



APPALACHIAN ENERGY

*NASA Earth Observation Detection of Burned and Blighted Areas for
Creation of an Unhealthy Forest Index to Prioritize Forest Harvest for
Biofuel Production*

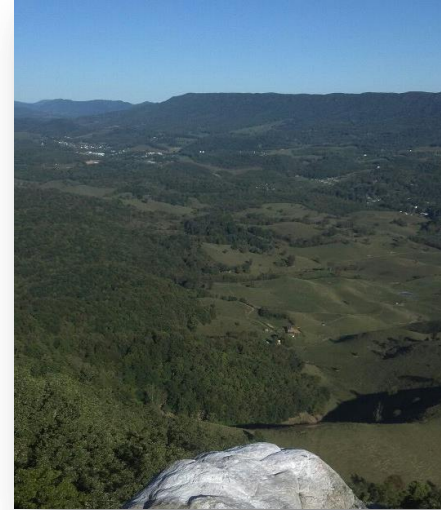
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 - ▶ Jessica Huff

- ▶ Rajkishan Rajappan
- ▶ Rohini Swaminathan
- ▶ Zachary Tate
- ▶ Asongayi Venard

Community Concerns



- ▶ Forests are under pressure from human activities such as residential development, agriculture and logging
- ▶ Natural factors: fires and invasions of pests such as the gypsy moth and the Hemlock woolly adelgid
- ▶ Biomass energy production destroys a large amount of healthy trees

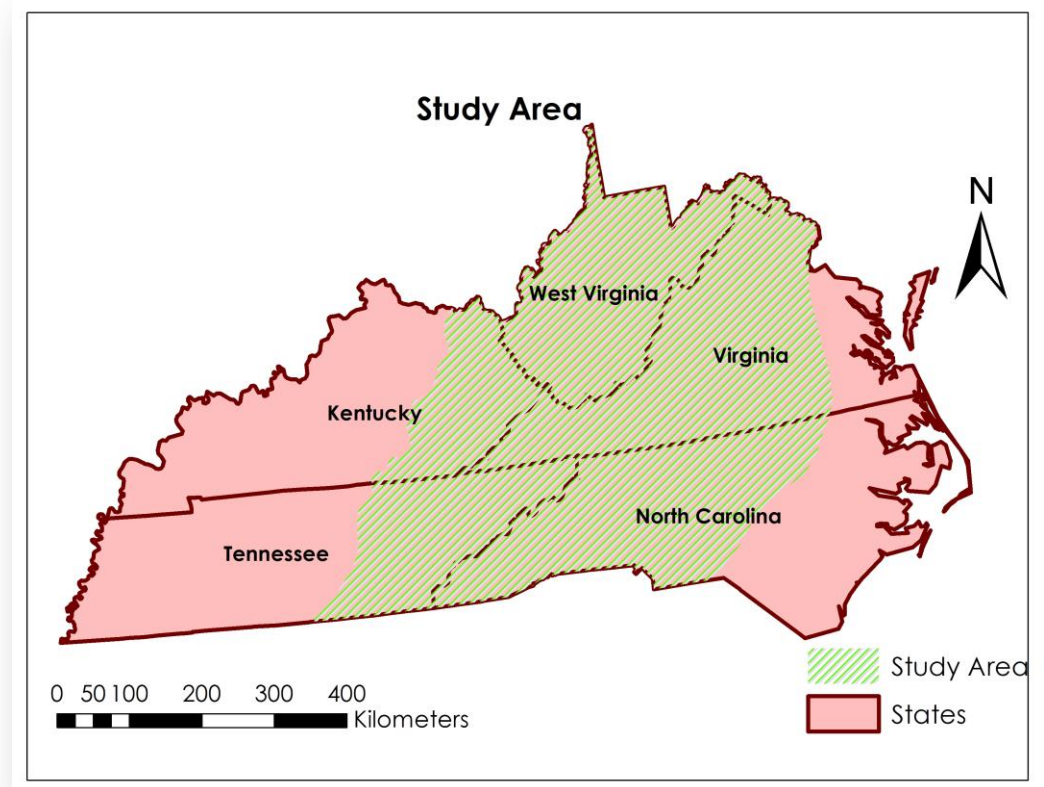
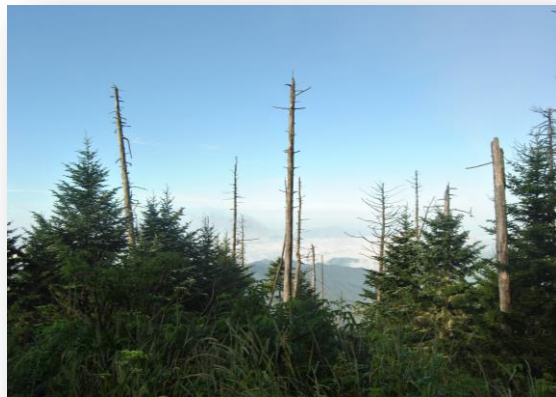


Study Area



Central Appalachian Mountains in the states of:

