AUBURN UNIVERSITY

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College of
Forestry, Wildlife
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Working with Nature for Society's Well-Being

Brown Spot Needle Blight Assessment Workshop

August 13-14, 2024

Mitigating Needle Blight: A Growing Economic Threat to Pine Forests

Detection and movement of *Lecanosticta acicola* with remote sensing

Apply remote sensing for detection and mapping of Brown Spot Needle Blight

Contribute to development of a framework for monitoring BSNB across landscapes

Multi-scale & multi-sensor approaches

Ground	Unmanned aerial vehicle (UAV)	Airborne	Spaceborne
• Tree-level measurements and observations • Symptoms of brown spot needle blight	• Fine-scale imagery and vegetation profiles • Development of validation datasets	• Lidar: Sub-meter accuracy of terrain and canopy heights • Structural vegetation information	• High temporal and spatial resolution data • Landscape and regional scale mapping

General Workflow

- Ground (in-situ) data: tree-level symptoms, individual tree detection, training/reference dataset construction for UAV-based framework development
- UAV-borne datasets: develop criteria for detection (combined spectral and structural attributes), calibrate airborne lidar-derived information and training/reference dataset construction
- Characterization of gridded landscape-level vegetation structural attributes, extraction and integration of satellite-derived and ancillary parameters
- Implementation of machine learning algorithms for fine and large-area BSNB classification

Anticipated Results & Status

1. Status of remote sensing-based detection of BSNB (Singh et al., *in review*)
2. A UAV-based framework for detecting BSNB and classifying disease severity (*in prep*)
3. Spatially explicit distribution and movement maps of *Lecanosticta acicula (*initial, fine-scale: *complete;* broad-scale: *in progress)*
4. Multi-scale approaches for BSNB assessment based on UAV, airborne and satellite data with machine learning (*in progress*)

1

Status of remote sensing-based detection of BSNB (Singh et al., *in review*)

- An overview of remote sensing techniques for detecting and monitoring BSNB
- Examines potential of data acquired from UAVs, space-based and airborne platforms for BSNB management, given current literature
- Recommendations for advancing understanding of remote sensing for detection and monitoring

2

A UAV-based framework for detecting BSNB and classifying disease severity (*in prep*)

- Field and UAV data collected over study sites in north and south Alabama
- UAV-borne data processed to derive orthoimages, point clouds and derived metrics
- UAV-based multispectral data used to detect diseased trees and classify BSNB severity

3

Spatially explicit distribution and movement maps of *Lecanosticta acicula (*initial, fine-scale: *complete;* broad-scale: *in progress)*

- Initial UAV-based, site-level BSNB detection and severity maps generated
- Potential of machine learning classifiers (ANNs, SVM) demonstrated

4

Multi-scale approaches for BSNB assessment based on UAV, airborne and satellite data with machine learning (*in progress*)

- Derived Sentinel-2 imagery, spatially and temporally coincident with field and UAV data and computed a suite of vegetation indices for modeling
- Pre-processed airborne lidar point clouds and generated structural metrics

Geospatial Team

Swati Singh, PhD student, Forestry

- Post Graduate Diploma, Remote Sensing and GIS, Specialization in Forestry
- MS, Environmental Sciences

Undergraduate Research Assistants

- Summer, 2024: Blake Johnson (Geospatial and Environmental Informatics major)
- Summer, 2023: Nathan Kurtz (BS, Geospatial and Environmental Informatics)

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