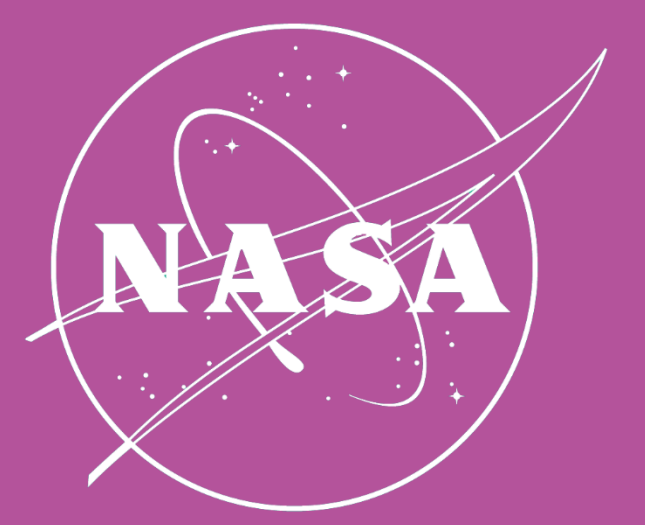# APPALACHIAN ENERGY

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

Jordan Bates, Dieudonne Dusenge, Andrew Foxx, Jessica Huff, Rajkishan Rajappan, Rohini Swaminathan, Zachary Tate, Asongayi Venard

Wise County Clerk of Court's Office

Abstract

The Appalachian Mountains are known for their extensive forest cover. However, these forests are under pressure from human activities such as residential development, agriculture and logging. The forests are also increasingly affected by forest fires, invasions of pests such as the gypsy moth and other natural factors. In addition, biomass energy production destroys a large amount of healthy trees. During the last 20 years, tens of thousands of acres of natural forest have been logged, many of them replanted as pine tree plantations. This project utilized data from Landsat 5 Thematic Mapper, and Landsat 8 Operational Land Imager (OLI) for forest monitoring to derive indices such as Normalized Differential Vegetation Index (NDVI) and Normalized Burn Ratio (NBR) to identify unhealthy forests. Aqua and Terra's Moderate Resolution Imaging Spectroradiometer (MODIS) provided vegetation dynamics and phenology products. Landsat 8 images provided targeted higher resolution analyses for areas demonstrated by MODIS. The results show locations that could potentially be harvested. In partnership with the U.S. Forest Service, Wise County and the Virginia Department of Agriculture and Forestry, this project facilitated the use of NASA Earth observations to identify unhealthy forests in this region for biofuel production.

Objectives

- Utilize NASA Earth observations to detect recently burned forest or forest that contained active blight

- Identify areas affected by insects such as gypsy moth and hemlock wooly adelgid

- Utilize results to help prioritize harvest of timber stocks on public lands to decrease fuel load and create biofuels to meet energy needs