- ▶ North Carolina
- ▶ Virginia
- ▶ West Virginia
- ▶ Kentucky
- ▶ Tennessee



Objectives and Partners



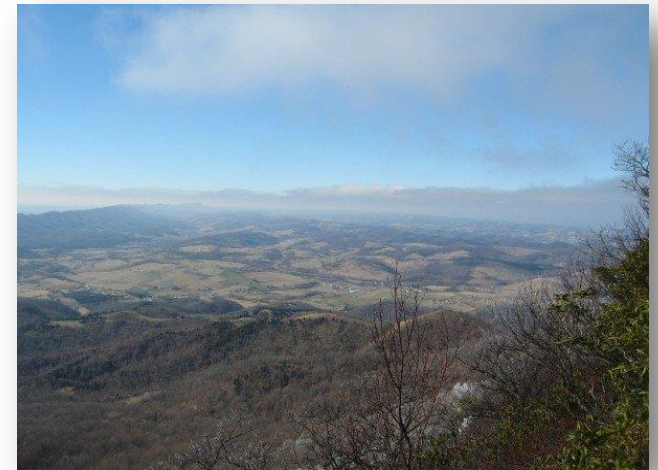
▶ **Objective:**

- ▶ Utilize NASA Earth observations to detect recently burned and blighted forests
- ▶ Results will help prioritize harvest of timber stocks on public lands to decrease fuel load and fire risk and create biofuels to meet energy needs

