Intelligent GeoSolutions

High Value, Low Cost Geoinformatics for Land Managers

Current Focus

- Statewide maps of tree species occurrence, relative abundance
- Statewide time series of forest disturbance
- Spruce budworm risk mapping
- Disturbance monitoring via Landsat 8 and Sentinel 2
- Support of forest projections (Landis-II)

The Future

- More layers (habitat, post-harvest assessment, biomass)
- Chronic disturbance and forest health
- Linkages to LiDAR

Forest Management Concerns

Forest managers in New England need timely, relevant information on the condition and spatial distribution of forest resources within their management areas and in the surrounding ecosystem to set management objectives, plan management actions, and ensure the long-term sustained yield of wood fiber without compromising forest health or non-timber resources.

Intelligent GeoSolutions Response

We developed sophisticated machine learning algorithms that can provide near real time, highly accurate geospatial information about forest attributes with high relevance to forest management, scalable to large areas using freely available satellite imagery and U.S. Forest Service FIA plot data.

Intelligent GeoSolutions Design Principles

Combine machine learning (ML) algorithms called Support Vector Machines (SVMs) to model complex, nonlinear relationships based on limited training data with the adaptability of a Genetic Algorithm. Produce highly generalizable maps across data types and forest conditions that require very little analyst time, and are capable of producing better data at substantially lower cost than is currently available through commercial vendors.

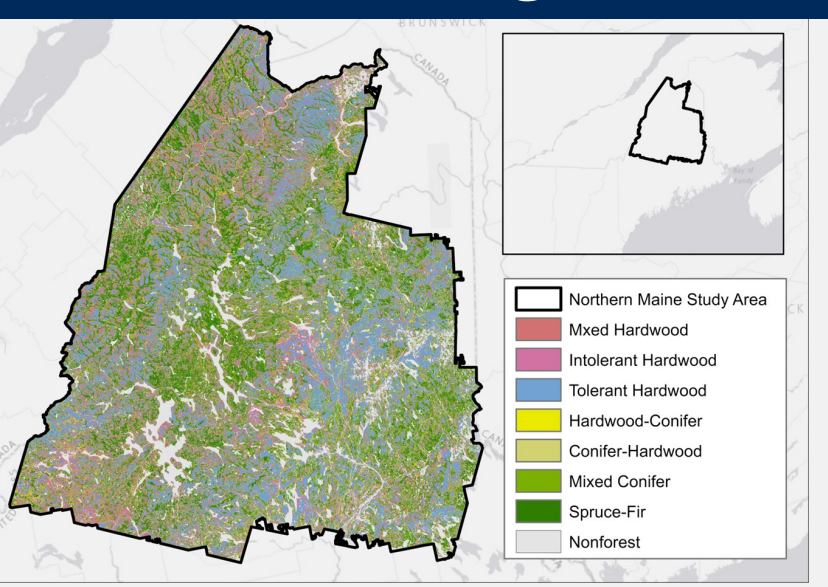
crsf.umaine.edu/research-2/igs

The GeoSolutions Team

Kasey Legaard
Research Professor, Geospatial Analytics and Machine Learning

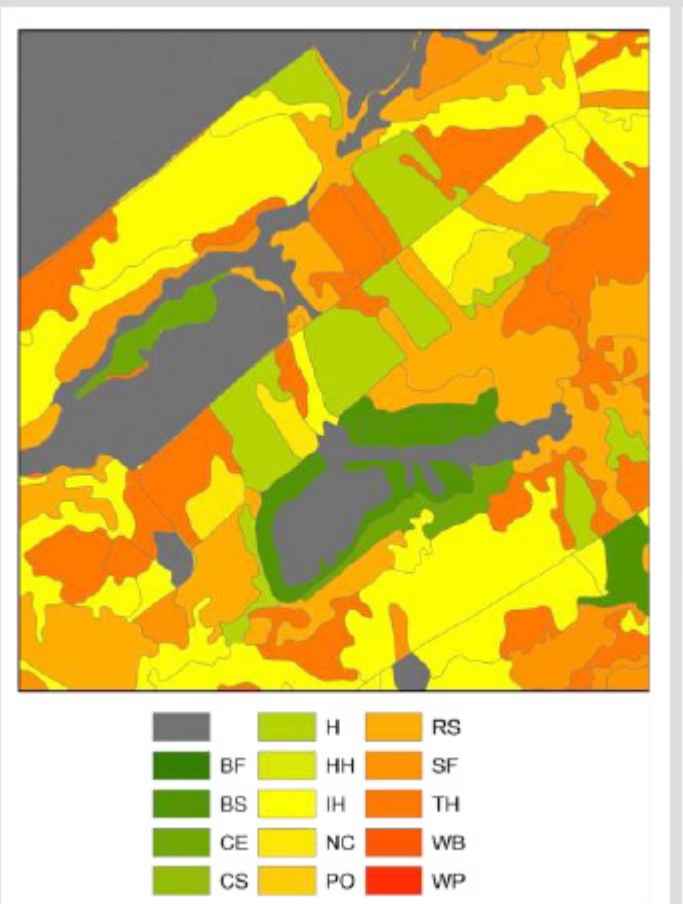
Erin Simons-Legaard
Research Professor, Forest Landscape Modeling