Methodology
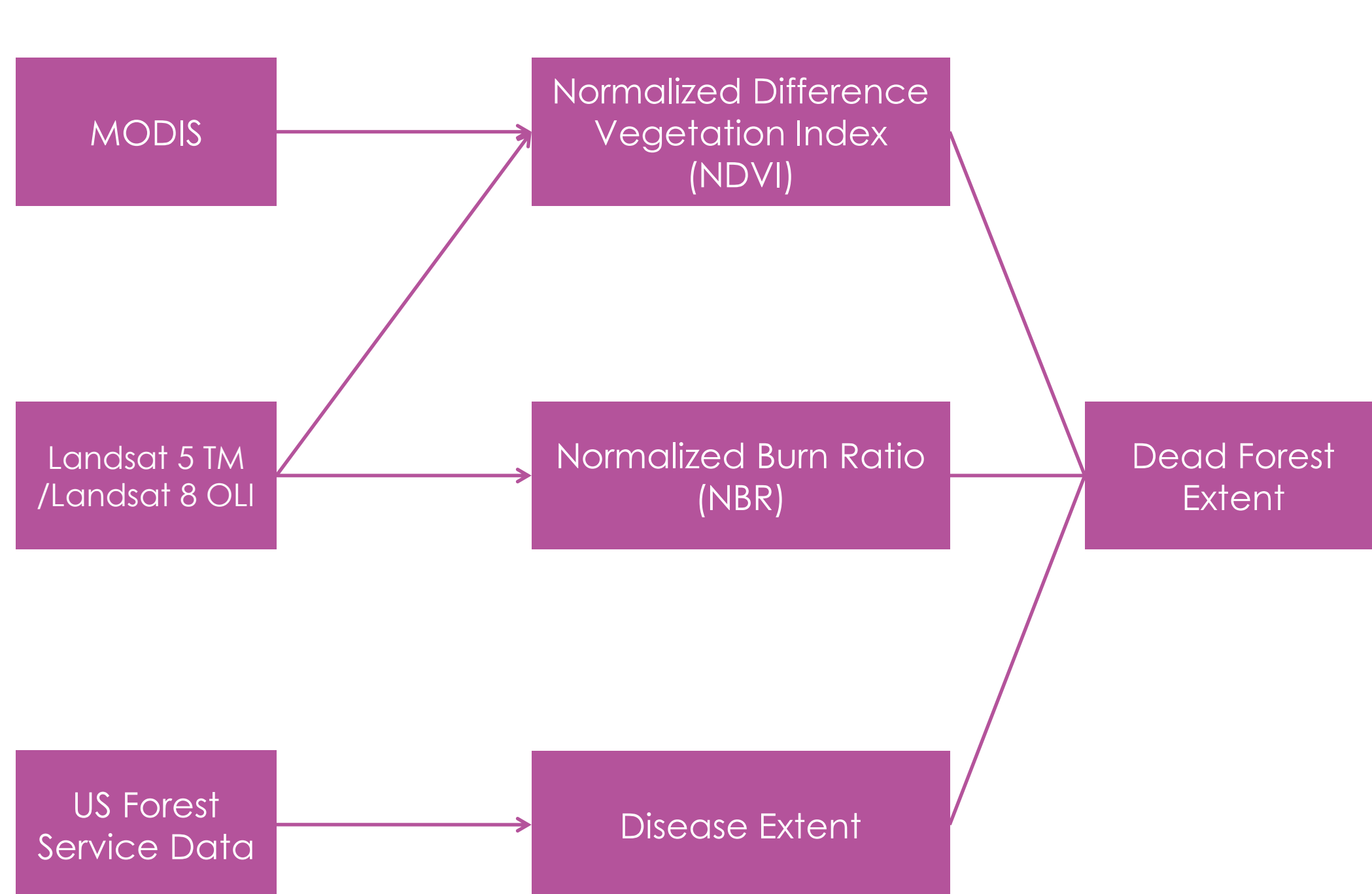
Ancillary Data

US Forest Service Burned Area Reflectance Classifications (BARC)
2012 National Insect and Disease Risk Map
USDA Forest Health Protection Mapping and Reporting's Disease and Insect Conditions Maps and reports
National Land Cover Datasets
ForWarn

