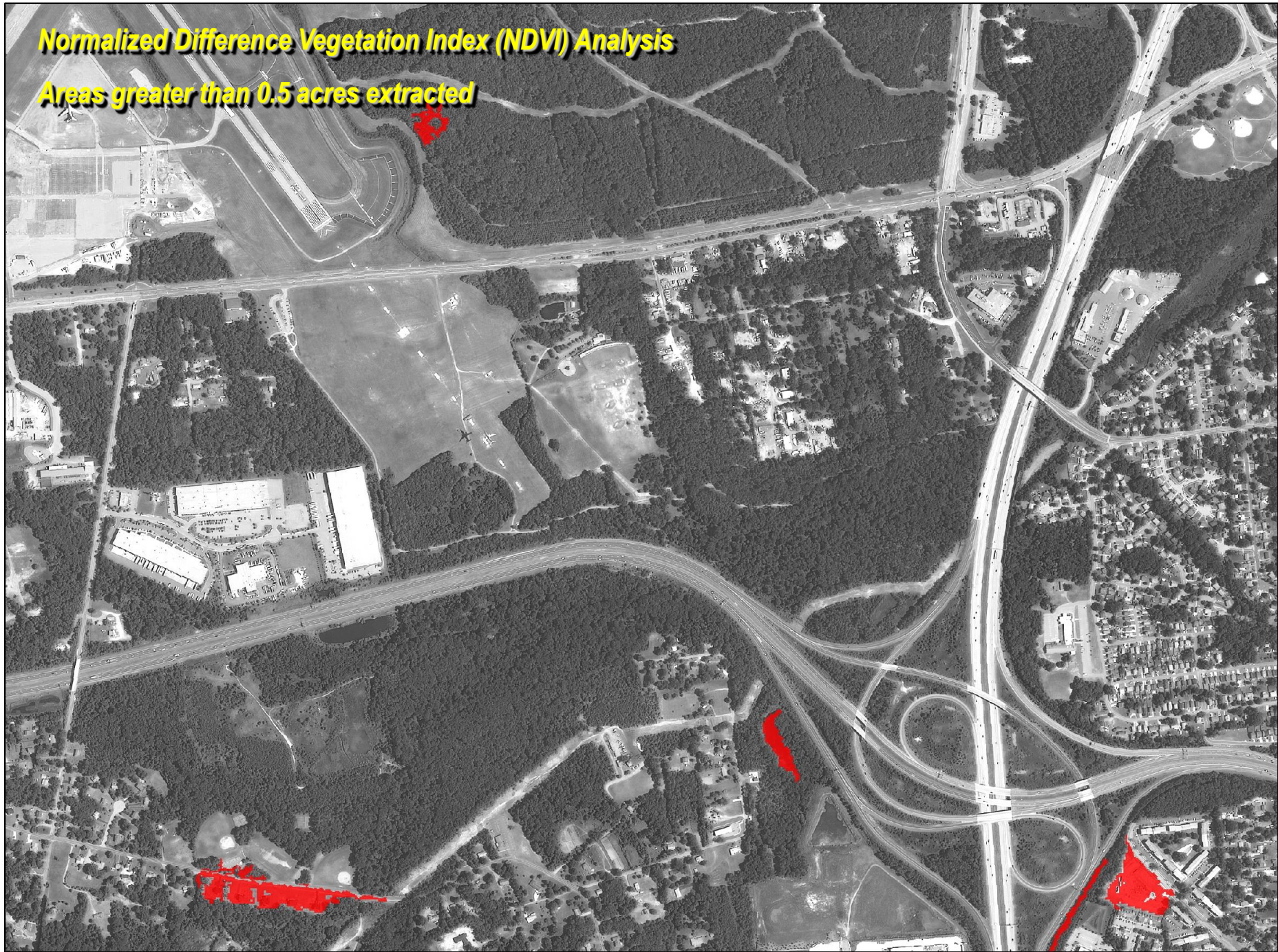
**Areas with  $\geq -0.2$  index value extracted (0.1799 in this case)**