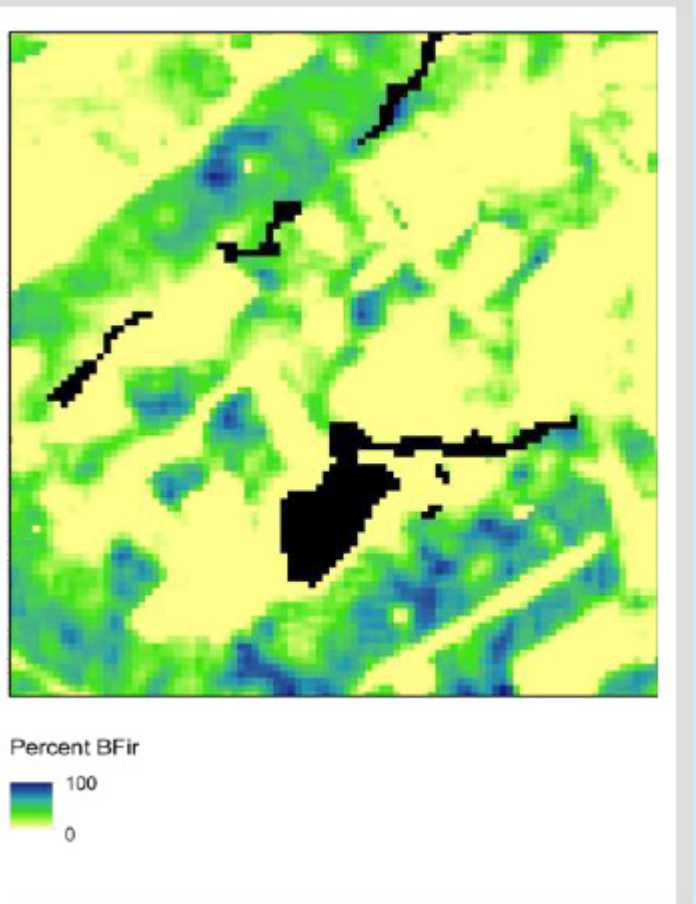
Aaron Weiskittel
Professor, Forest Biometrics & Modeling
Director, Center for Research on Sustainable Forests



	Aerial Photography	LiDAR	Satellite Imagery
Tree Species ID	~	-	+
Timber Volume Estimation	-	+	~
Harvest Monitoring	~	-	+
Large Area Application	-	-	+
Cost per acre	~	-	+

From programs such as Landsat and Sentinel, new satellite imagery becomes available every few days or weeks, enabling near-real time mapping of forests and detection of changes in landscape conditions. **Intelligent GeoSolutions** leverages algorithms and software developed at the University of Maine to deliver products of higher information content than is offered by traditional aerial photography or LiDAR, at lower cost per acre.





Traditional forestry "stand" maps, as shown on the left, are derived from aerial photographs collected from fixed wing aircraft. Photographs are manually interpreted by an expert to identify areas of relative homogeneity. The example includes stands classified by dominant tree species (e.g., BF refers to Balsam Fir). For comparison, the Intelligent GeoSolutions (IGS) map of BF relative abundance (0-100%) derived using inventory data from the US Forest Service and Landsat satellite imagery is shown on the right for the same area. Similar landscape patterns are apparent. However, the IGS map has a much higher resolution and is thus able to provide much more information about forest conditions. Based on the stand map, for example, you would not know that many areas of relatively high BF abundance occur in the example area.