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**Carbon Monitoring System (CMS) Applications Policy Speaker Series**

**Thursday, September 25, 2014**

NASA Goddard Space Flight Center

### The Maryland Forest Service

Mission: *Restore, manage, and protect Maryland's trees, forests, and forested ecosystems to sustain our natural resources and connect people to the land.*

- 82 permanent employees
- Numerous Seasonal and Contractual employees annually
- Manage state forests
- Provide services to private landowners.
- Primary tool is legislation.

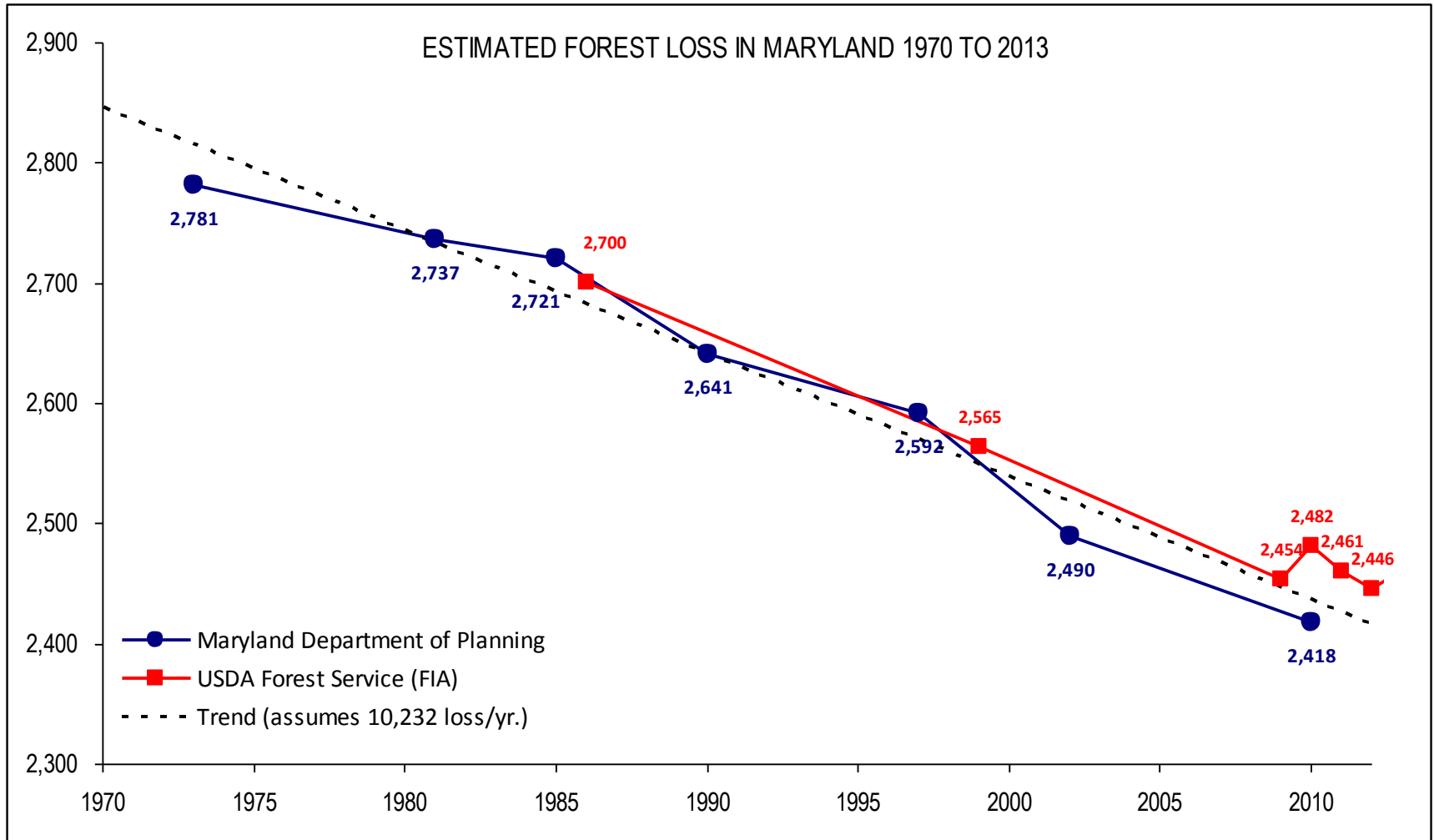




### A Brief Introduction to Maryland Forests and Forestry

- 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)







### A Brief Introduction to Maryland's Forests

- 8000-10,000 acres of “natural cover fires” occur each year.
- Forestry is the 5<sup>th</sup> largest employer in the state, with estimated 18,000 jobs.
- No National Forests

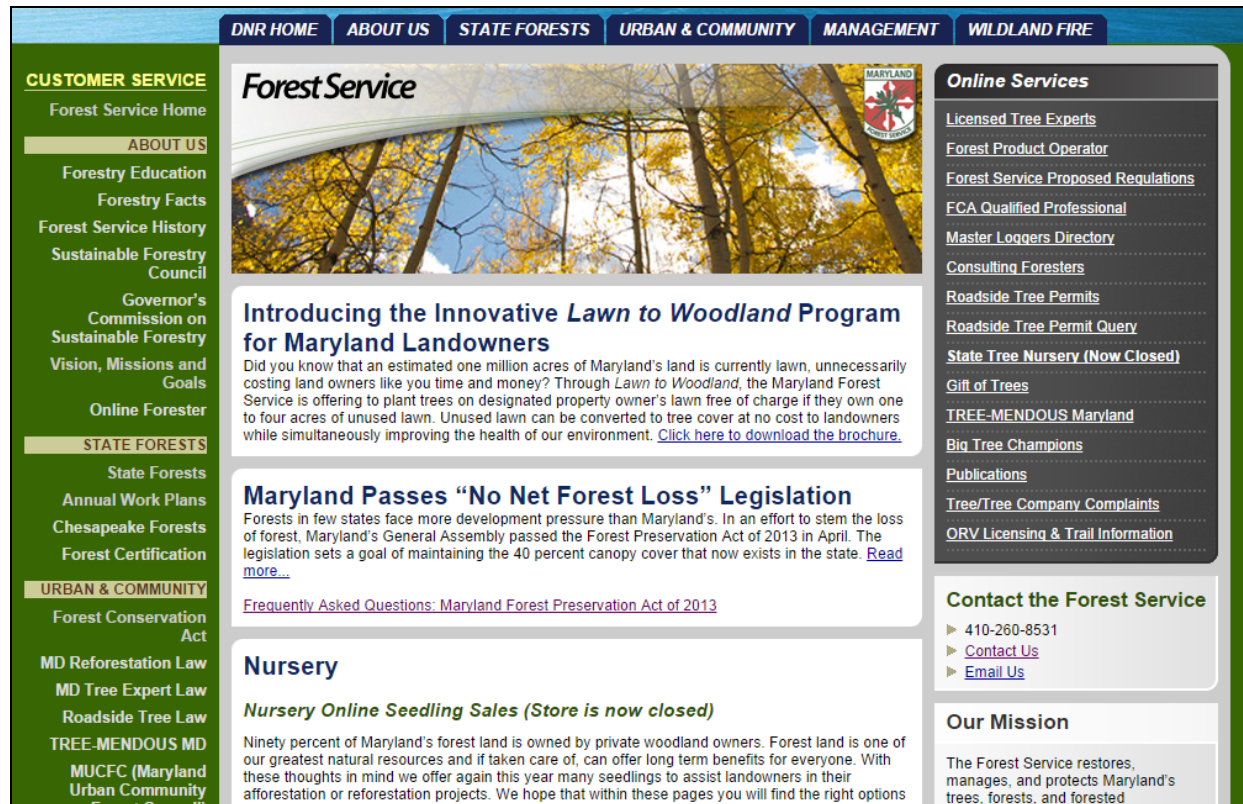


*Evan Jones*

### 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, Forest Service History, Sustainable Forestry Council, Governor's Commission on Sustainable Forestry, Vision, Missions and Goals, Online Forester, STATE FORESTS, URBAN & COMMUNITY, and TREE-MENDOUS MD. The main content area features a large banner for the Forest Service with a photo of trees. Below the banner, there are several articles and sections: 'Introducing the Innovative Lawn to Woodland Program for Maryland Landowners', 'Maryland Passes "No Net Forest Loss" Legislation', 'Nursery', and 'Contact the Forest Service'. The right sidebar contains 'Online Services' with links to various resources and 'Our Mission'.