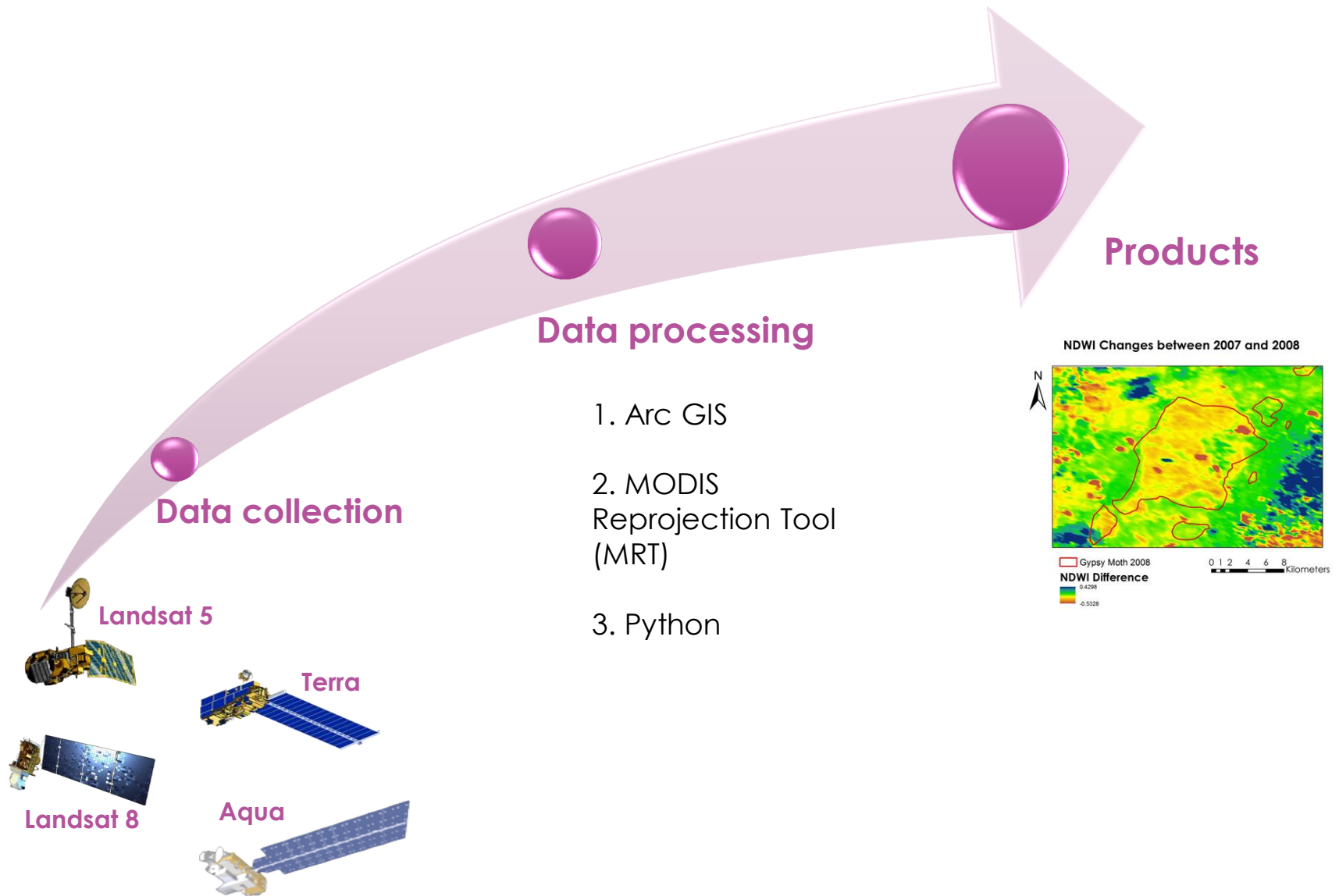


▶ **Partners:**

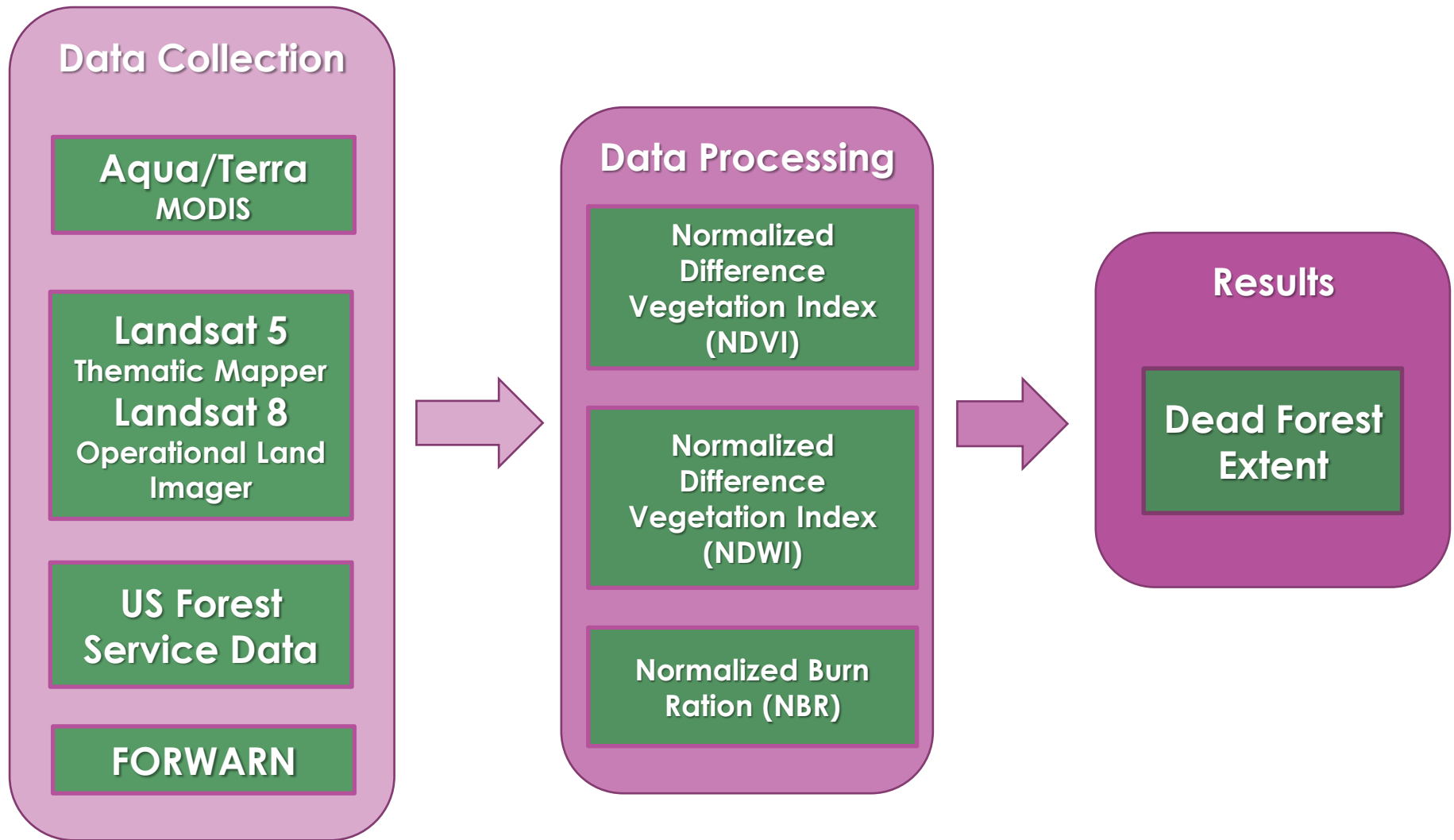
- ▶ U.S. Forest Service
- ▶ Virginia Department of Agriculture and Forestry
- ▶ EnviraCarbon Inc. (boundary organization)
- ▶ Wise County, through EnviraCarbon, Inc.