# **Normalized Difference Vegetation Index (NDVI) Analysis**

**Areas greater than 0.5 acres extracted**

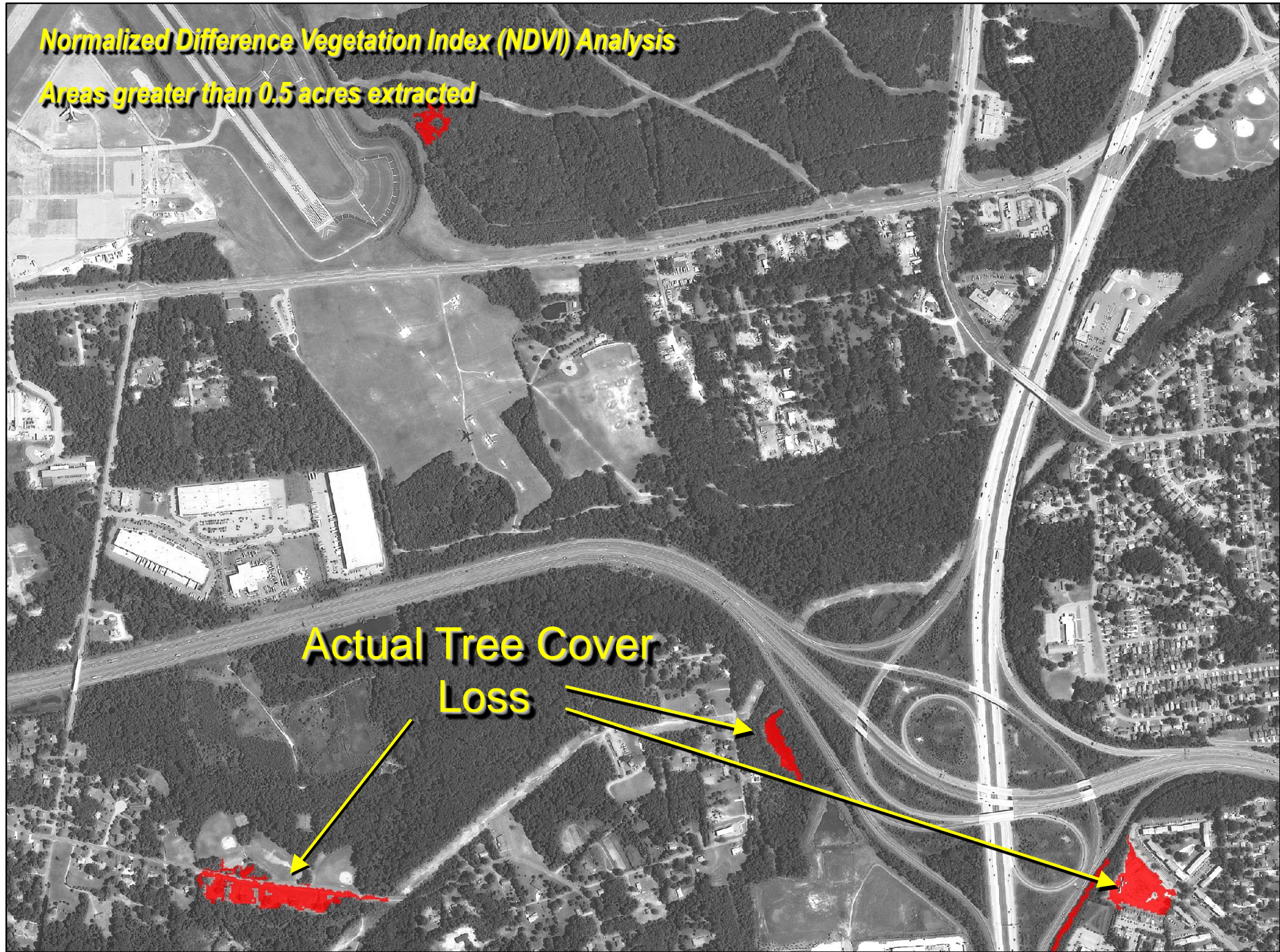




# Normalized Difference Vegetation Index (NDVI) Analysis

Areas greater than 0.5 acres extracted

Actual Tree Cover  
Loss





**Updated Tree Cover Dataset.**





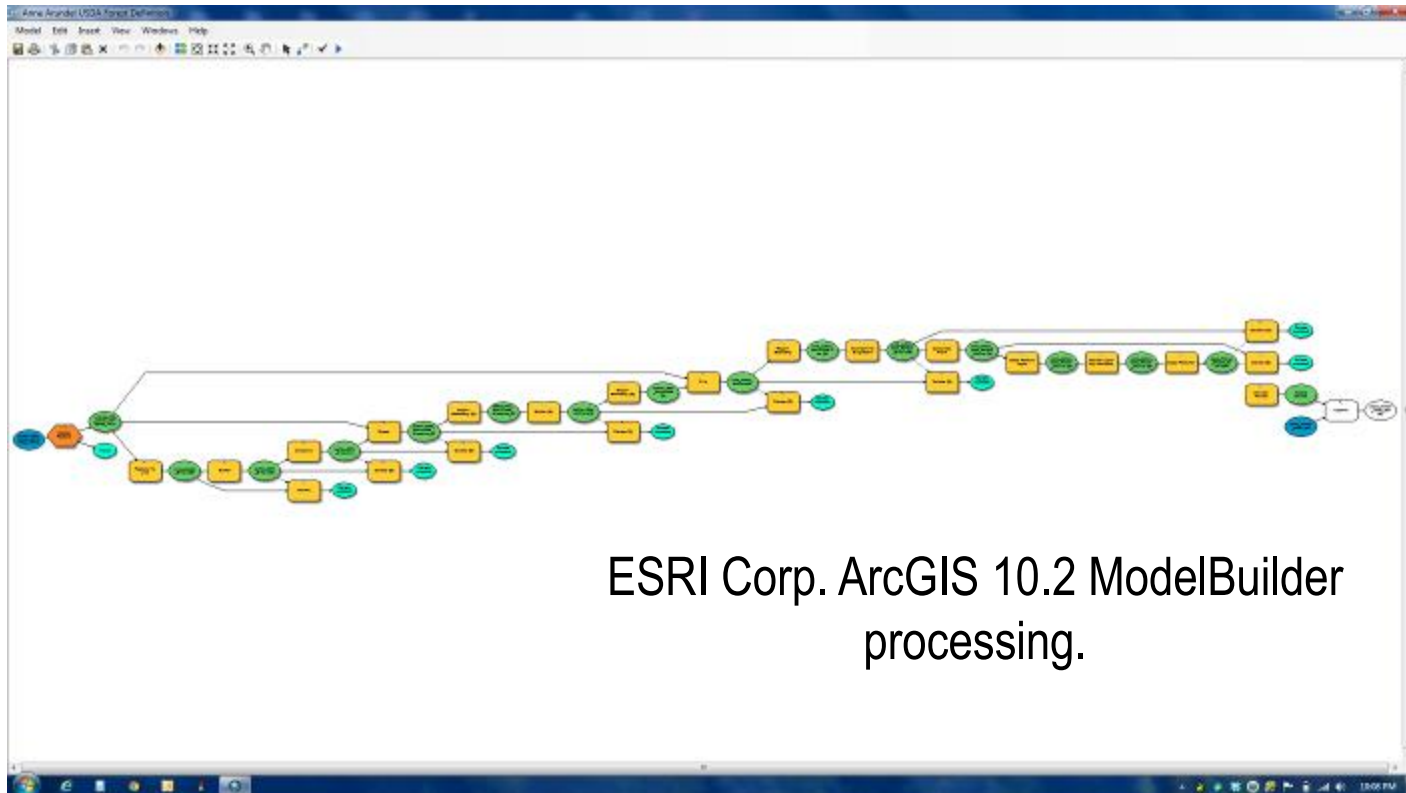