**Forest Service**

**Introducing the Innovative Lawn to Woodland Program for Maryland Landowners**  
Did you know that an estimated one million acres of Maryland's land is currently lawn, unnecessarily costing land owners like you time and money? Through *Lawn to Woodland*, the Maryland Forest Service is offering to plant trees on designated property owner's lawn free of charge if they own one to four acres of unused lawn. Unused lawn can be converted to tree cover at no cost to landowners while simultaneously improving the health of our environment. [Click here to download the brochure.](#)

**Maryland Passes "No Net Forest Loss" Legislation**  
Forests in few states face more development pressure than Maryland's. In an effort to stem the loss of forest, Maryland's General Assembly passed the Forest Preservation Act of 2013 in April. The legislation sets a goal of maintaining the 40 percent canopy cover that now exists in the state. [Read more.](#)

[Frequently Asked Questions: Maryland Forest Preservation Act of 2013](#)

**Nursery**  
**Nursery Online Seedling Sales (Store is now closed)**  
Ninety percent of Maryland's forest land is owned by private woodland owners. Forest land is one of our greatest natural resources and if taken care of, can offer long term benefits for everyone. With these thoughts in mind we offer again this year many seedlings to assist landowners in their afforestation or reforestation projects. We hope that within these pages you will find the right options

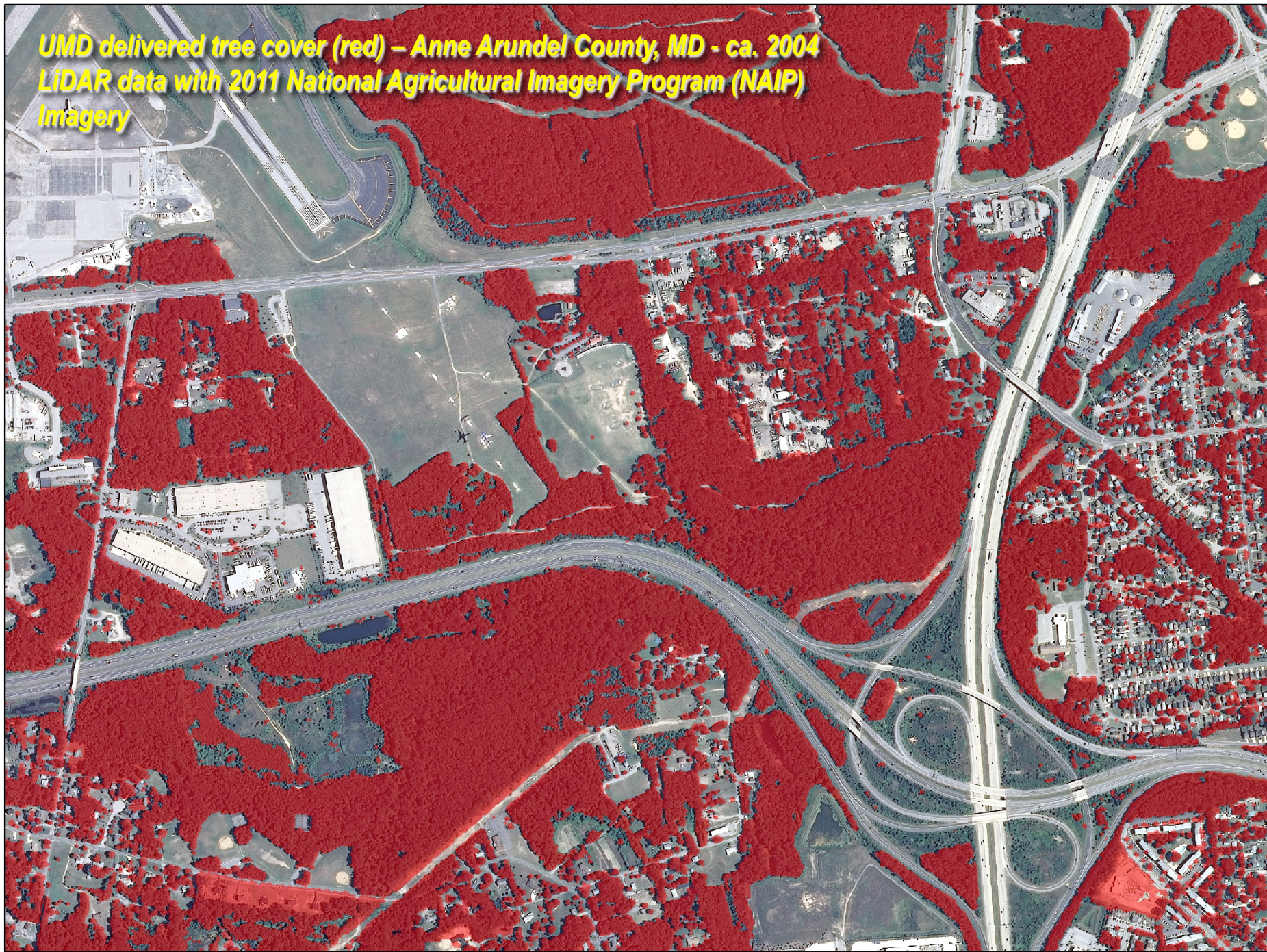
**Online Services**  
[Licensed Tree Experts](#)  
[Forest Product Operator](#)  
[Forest Service Proposed Regulations](#)  
[FCA Qualified Professional](#)  
[Master Loggers Directory](#)  
[Consulting Foresters](#)  
[Roadside Tree Permits](#)  
[Roadside Tree Permit Query](#)  
[State Tree Nursery \(Now Closed\)](#)  
[Gift of Trees](#)  
[TREE-MENDOUS Maryland](#)  
[Big Tree Champions](#)  
[Publications](#)  
[Tree/Tree Company Complaints](#)  
[ORV Licensing & Trail Information](#)