Methodology



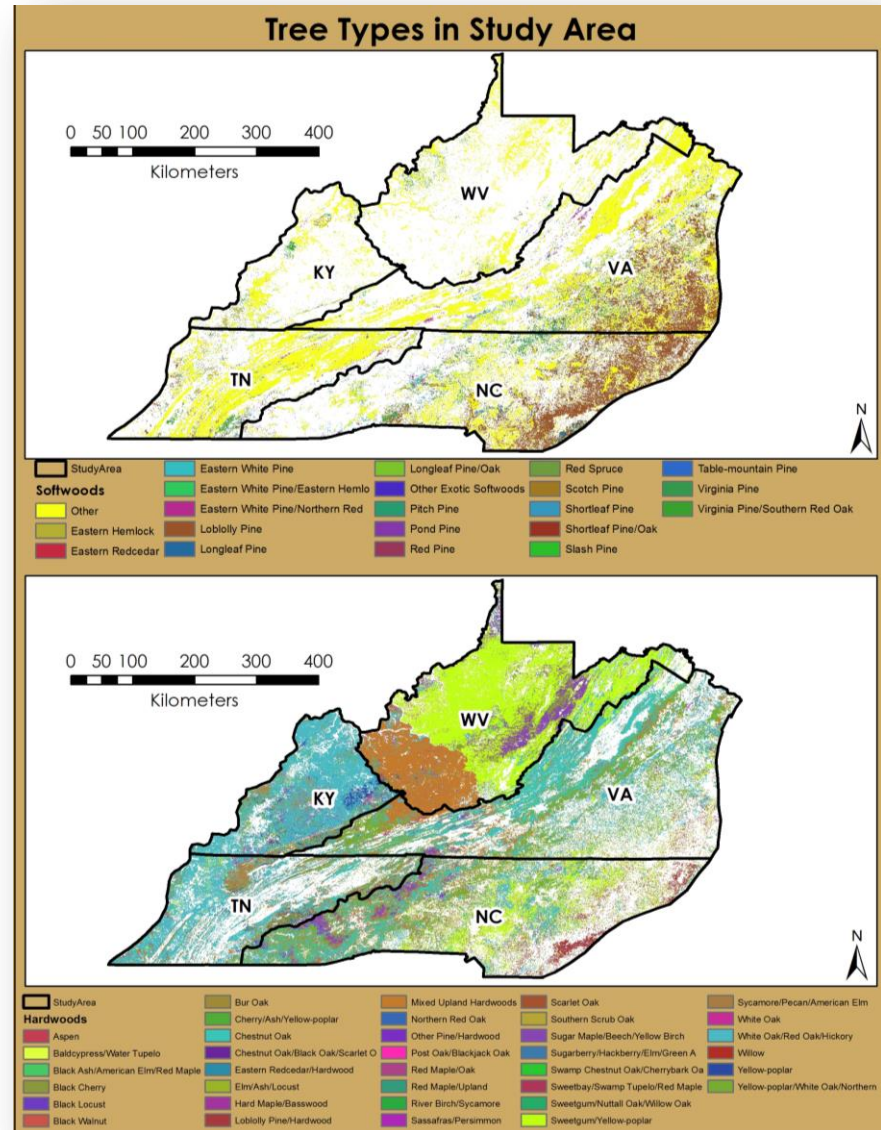
Project Flowchart



Forest Type



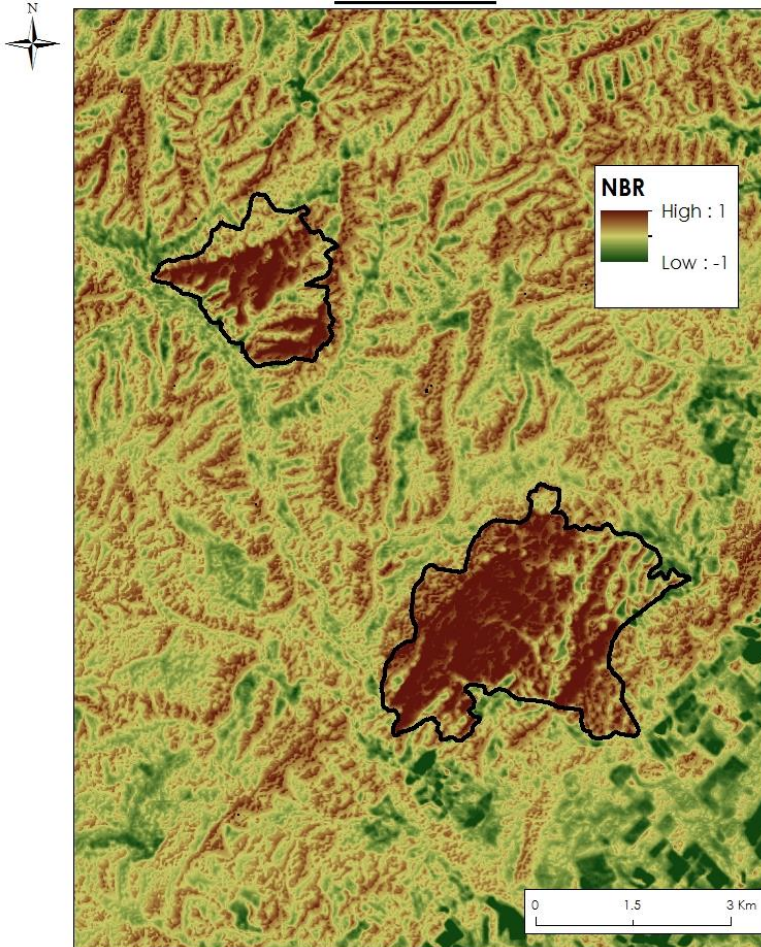
- ▶ Hardwoods can resist defoliation and withstand decomposition longer than softwoods
- ▶ Softwoods die and decompose more easily
- ▶ Data obtained from US Forest Service