## Forest vs. Tree Cover

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.*



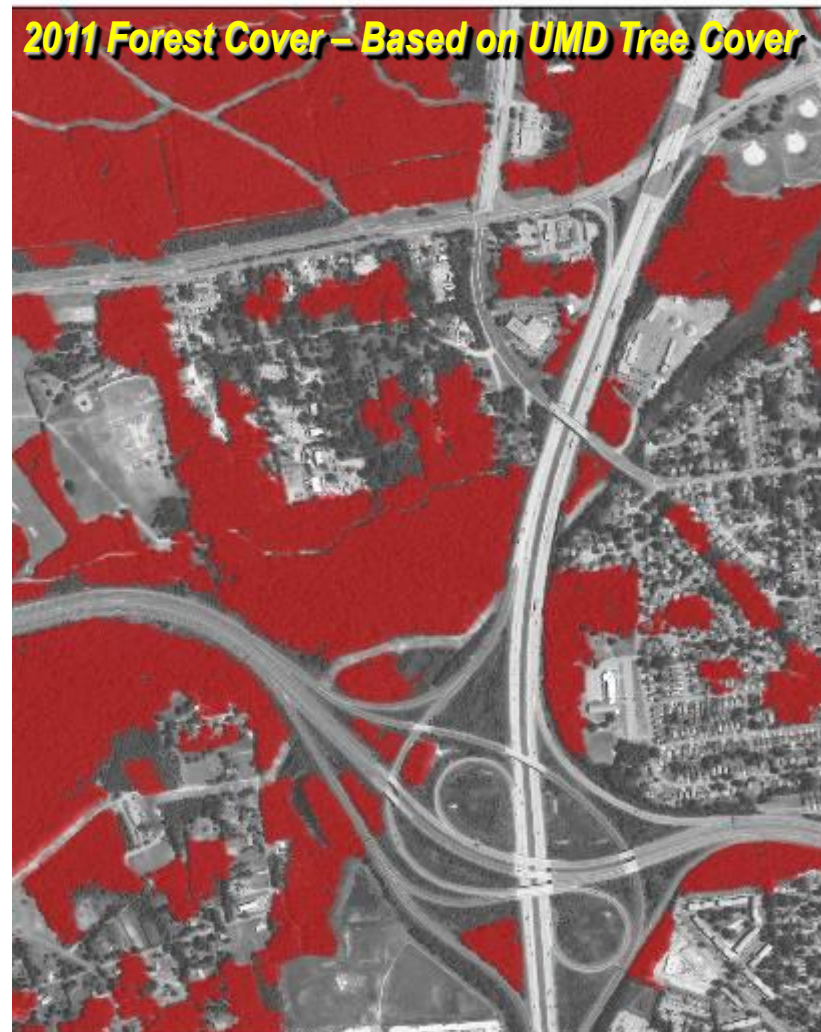
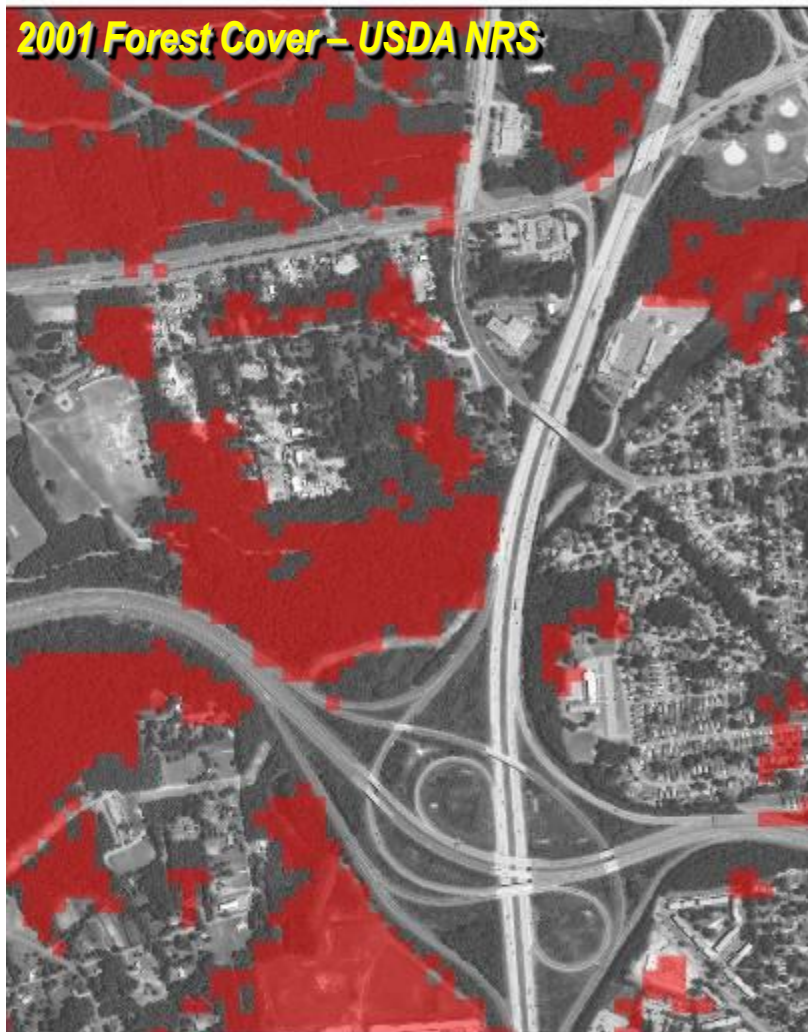
--National Core Field Guide, Version 6.0, October, 2012

### Where is Forest on the Landscape?



ESRI Corp. ArcGIS 10.2 ModelBuilder  
processing.