**Contact the Forest Service**  
► 410-260-8531  
► [Contact Us](#)  
► [Email Us](#)

**Our Mission**  
The Forest Service restores, manages, and protects Maryland's trees, forests, and forested



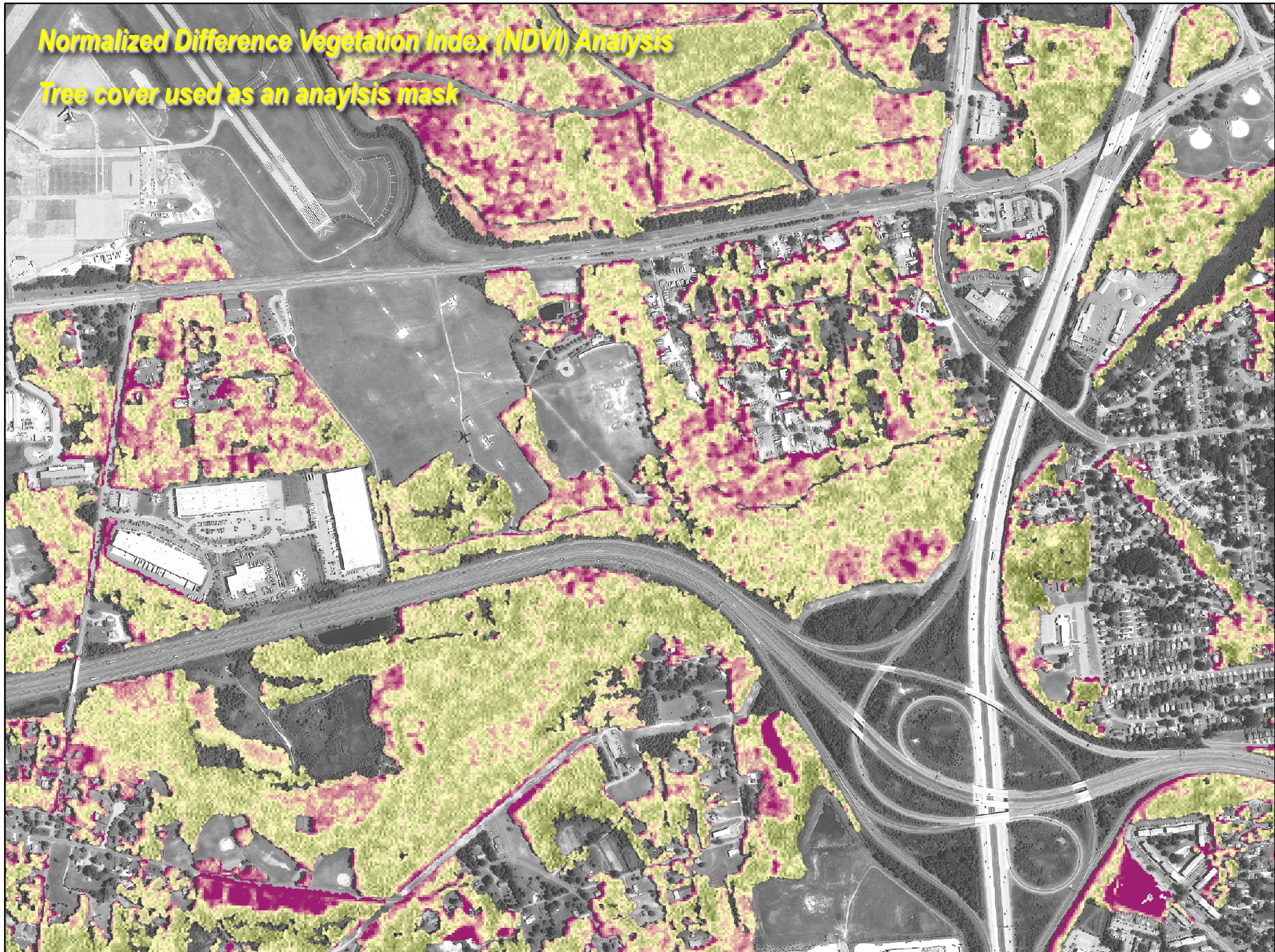
**UMD delivered tree cover (red) – Anne Arundel County, MD - ca. 2004**  
**LiDAR data with 2011 National Agricultural Imagery Program (NAIP)**  
**Imagery**