Forest Fires



Normalized Burn Ratio - Virginia (near Harrisonburg)
March 2011



$$\blacktriangleright NBR = \frac{Band\ 4 - Band\ 6}{Band\ 4 + Band\ 6}$$

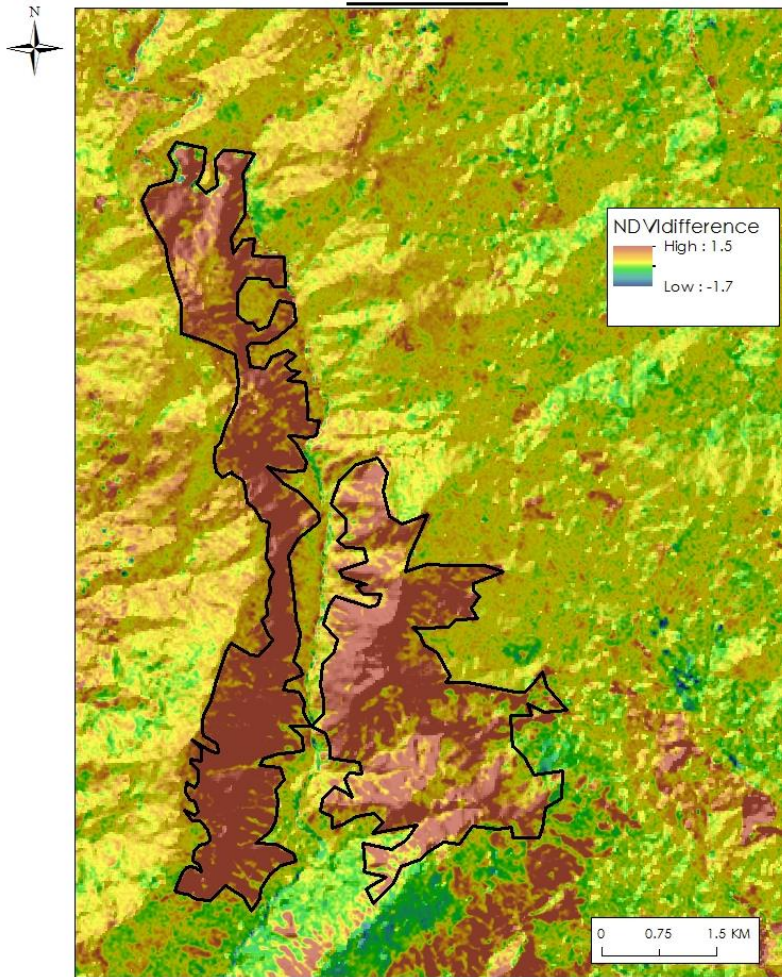
(in Landsat 8)

- ▶ Comparatively small scale fires happen in the Appalachian region
- ▶ Not profitable for timber harvest

Hemlock Wooly Adelgid Infestation



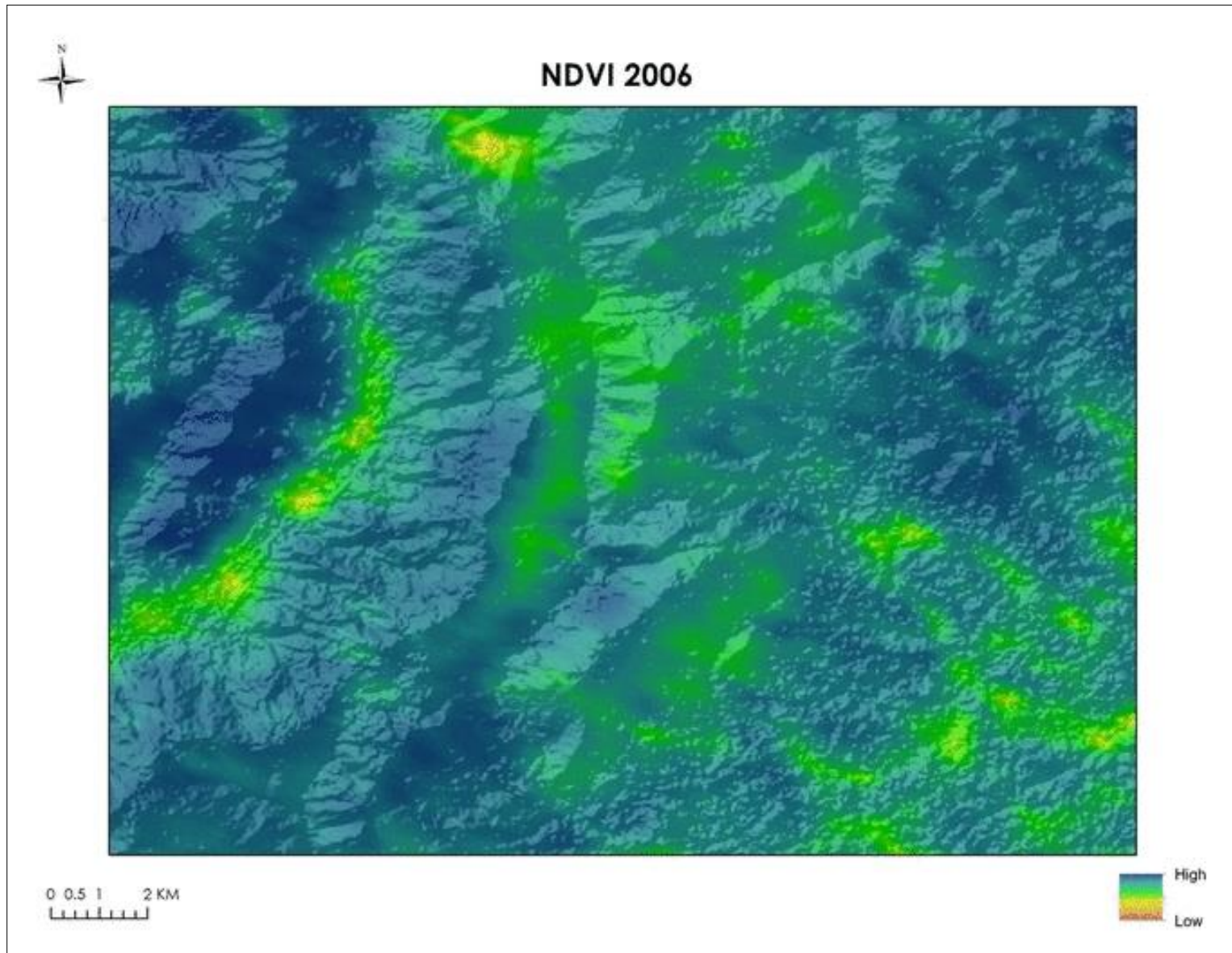
Hemlock Wooly Adelgid - North Carolina (Linville Region)
2003 - 2013