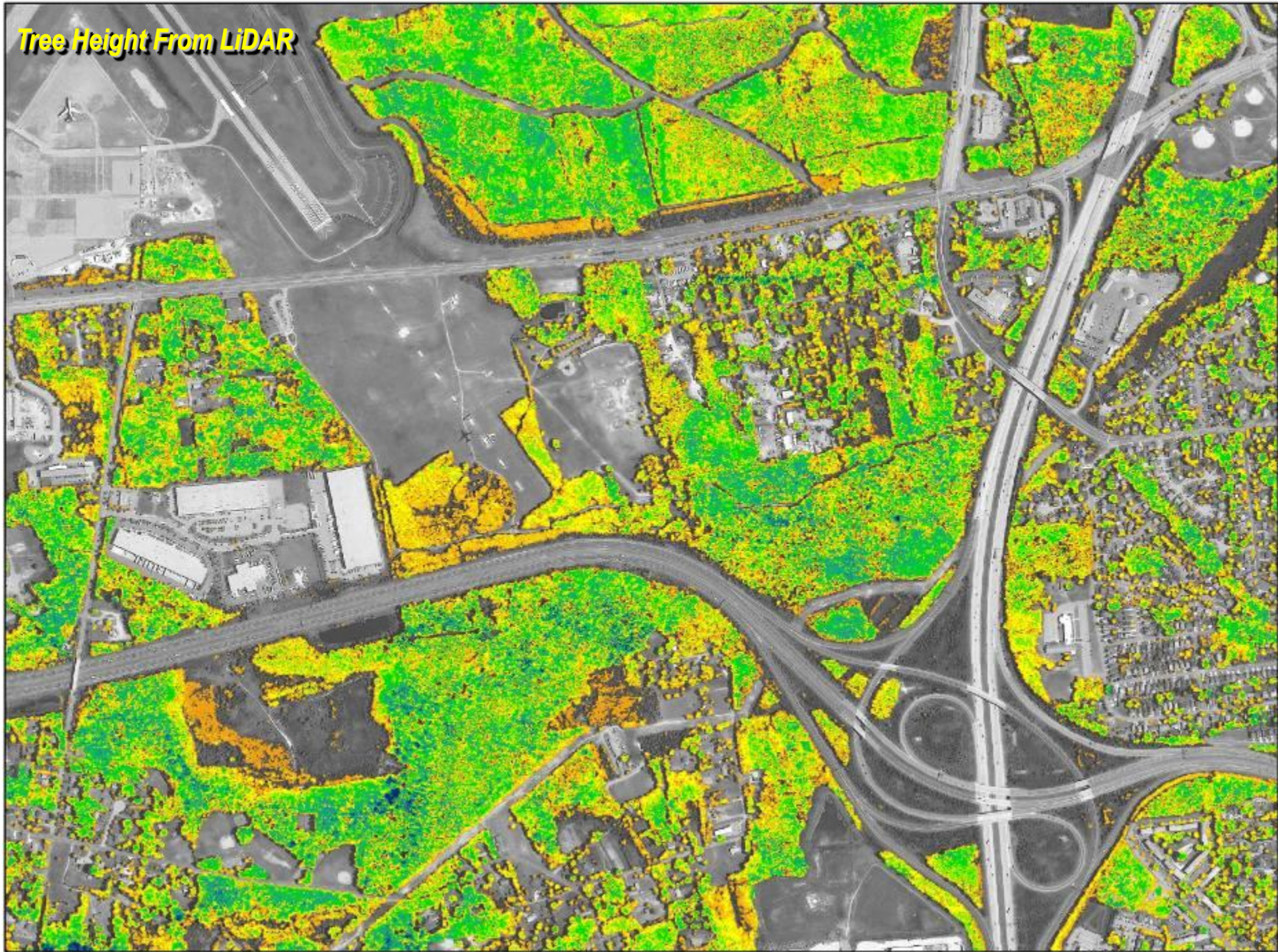




### **Example: Golden Winged Warbler Habitat Location**

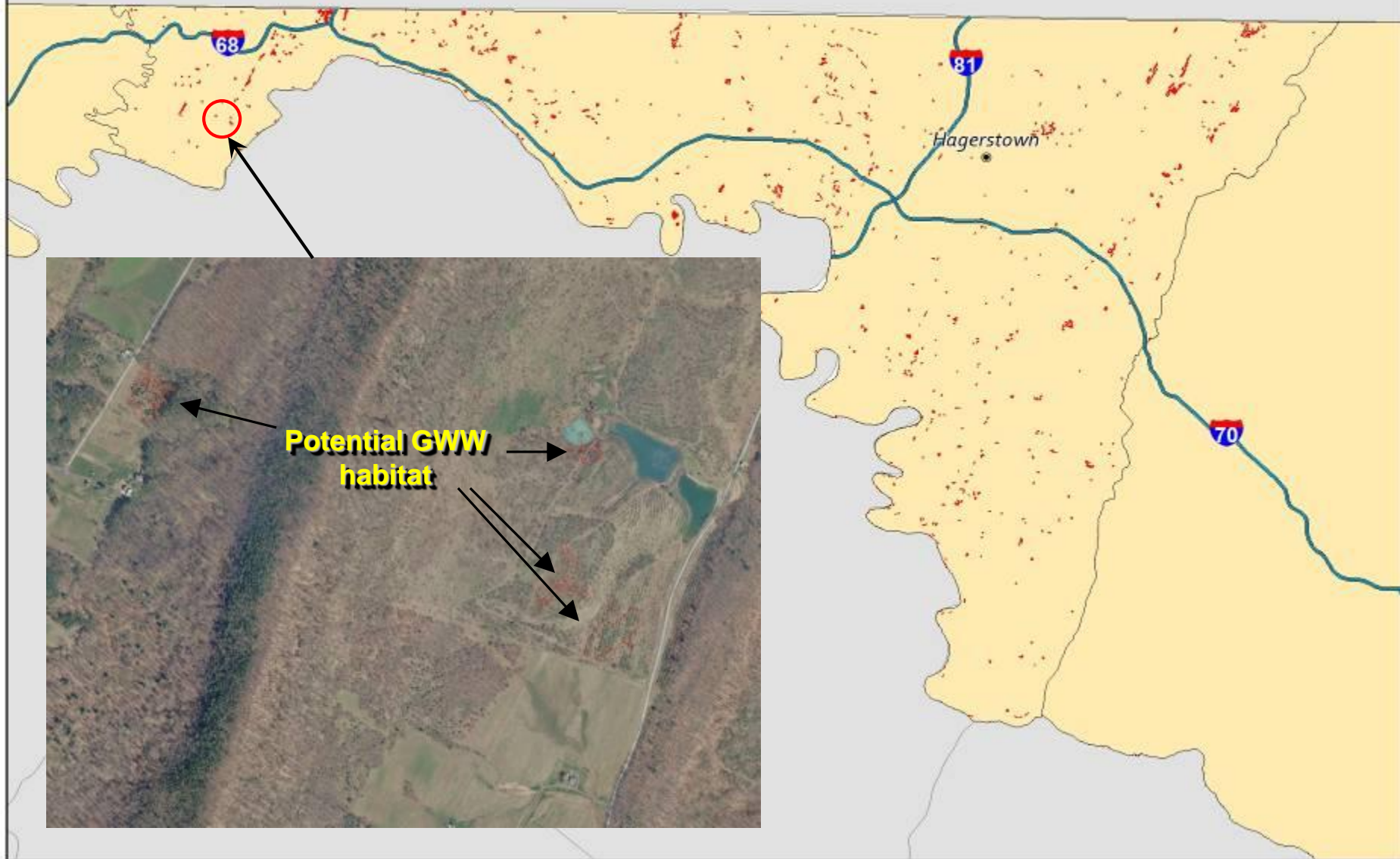


**Tree Height From LiDAR**





## 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%)**

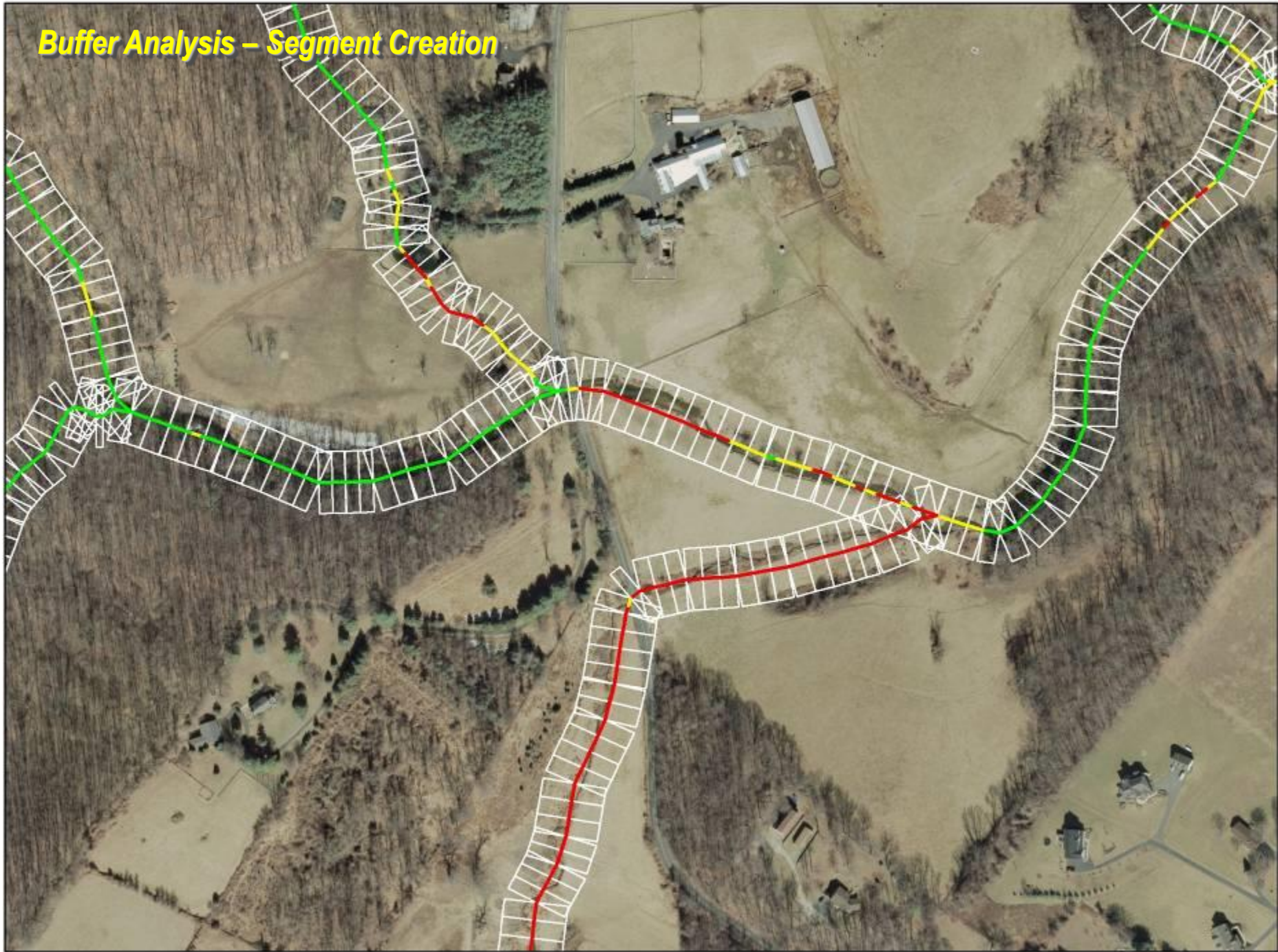