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

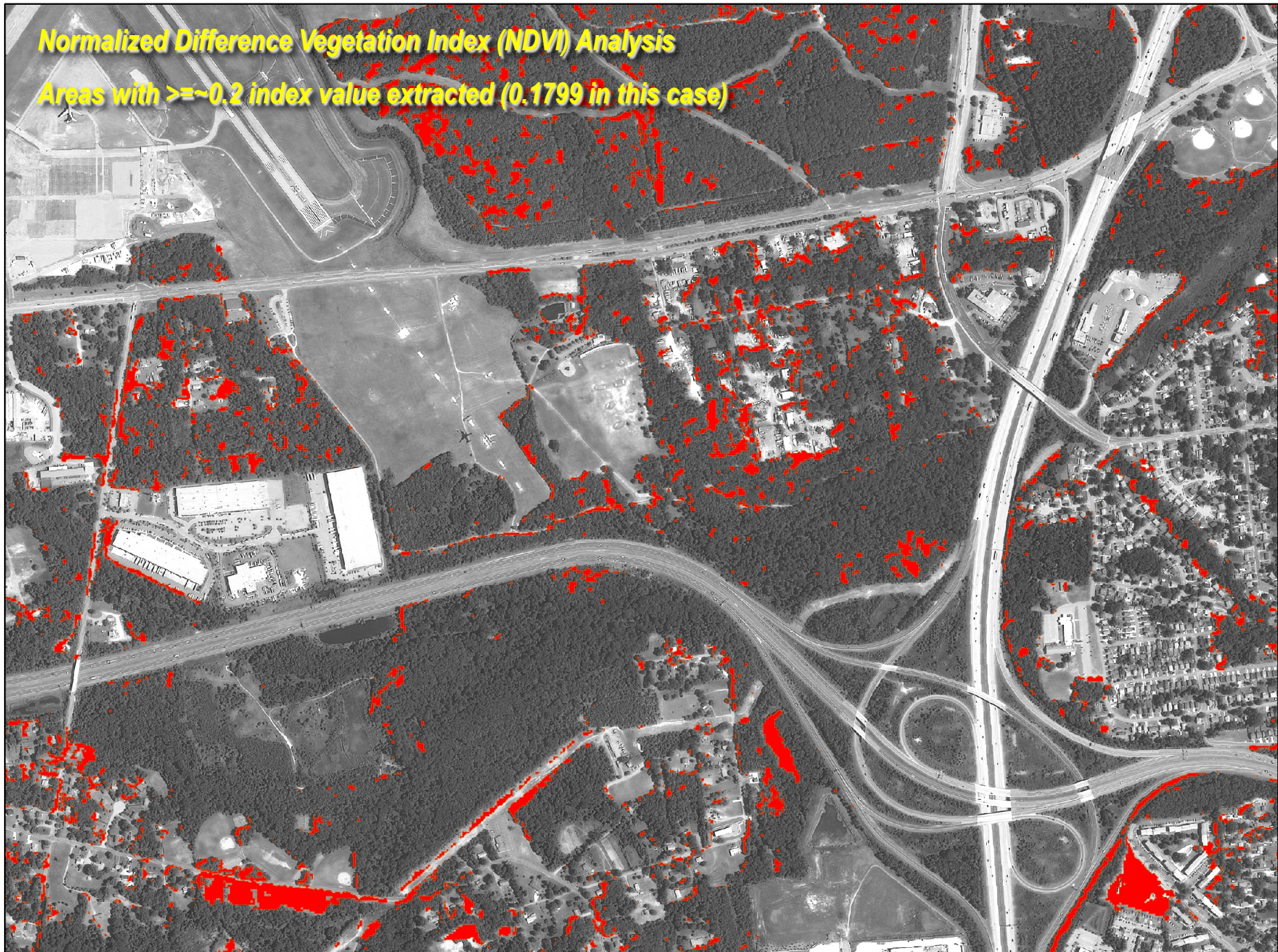
**Tree cover used as an analysis mask**





## 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

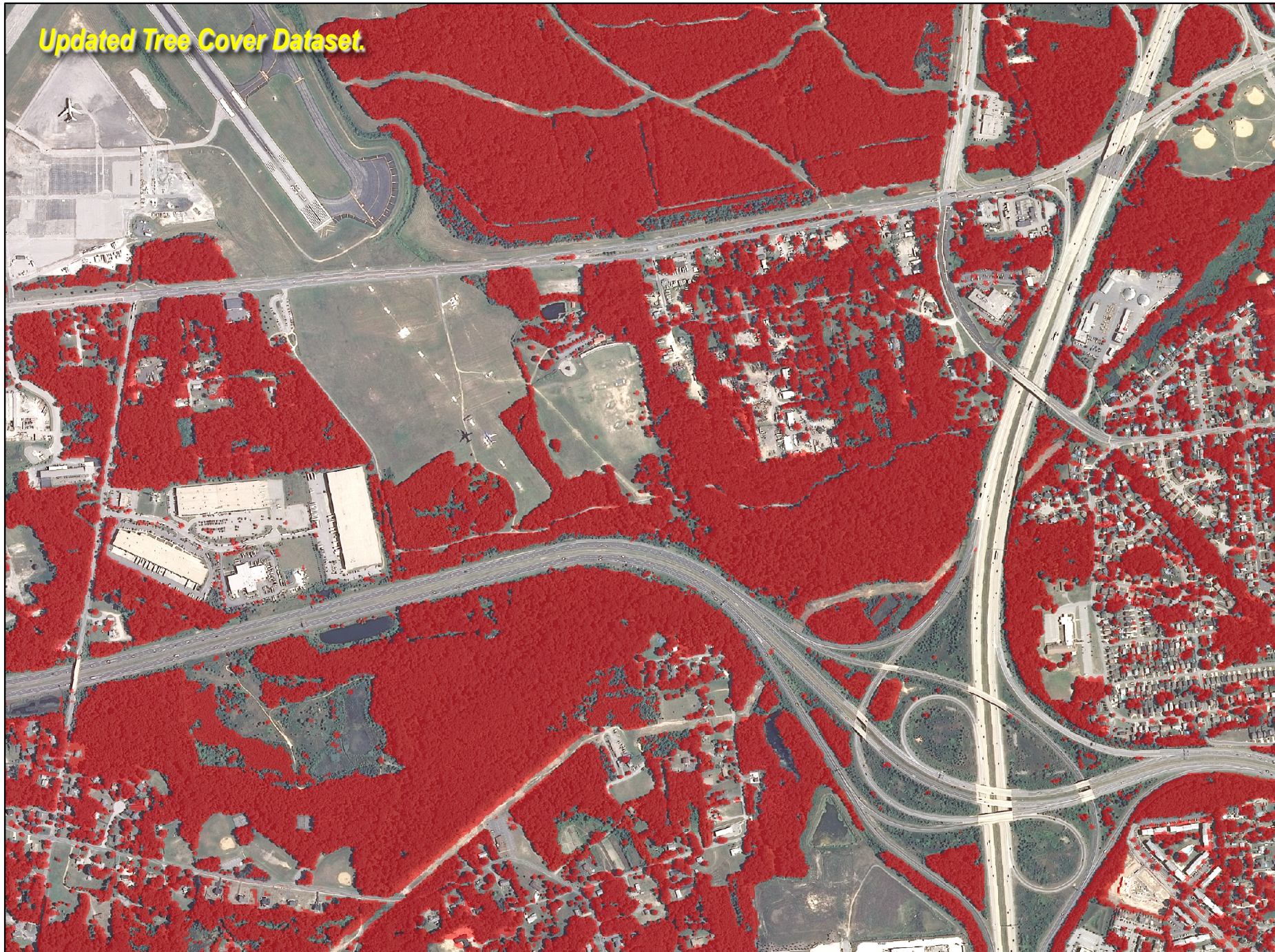
Areas greater than 0.5 acres extracted

Actual Tree Cover  
Loss





Updated Tree Cover Dataset.





## Forest vs. Tree Cover

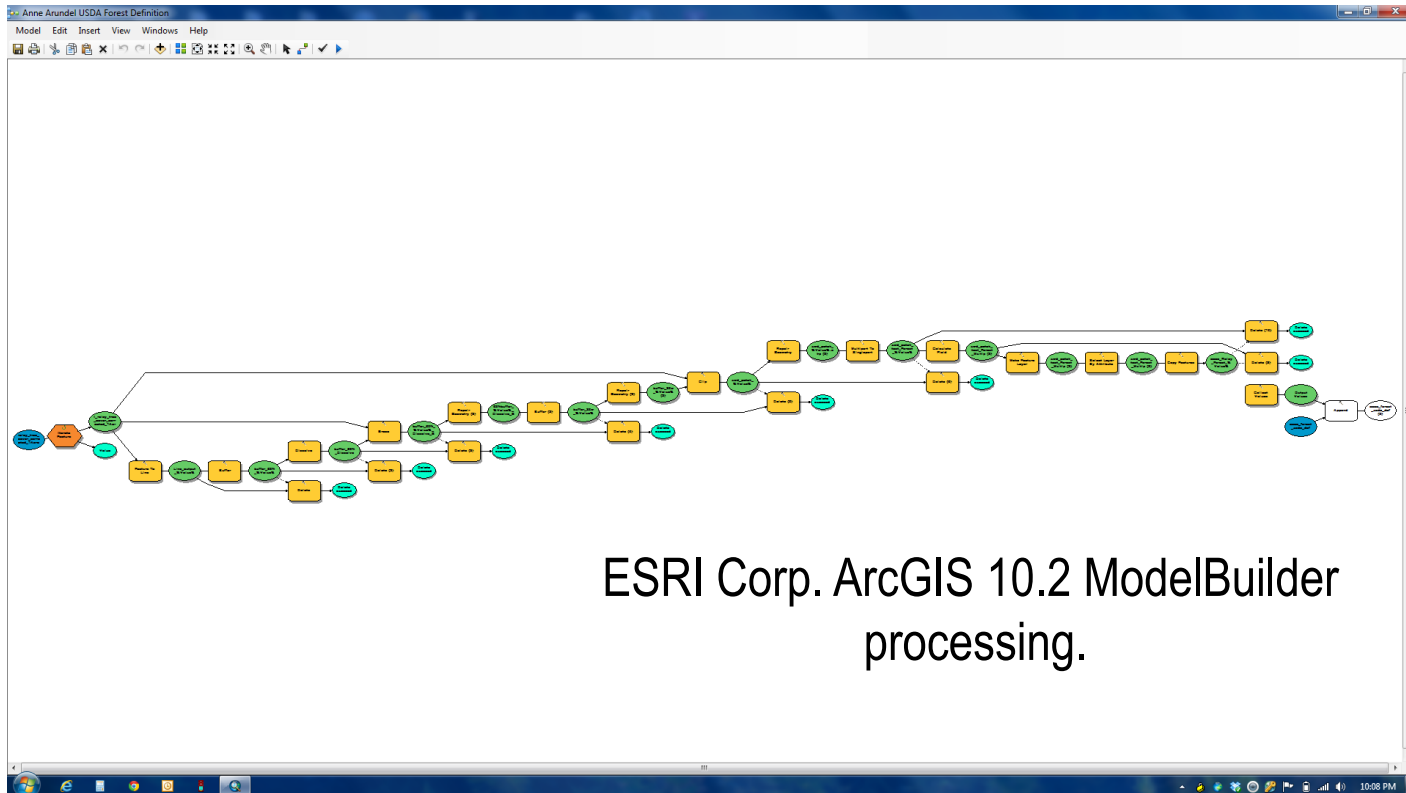
USDA Forest Service, Forest Inventory and Analysis (FIA) Definition of Forest: *An area of trees with at least 10% tree cover and at least 1.0 acre in size and 120.0 feet wide measured stem-to-stem from the outer-most edge. Forested strips must be 120.0 feet wide for a continuous length of at least 363.0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



