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 nontimber 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 Machine Learning

Our approach combines the strength of Support Vector Machines (SVMs) to model complex, nonlinear relationships with the adaptability of a Genetic Algorithm (GA). The GA guides the evolution of SVMs to simultaneously increase accuracy and reduce bias, an important source of error that can severely impact map use. Our methods are highly automated, can be applied to any forest conditions, and are capable of producing better data at lower cost than is currently available through commercial vendors.

crsf.umaine.edu/research-2/igs

The GeoSolutions Team

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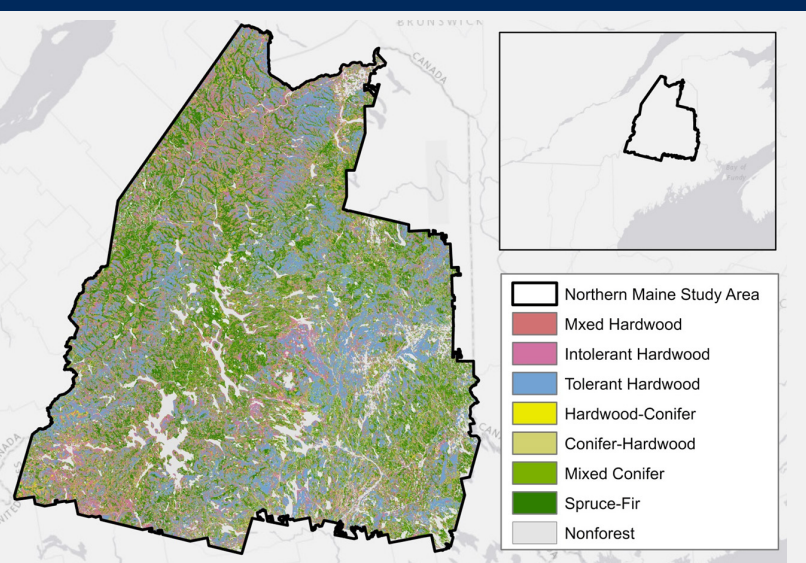
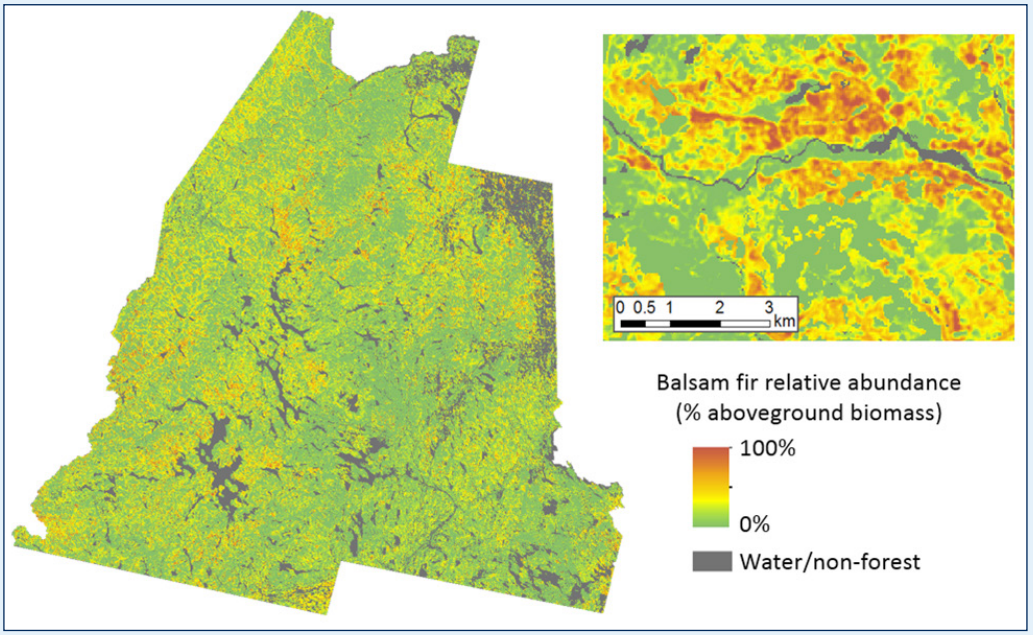
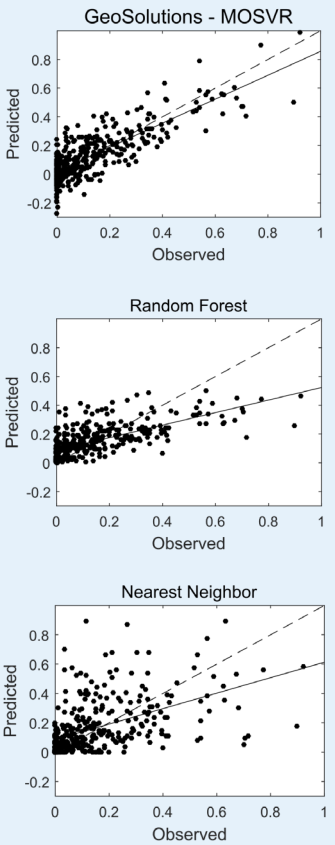
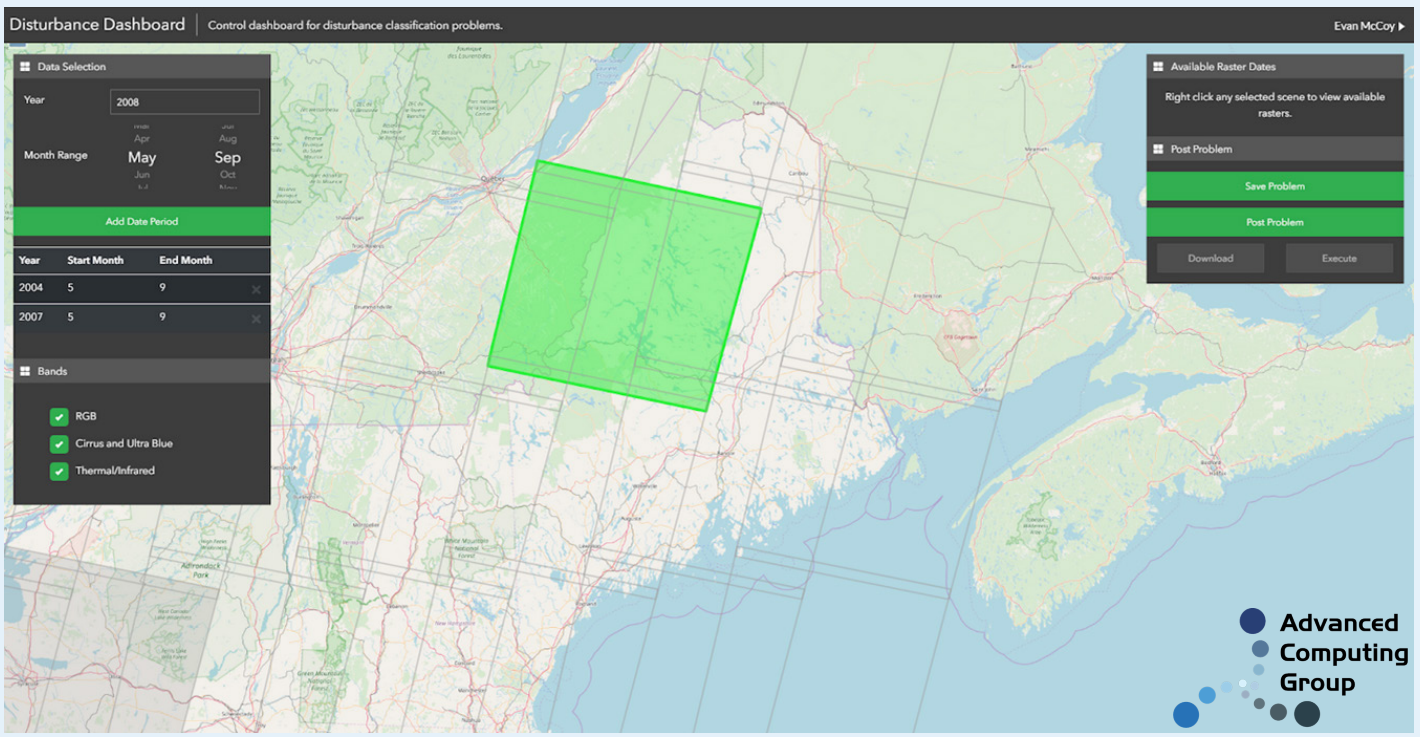






Accurate maps are needed to manage forest resources, and satellite imagery from programs such as Landsat and Sentinel enable affordable mapping of forest conditions (e.g., distribution and relative abundance of balsam fir, shown here). However, available methods generally fail to achieve the accuracy required by land managers, and they often produce a strong attenuation bias where high observed values are systematically underestimated. The Multi-Objective Support Vector Regression (MOSVR) method developed by IGS minimizes error and bias, yielding maps of greater value to users.



IGS and the University of Maine Advanced Computing Group have developed a computationally efficient code base for our ML algorithms, run on the UMaine supercomputer cluster. ML algorithms are linked to automated image processing and data handling workflows accessed through a secure online user environment including graphical interfaces for problem specification, data management, and map production. Our fully customized software system was created by a talented and skilled team of professional and student software developers to support production of forest maps at high volume and low cost.