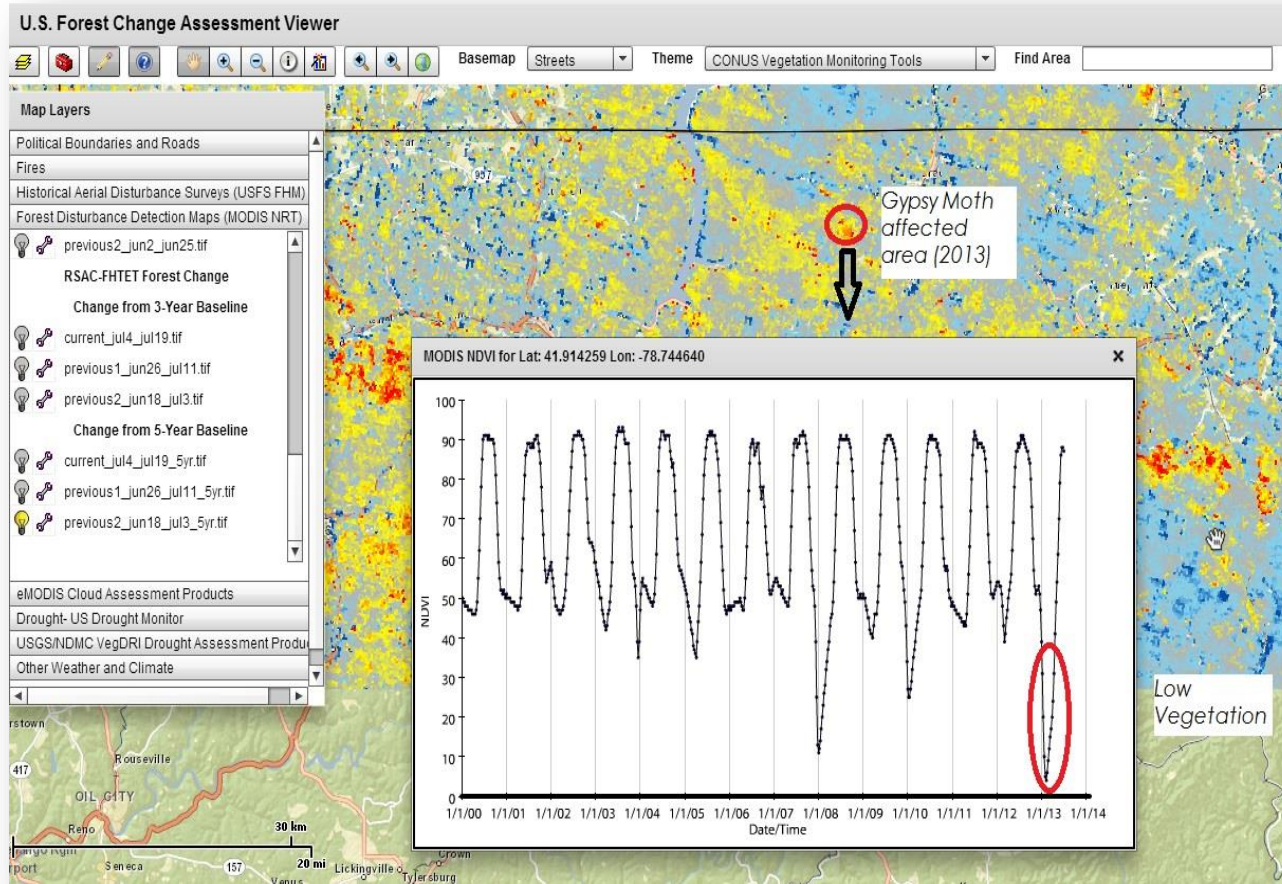
- ▶ Hemlocks are evergreen and recently affected by exotic insect, the wooly adelgid
- ▶ Hemlock infested areas have negative values due to defoliation