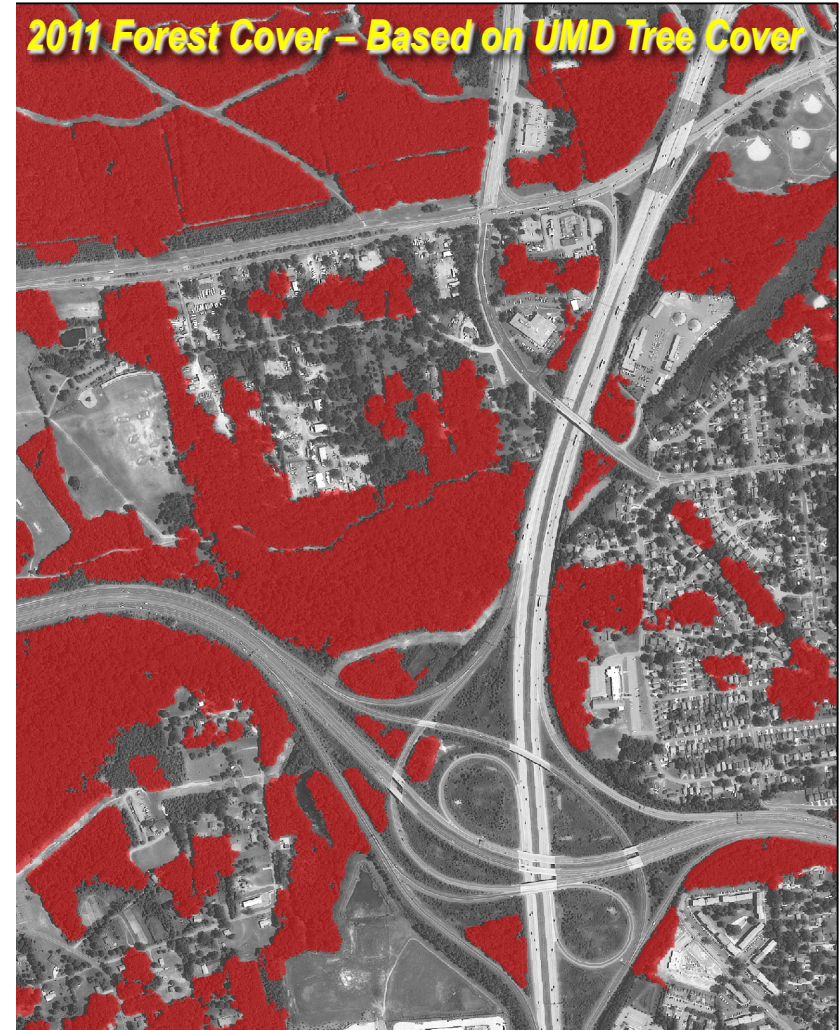
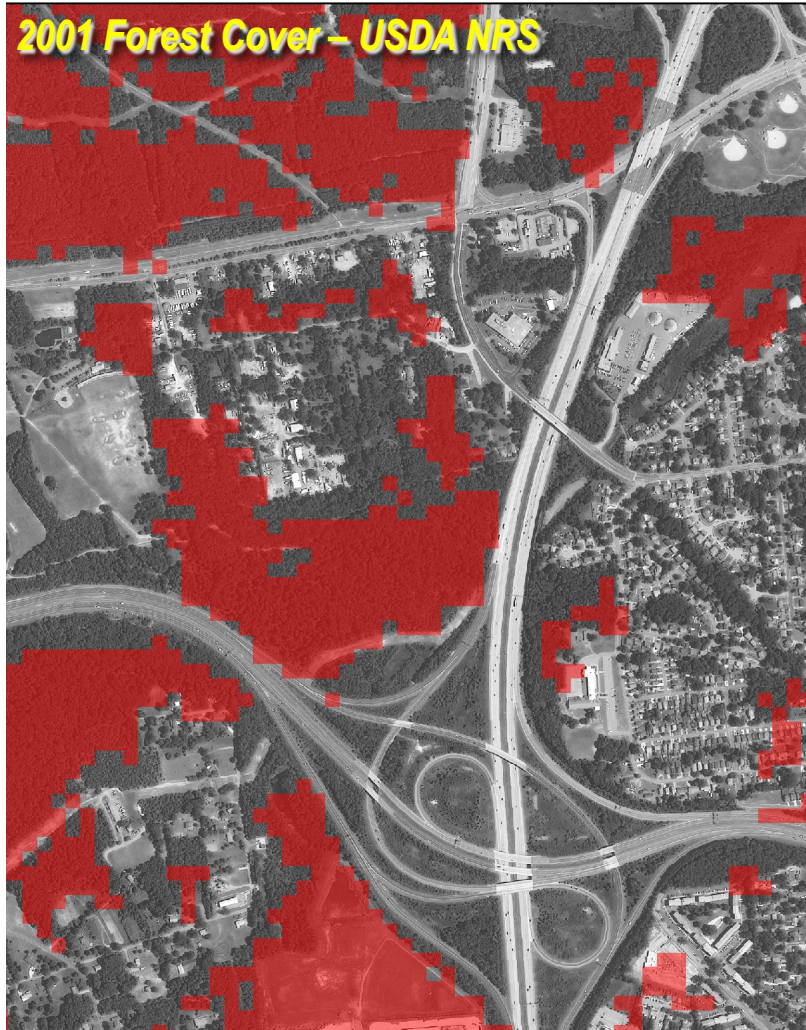
--National Core Field Guide, Version 6.0, October, 2012



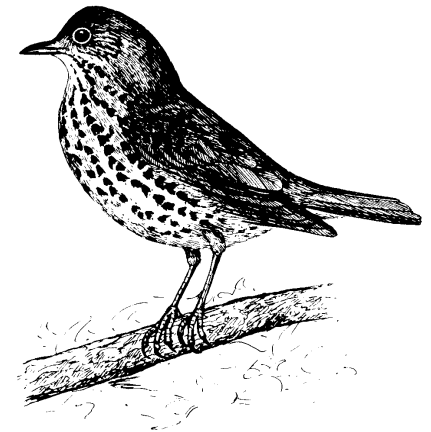
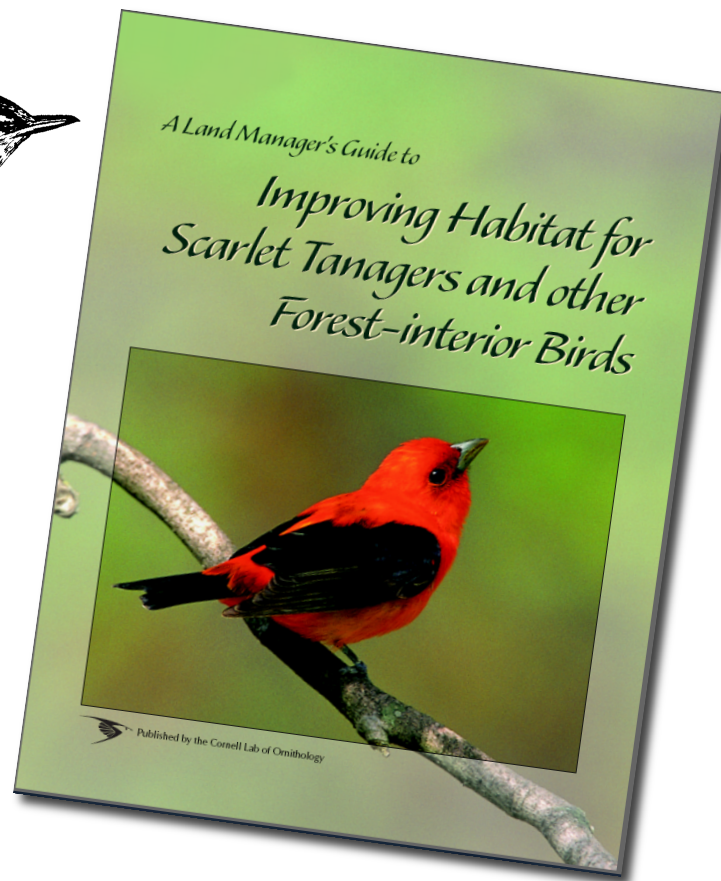
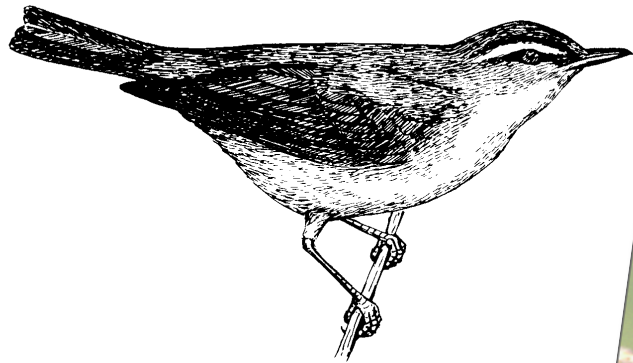
### Where is Forest on the Landscape?



ESRI Corp. ArcGIS 10.2 ModelBuilder  
processing.