Software Programs

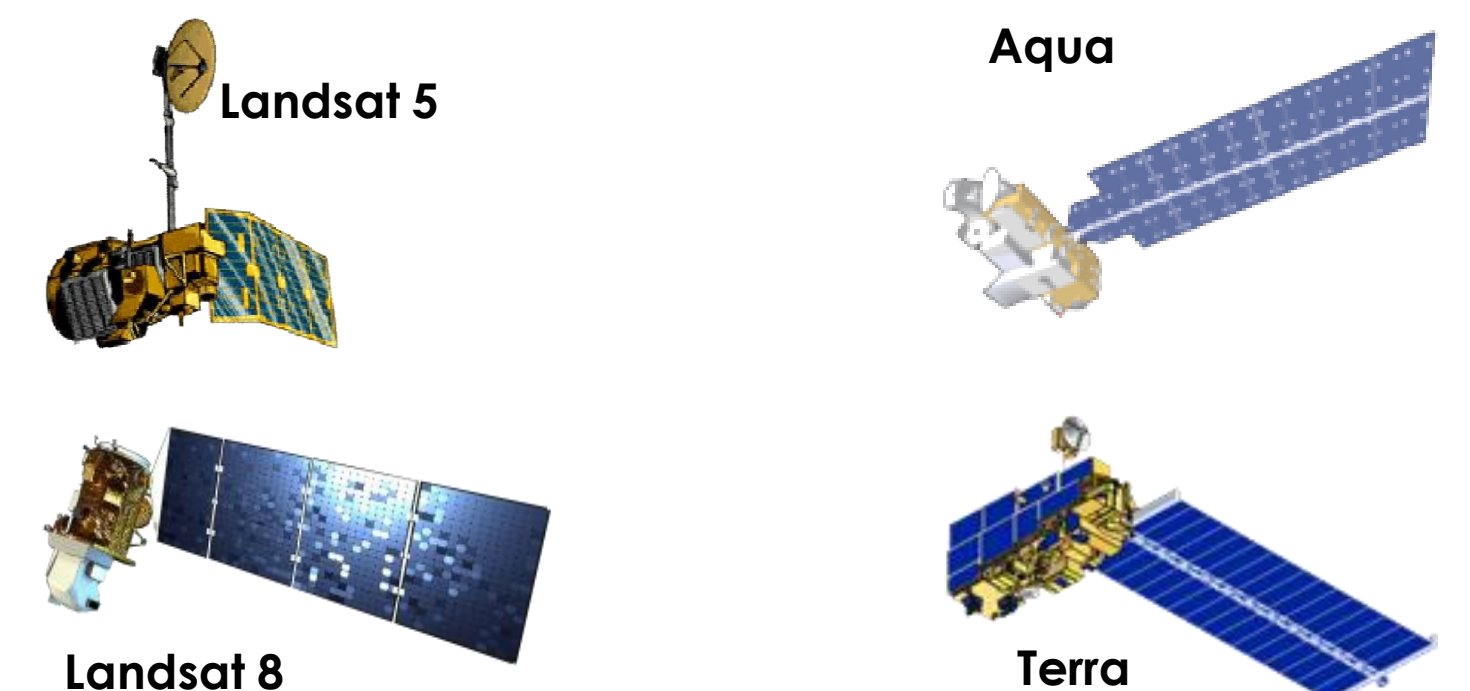| ArcGIS |
| --- |
| Python |

Study Area