Woolly Adelgid Infestation Animation

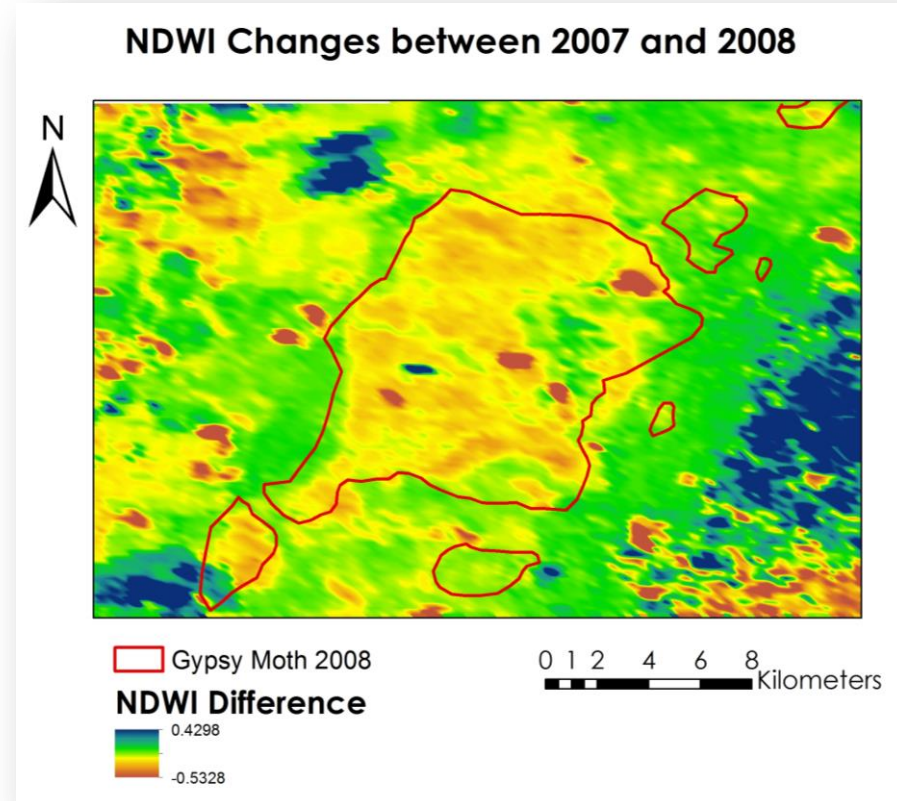
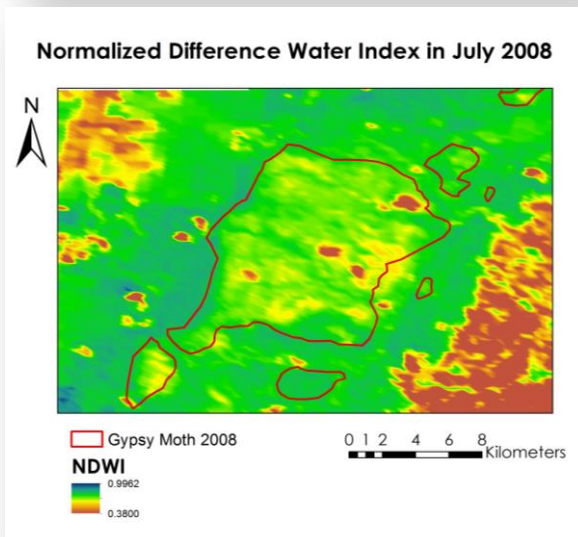
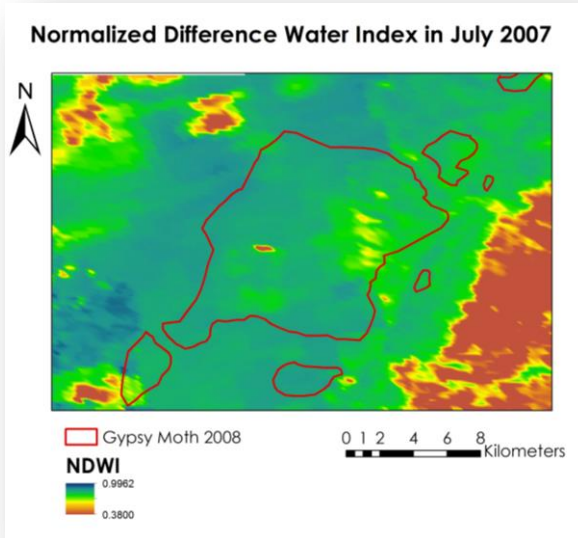


Gypsy Moth Infestation



- ▶ Gypsy moth infested areas show negative difference due to defoliation
- ▶ Results collected from FORWARN

