TerrSet 2020 Geospatial Monitoring and Modeling System

Land Change Modeler

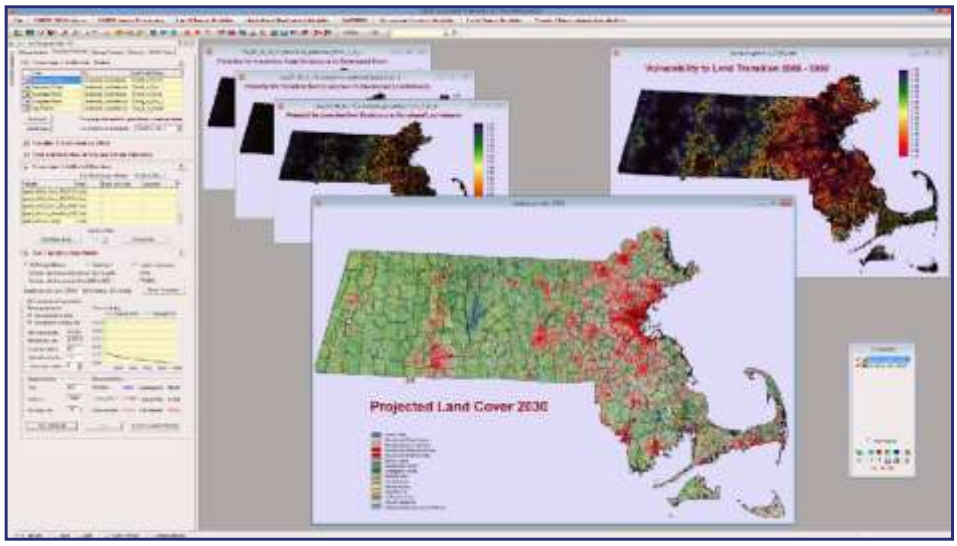
Land cover change is one of the largest imprints of humans on the Earth system. Understanding and projecting transitions into the future is critical for smart development, biodiversity conservation and managing climate mitigation strategies such as REDD (Reducing Emissions from Deforestation and forest Degradation). The Land Change Modeler (LCM) analyzes historical land cover data to assess, model and predict land cover change using powerful machine learning procedures. Major components of LCM include:

Land Change Analysis

Given two historical land cover layers, quickly generate graphs and maps of land change, including gains and losses, net change, persistence and a breakdown of contributors to each transition. LCM includes the ability to generalize complex transitionsusing trend surface analysis.

Transition Potential Modeling

Modeling the potential of land to experience specific transitions (such as defores-tation for agricultural development) lies at the very heart of LCM. Using histori- cal land cover layers along with a set of potential explanatory variables (such as proximity to roads, soil type and slopes), LCM uses empirical modeling tools to establish the relationship between them. LCM supports an exceptionally powerfulMulti-Layer Perceptron (MLP) neural network, SVM (Support Vector Machine),DecisionForest (an implementation of Random Forest), and WNL (Weighted Normalized Likelihoods) – a fast modeling procedure for large numbers of transi-tions, logistic regression, and a modified KNN (K-nearest neighbor) for model development. All models return detailed accounting of model skill and the qualityof each explanatory variable.



The Land Change Modeler (LCM) in TerrSet uses map layers of historical change in combination with layers of potential explanatory variables (such as slope, proximity to roads, and so on) to develop empirical models of change. From these, projections can be made of the expected land cover at a future date. The LCM dialog to the left shows the process of specifying explanatory variables associated with a specific transition and the use of the Multi-Layer Perceptron (MLP) neural network to learn their association with the transition. The result is a series of transition potential maps (upper left). These are then used in combination with Markov Chain analysis to generate a projected land cover map for a future date (lower-center). In addition, LCM can generate a soft projection—a map of the vulnerability to land transition (upper-right).

Change Prediction

Using transition potential models as a foundation, LCM uses Markov Chain analysis to project the expected quantity of change and a competitive land allocation model to determine scenarios for a specified future date. Options exist to incorporate planning interventions such as incentives and constraints, proposed reserve areas and infrastructural

REDD Analysis

REDD—Reducing Emissions from Deforestation and forest Degradation—is a climate change mitigation strategy that offers developing countries incentives to reduce their forest carbon emissions. Critical to the development of a REDD project is the ability to model expected land cover change in the absence of intervention. LCM is the ideal tool for this purpose and provides additional tools to quantify baseline carbon stock changes, including both CO2 and non-CO2 greenhouse gas emissions, and the possible associated leakage from displaced baseline activities. LCM's REDD tools follow the World Bank's BioCarbon Fund methodology and have been successfully employed in establishing approval for projects submitted to the Verified Carbon Standard program.changes.