Central Appalachian Mountains in the states of North Carolina, Virginia, West Virginia, Kentucky and Tennessee
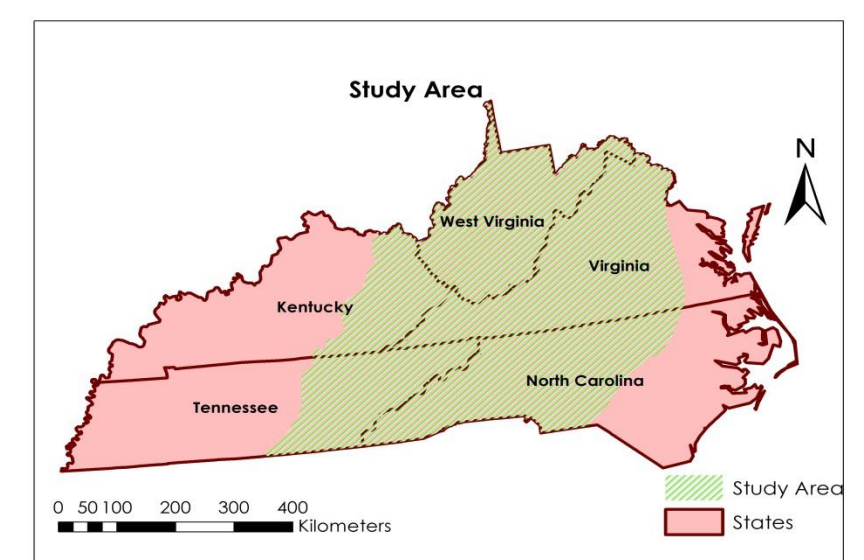