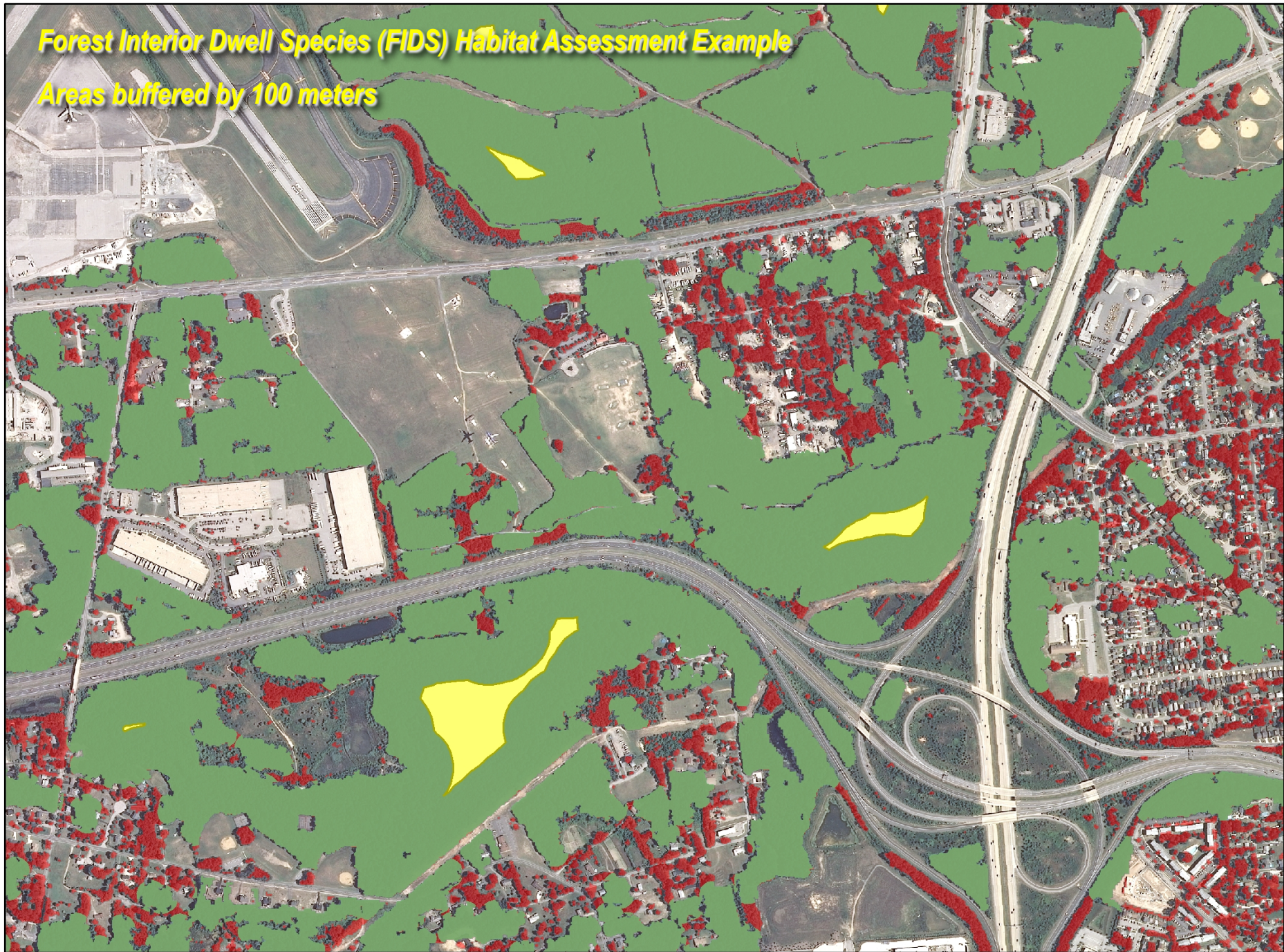
### Better Forest Management for Bird Habitat