Gypsy Moth Detection

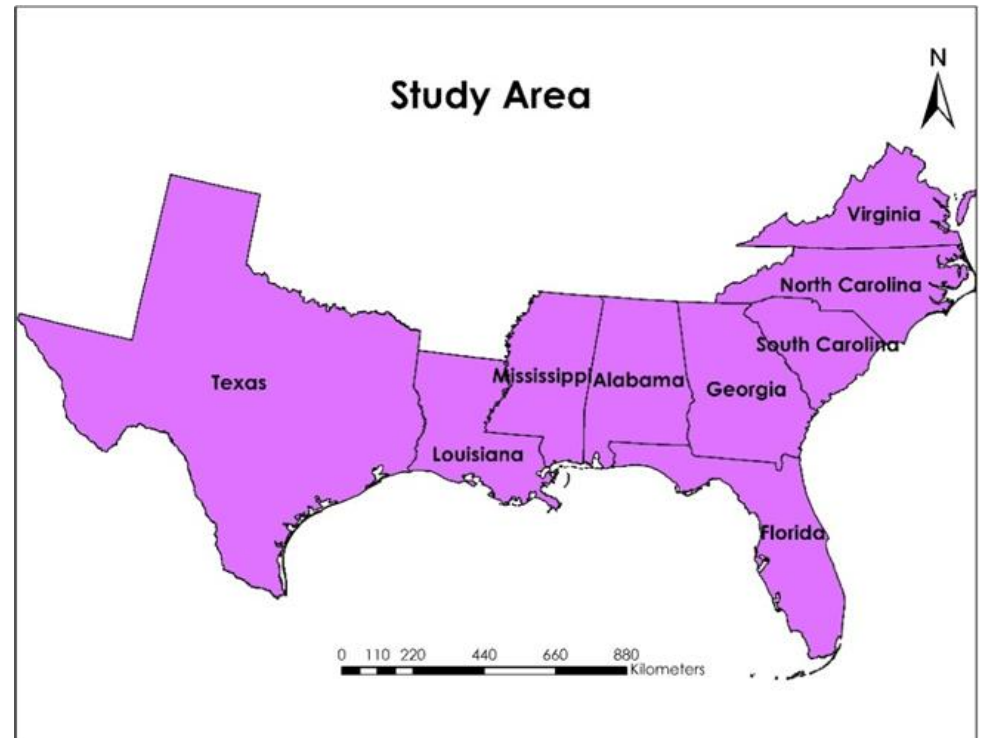


- ▶ The gypsy moth causes defoliation
- ▶ NDWI images can be used for change detection

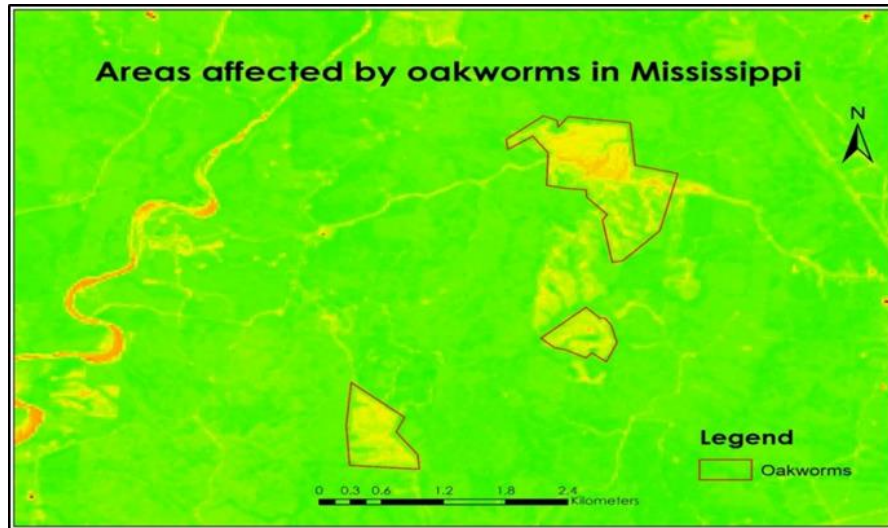
Following Term of Work



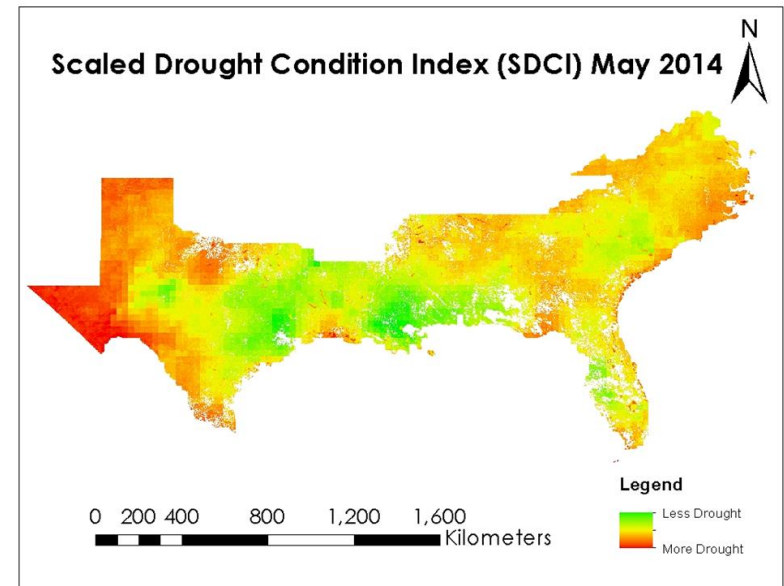
- ▶ In the following term, we extended the study area to the State of Texas
- ▶ The new project was called South East United States Energy
- ▶ We used the same methodology but added droughts as a factor to consider when identifying unhealthy forests



South East United States Energy II



- ▶ NDVI with areas affected by invasive species marked
- ▶ 4,300 acres of forests in Virginia, 6,000 acres in Mississippi and 3,700 acres in Louisiana were identified as infected with insects



- ▶ $SDCI = (0.25) \text{Vegetation (NDVIs)} + (0.25) \text{Temperature LSTs} + (0.5) \text{Precipitation (Ps)}$
- ▶ SDCI model takes into account temperature, rainfall and vegetation indices to compute an estimation of drought severity

Conclusion



- ▶ Results from this project can help the partners to identify unhealthy forests or dead wood for harvest and reforestation
- ▶ Identifying dead forests will substantially decrease the deforestation of healthy forests and also increase fuel production efficiency



Acknowledgement

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