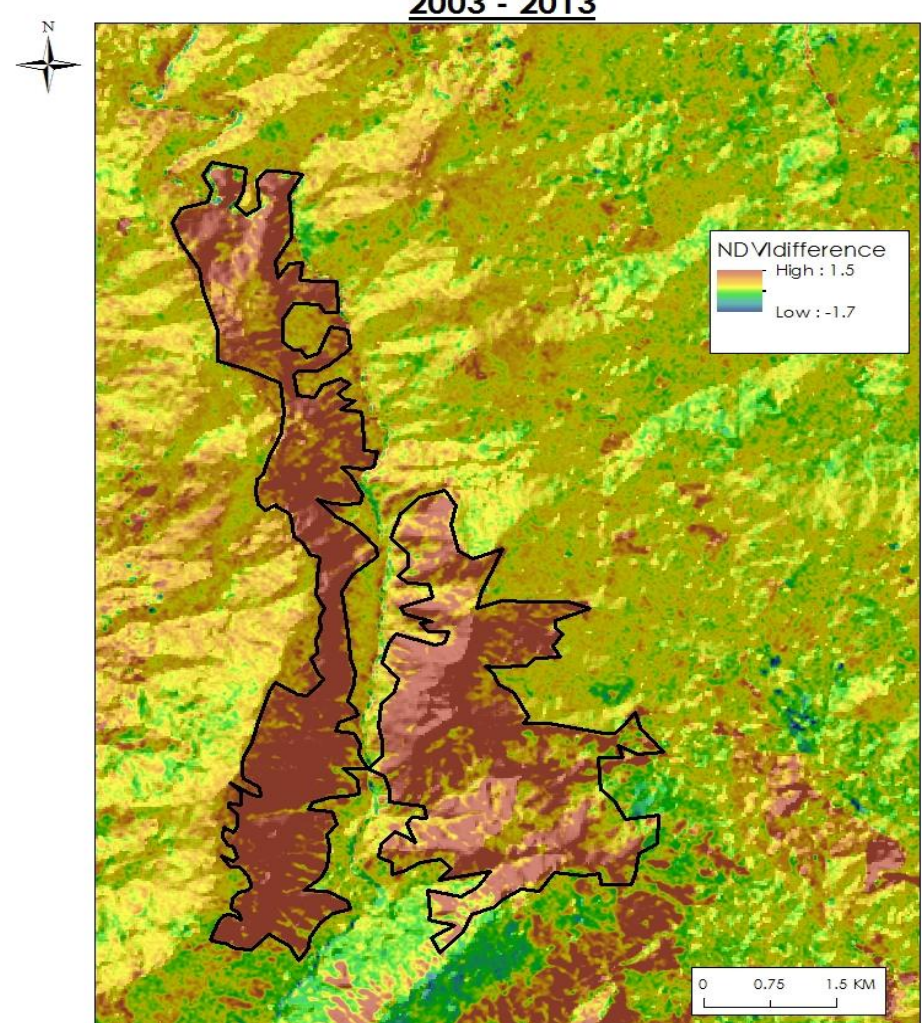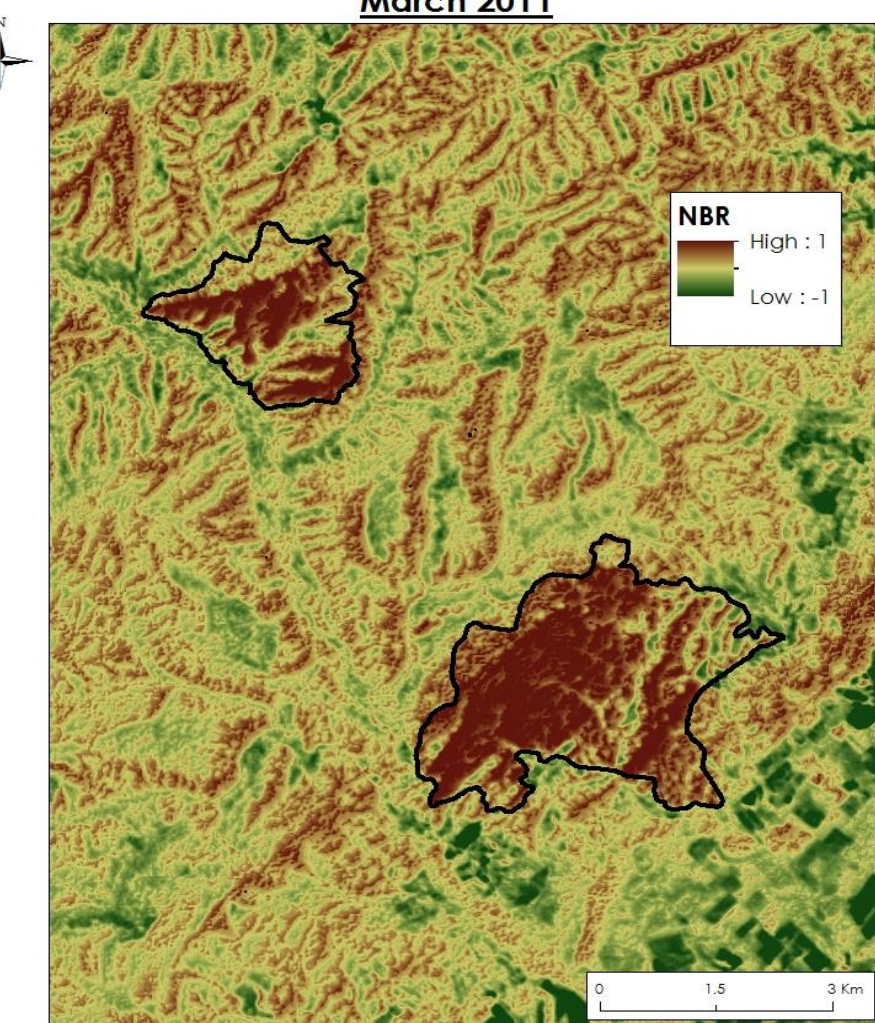## Earth Observations