# Forest Interior Dwell Species (FIDS) Habitat Assessment Example

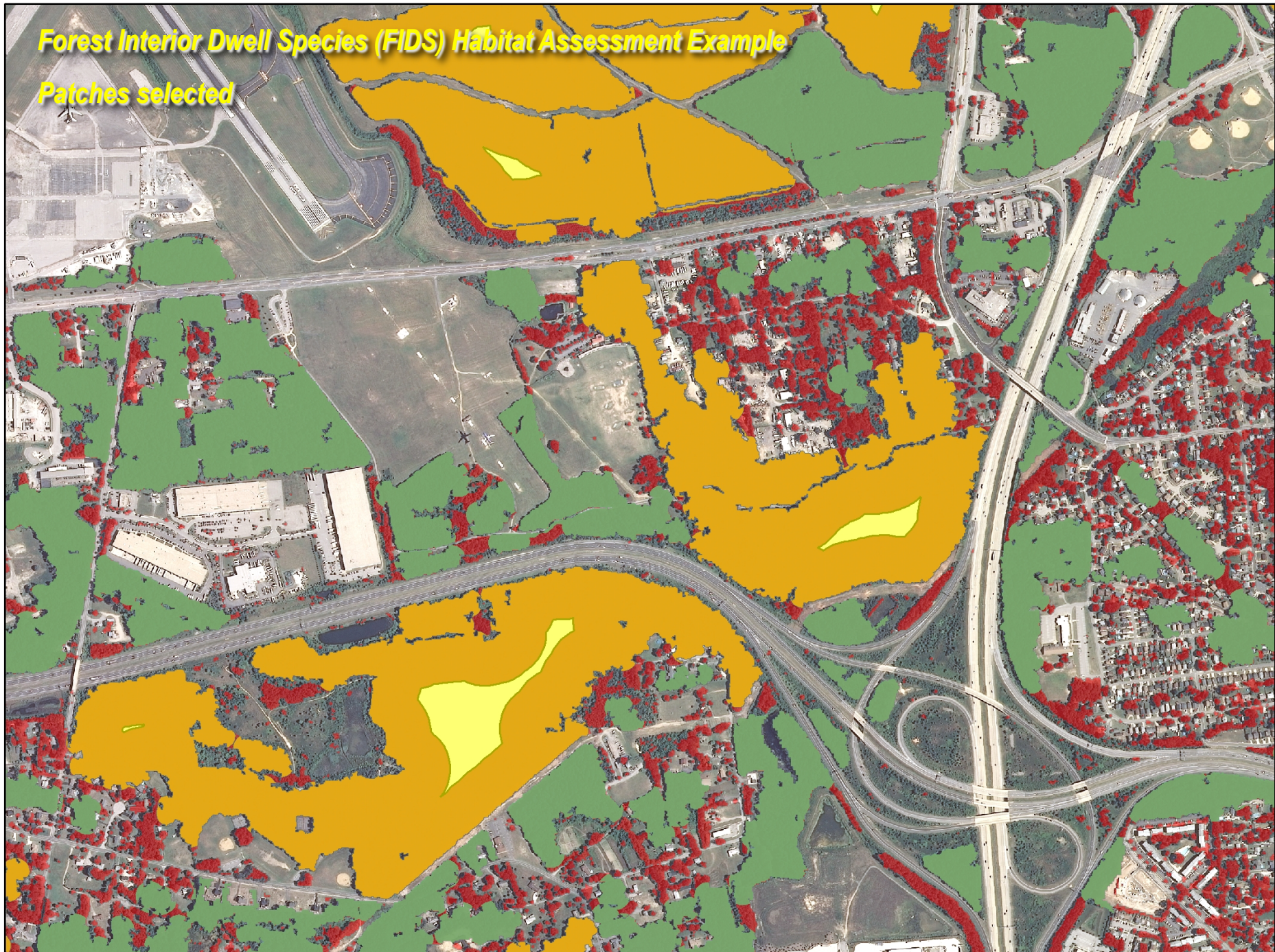
Areas buffered by 100 meters





# Forest Interior Dwell Species (FIDS) Habitat Assessment Example

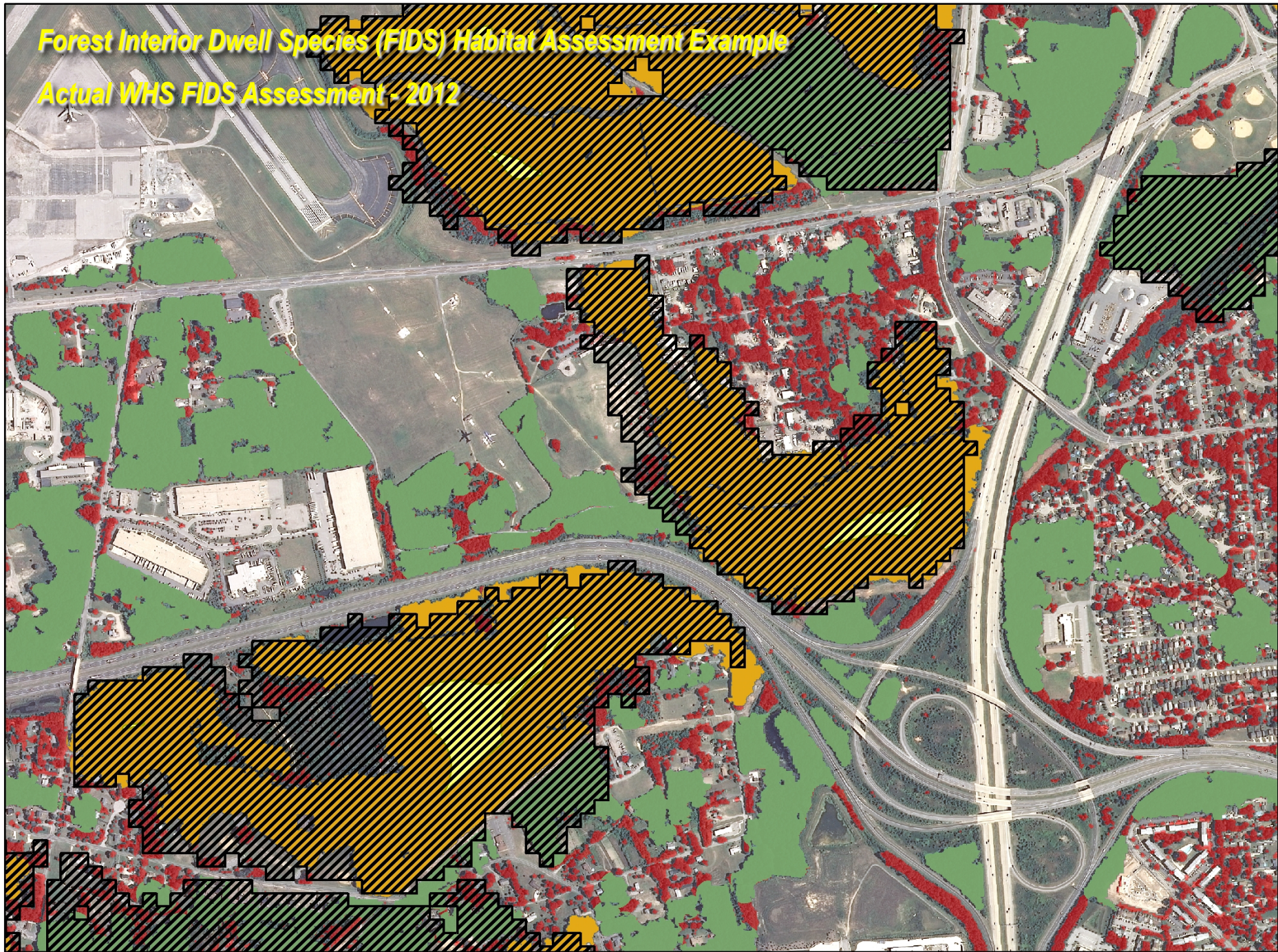
Patches selected





# Forest Interior Dwell Species (FIDS) Habitat Assessment Example

Actual WHS FIDS Assessment - 2012







### Example: Golden Winged Warbler Habitat Location

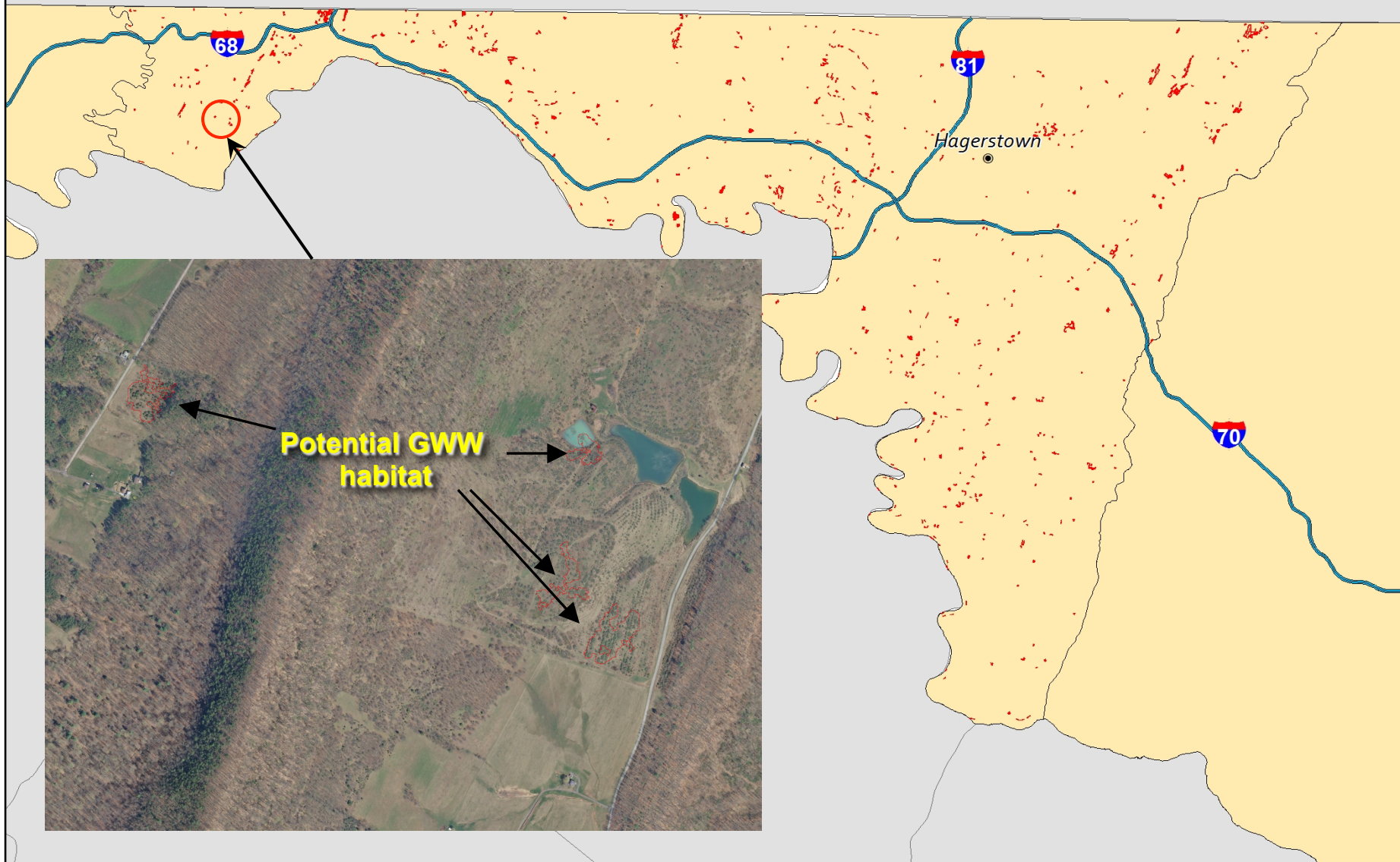


# Tree Height From LiDAR





## 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%)**

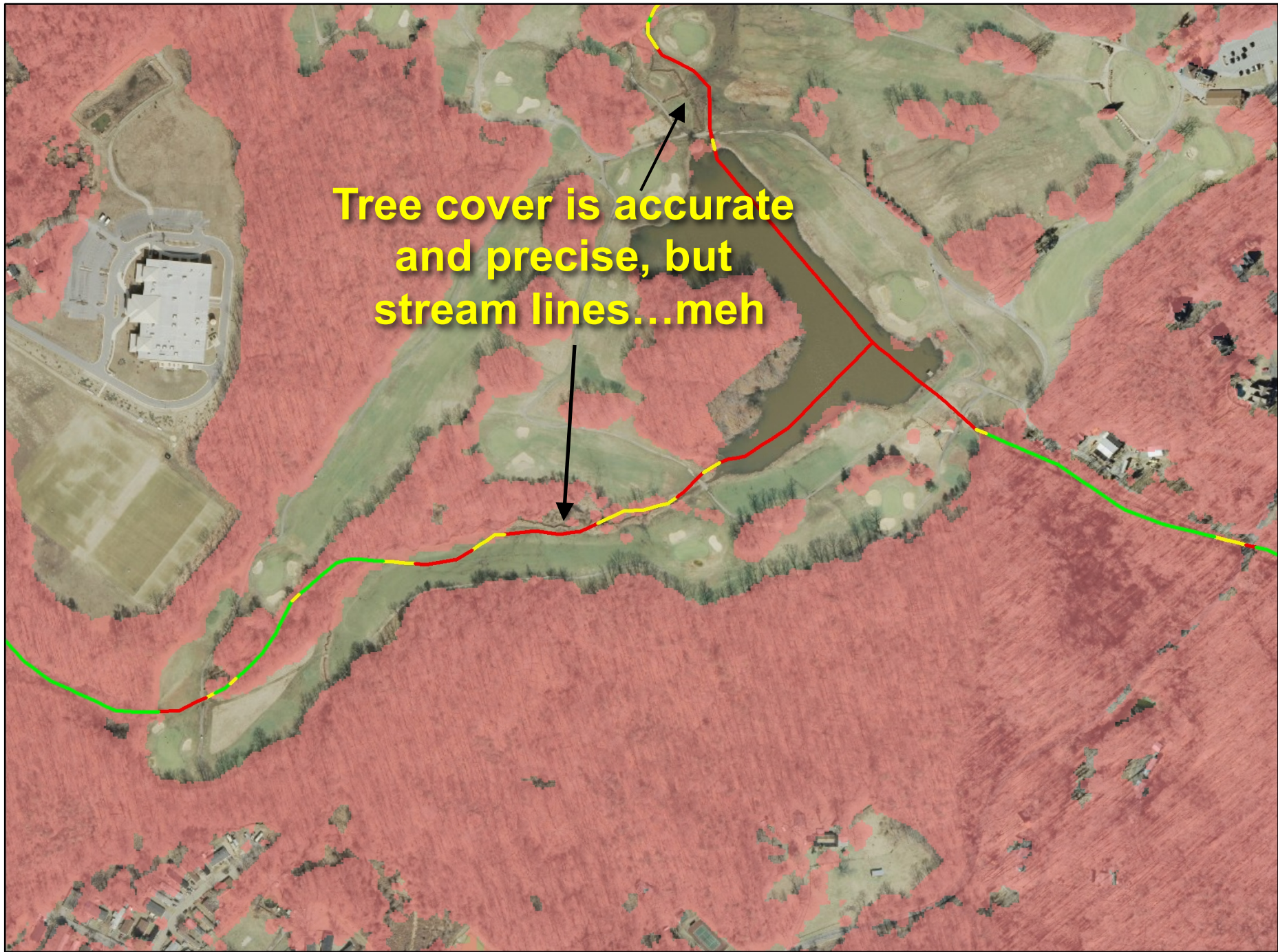








**Tree cover is accurate  
and precise, but  