**Yellow – Partially Buffered**

**Green – Mostly Buffered (>80%)**





## ***Buffer Analysis – Segment Creation***

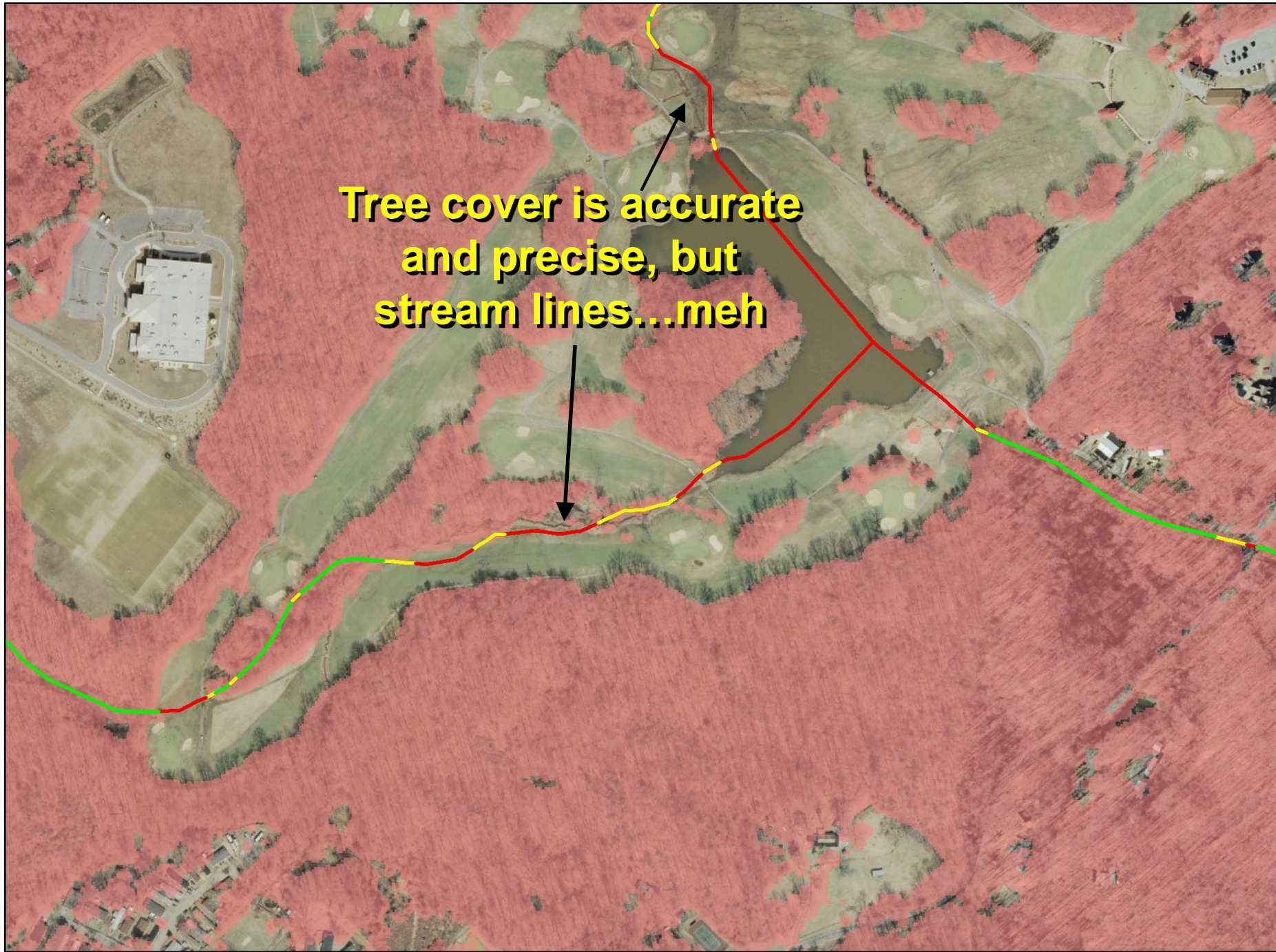




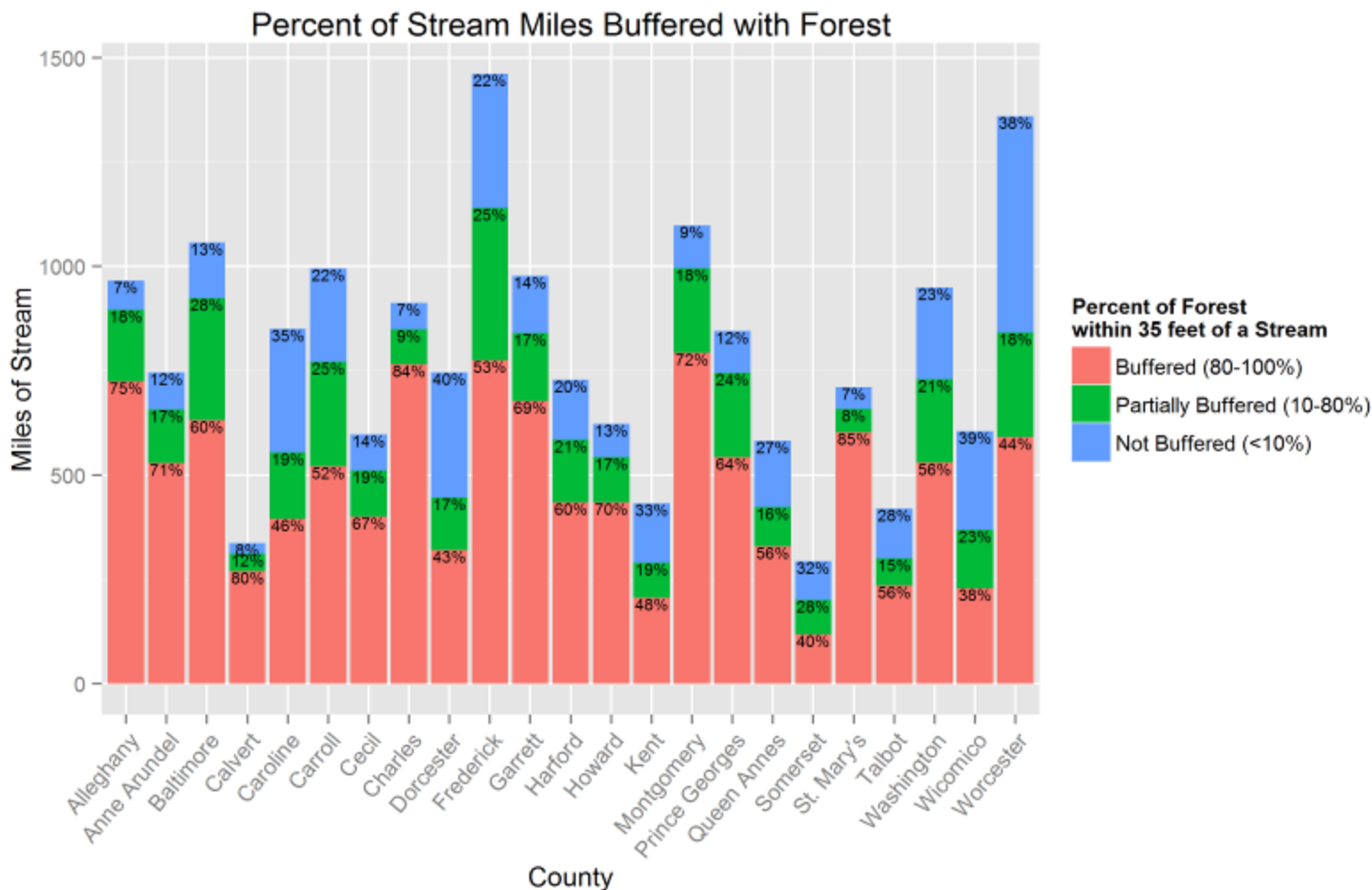




**Tree cover is accurate  
and precise, but  
stream lines...meh**







Data Source: Maryland DNR Forest Service. 2014.



*We've identified them, now what?*

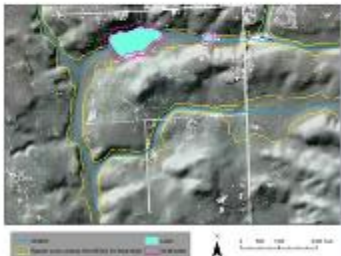
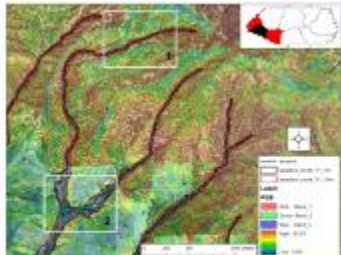


Figure of working Riparian Model, from Abood et al 2012 manuscript. (available after submitting information and clicking through to next page)