Landsat 5

Aqua

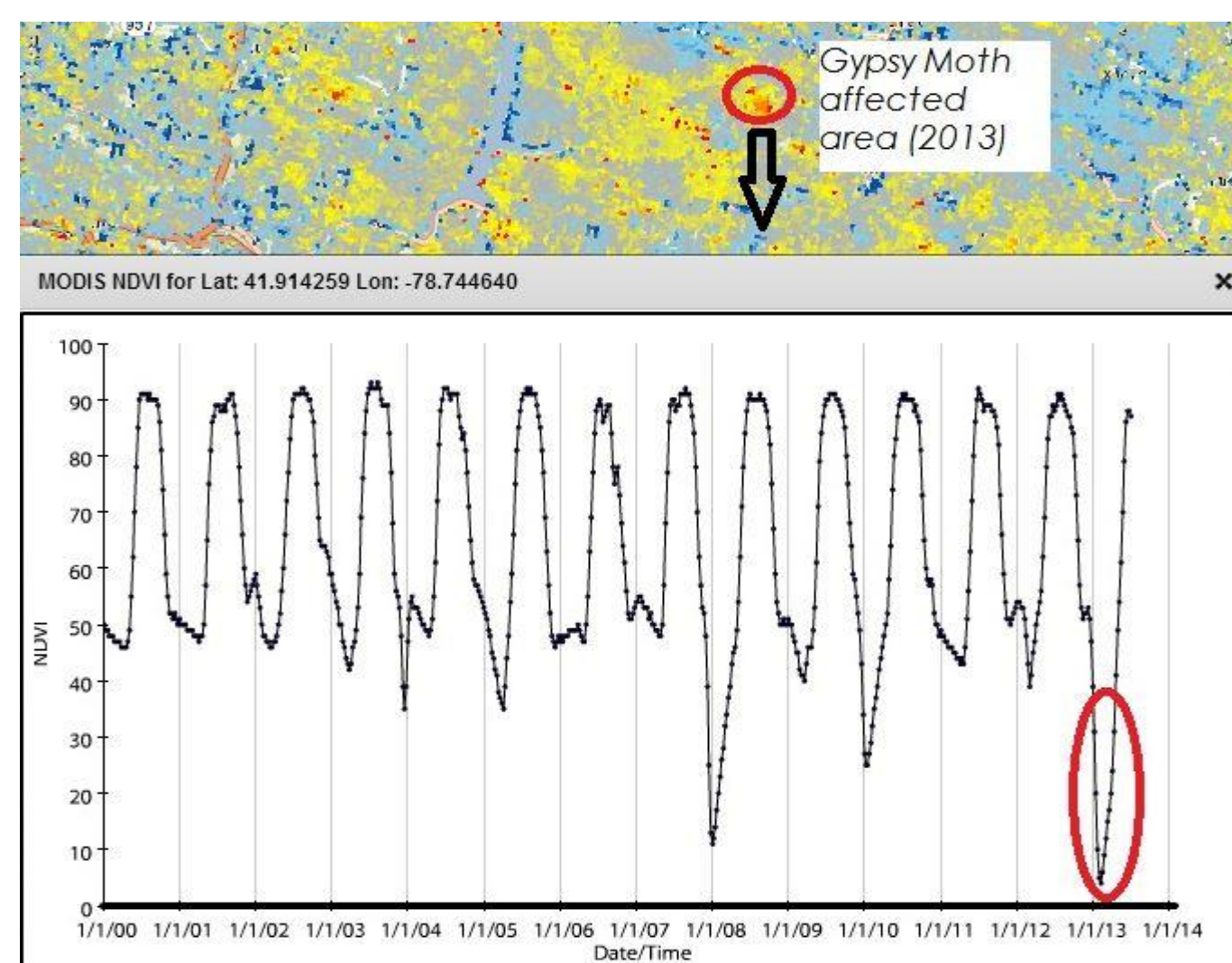Landsat 8

Terra

Results

NDVI change detection using Landsat 5 TM and Landsat 8 OLI showing hemlock wooly adelgid infested areas in Linville Gorge, North Carolina

Normalized Burn Ratio from Landsat 5 TM showing an area of dead forest

Graph computed using data from ForWarn shows a loss of vegetation due to a gypsy moth invasion

Conclusions

- Forest fire is very limited in the Appalachian ranges and happens at a much smaller scale for timber harvest.

- Results from this project will help the partners to identify unhealthy forests or dead wood for bio fuel production.

- Identifying dead forests will substantially decrease the deforestation of healthy forests and also increase fuel production efficiency.

Team Members

Left to Right:
Asongayi Venard, Rohini Swaminathan, Jessica Huff, Andrew Foxx, Dieudonne Dusenge, Zachary Tate, Jordan Bates, Rajkishan Rajappan

Project Partners

- U.S. Forest Service

- Virginia Department of Agriculture and Forestry

- EnviraCarbon Inc.

- Wise County/Norton Clerk of Circuit Court

Acknowledgements