stream lines...meh**



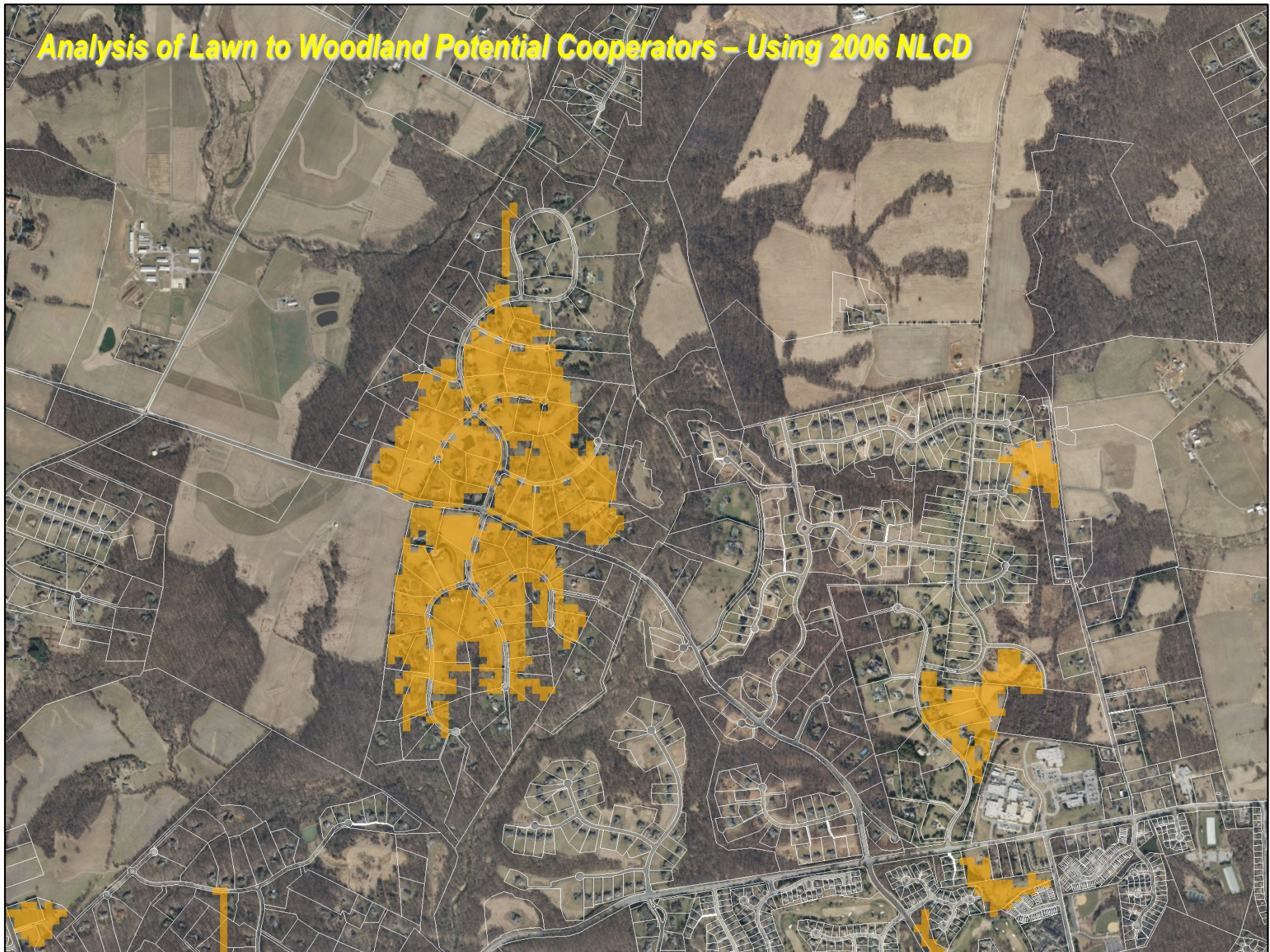




- Identify landowners appropriate for the program
- 2 to 10 acres no tree cover (turf)
- Used NLCD 2006 landcover dataset.



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





### A Forest Planner's Wish List:

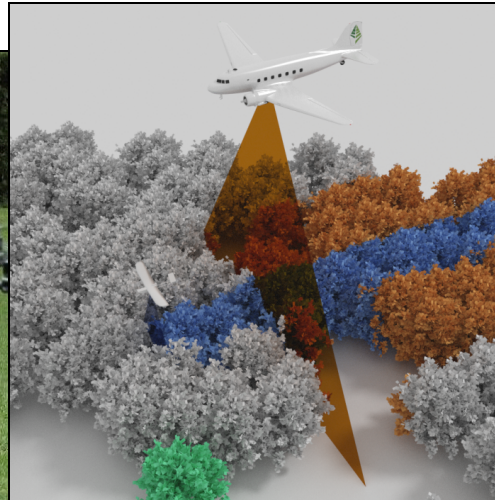
- We have great tree/forest cover, now we need precision streams
- Can identify tree cover, now can you tell me what kind of tree species?
- Affordable updates to LiDAR coverage at regular intervals (3 to 5 years)— Improves estimates of in-growth.





### 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?