### 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.

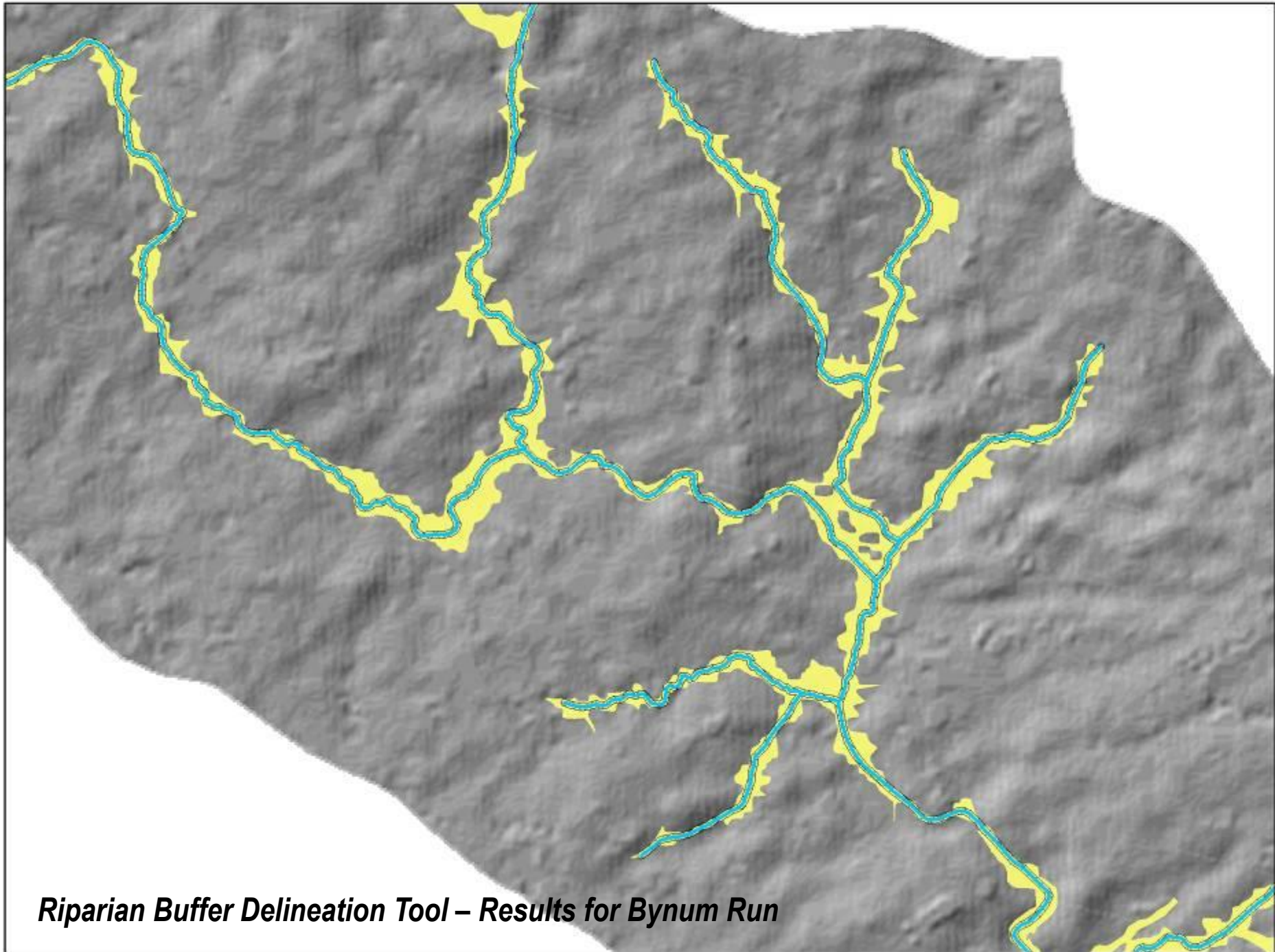
First Name:  MI:  Last Name:

E-mail Address:

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

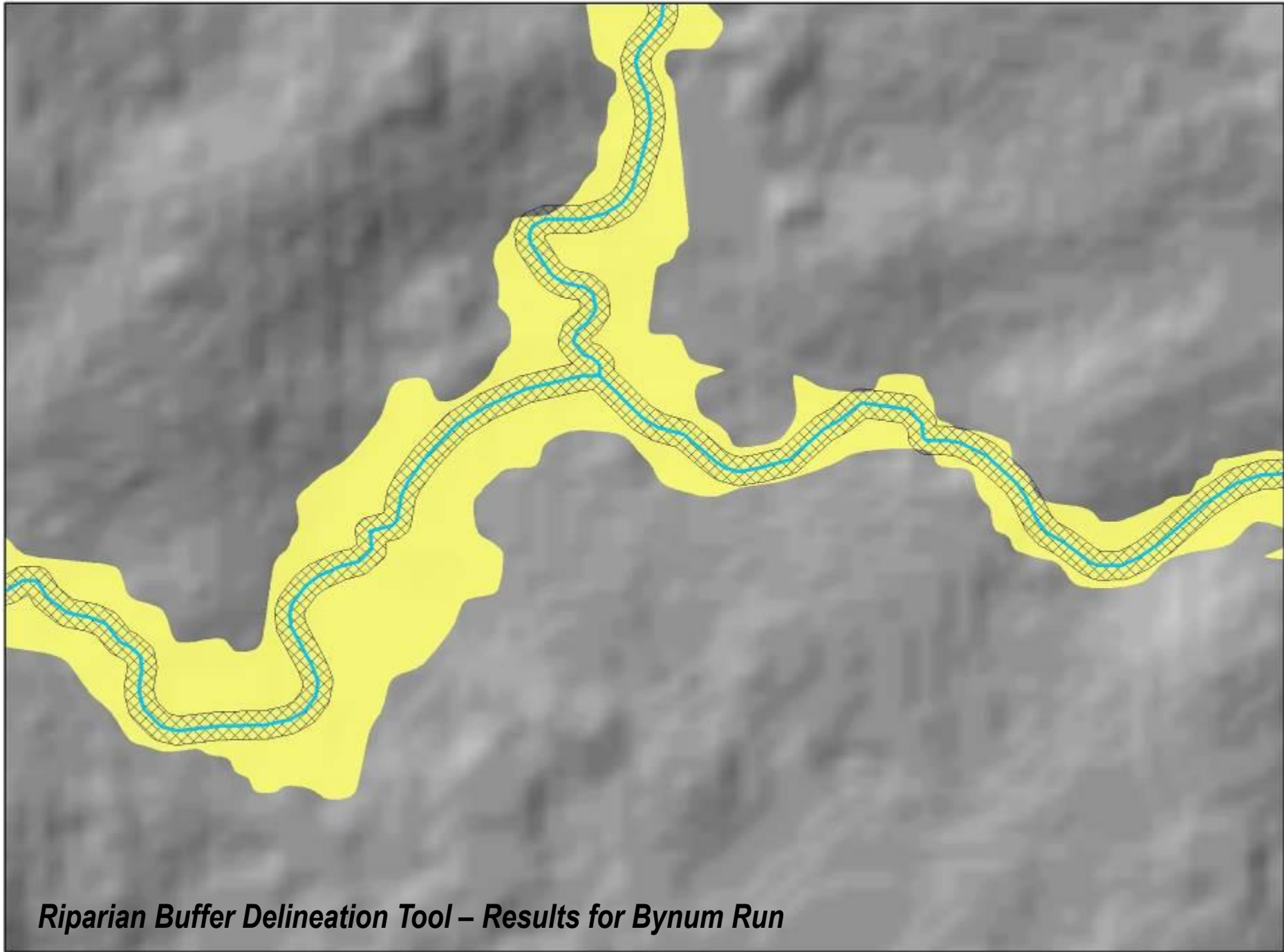
**Michigan Tech**





***Riparian Buffer Delineation Tool – Results for Bynum Run***





***Riparian Buffer Delineation Tool – Results for Bynum Run***

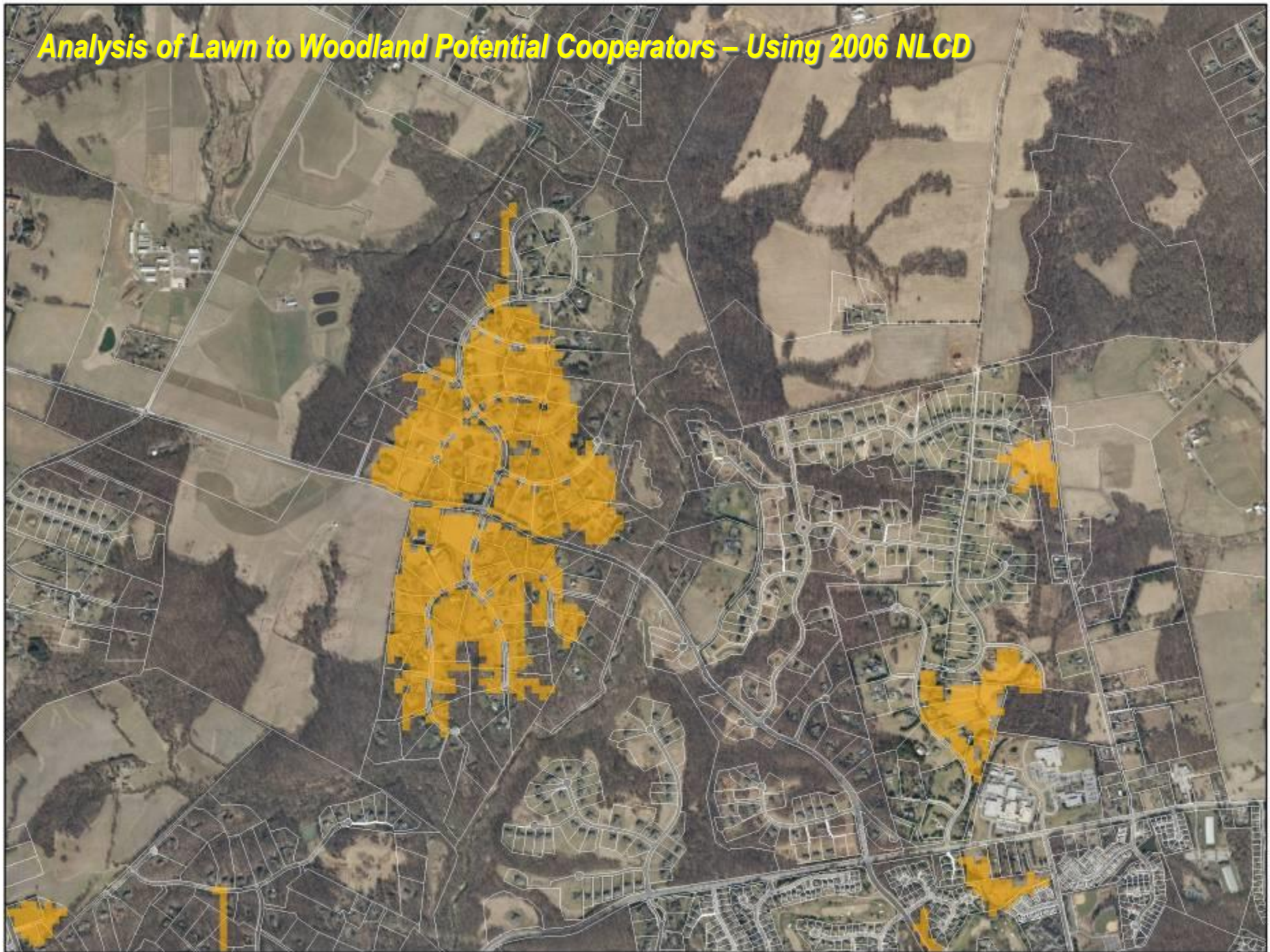




- Identify landowners appropriate for the program
- 2 to 10 acres no tree cover (turf)
- Used NLCD 2006 landcover dataset.



***Analysis of Lawn to Woodland Potential Cooperators – Using 2006 NLCD***





## **A Forest Planner's Wish List:**

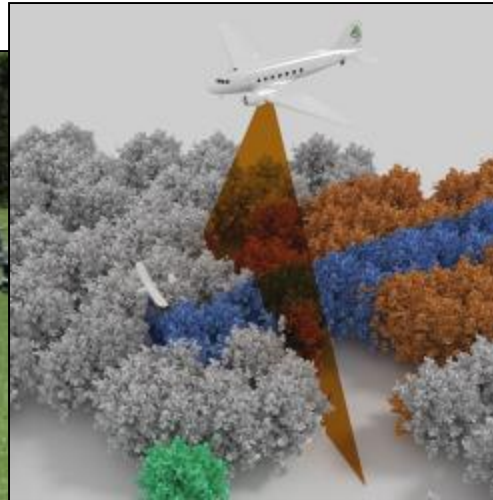
- We have great tree/forest cover, now we need precision streams
- Can identify tree cover, now can you tell me what kind of tree species?
- Affordable updates to LiDAR coverage at regular intervals (3 to 5 years)– Improves estimates of in-growth.





### Future Data Collection of LiDAR for Forestry:

#### Drones?



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

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

- 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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