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Landscape Dynamics of Northeastern Forests

Charles D. Canham, Institute of Ecosystem Studies (P.I.)
John A. Silander, Jr. and Daniel L. Civco, University of Connecticut (Co-P.I.s)

Summary

This project involves collaborative research with Stephen W. Pacala and Simon A. Levin of Princeton University to calibrate, test, and analyze models of heterogeneous forested landscapes containing a diverse array of habitats. The project is an extension of previous, NASA-supported research to develop a spatially-explicit model of forest dynamics at the scale of an individual forest stand (hectares to square kilometer spatial scales) (Pacala et al. 1993). That model (SORTIE) has been thoroughly parameterized from field studies in the modal upland environment of western Connecticut (Canham et al. 1994, Ribbens et al. 1994, Pacala et al. 1994, Kobe et al., submitted). Under our current funding, we are scaling-up the model and parameterizing it for the broad range of upland environments in the region. Our most basic goal is to understand the linkages between stand-level dynamics (as revealed in our previous research) and landscape-level dynamics of forest composition and structure.

Empirical Calibration of Variation in Tree Growth and Mortality at Landscape Scales

We have obtained permanent forest plot data from the U.S. Forest Service for the New England states as a primary source of data on landscape-level variation in patterns of tree growth and mortality. These data come from long-term plots established for forest inventory purposes. They provide an extremely extensive sample of tree growth and mortality from virtually all forested environments within the region. The datasets include both saplings and mature trees. We are currently analyzing datasets from both Connecticut and Massachusets, and will add additional, neighboring states when data from new surveys, currently underway, become available this fall.

We are also preparing for our first full field season (1994). Our plans are to focus on landscape variation in tree seedling dynamics (which are generally not represented in the Forest Service datasets).

Remote Sensing and Vegetation Classification

We are using remote sensing to (1) determine landscape-level relationships between environmental parameters and forest composition and structure; and (2) to provide a validation dataset against which to test our model predictions of landscape-level variation in

forest composition and structure. To date, we have acquired, integrated and completed in part image to image, and image to ground orthorectification and georeferencing of the following GIS data layers:

3 Multidate Landsat TMscenes 5/4/88, 8/30/90, 10/6/92
3 Mulidate SPOT Panchromatic scenes 5/4/88, 6/22/88, 10/7/93
USGS DEM's for shadow/terrain correction
USGS DLG road coverages for calibration/ GCP evaluation
USGS DLG hydrography coverages

Preliminary image assessment has been performed calculating the vegetation indices, and multi-date band ratioed images (TM 4/TM3) to assess spatial and temporal vegetation changes and to delineate nonforest areas (agricultural areas and impervious surfaces) for masking later on. We have also examined the spectral separability of forest classes using signatures derived from single seeded GPS point data and those signatures derived from combined region grown areas.

We have also sorted, formatted, and input GPS acquired geographic and attribute field point data. The effort is being made so as to have the data accessible and compatible for input into and analysis with the various statistical, analytical, and image processing software applications and platforms including:

PC to Unix platforms
PC ERDAS 7.5
ERDAS Image 8.0.1/8.1 for UNIX
PC Arc-Info
Paradox for Windows database manager
SAS statistical software
Data Sculpter - Neural Net software
Geocalc Datum conversion software

This will allow full integration of the GIS/GPS data base within the broader ecological scope of the project, and allow us to explore a full range of ecological interpretations.

Additional collaboration is being done with Dr. Agustin Lobo, of Princeton University on the integration of large scale 1:400 color and color-infrared aerial photographs from October 92 for 6 selected flight lines in our study area. Our objective here is the interpretation and delineation of the species specific tree crowns, using an experimental segmentation algorithm. This will aid in our ability to go from the large scale (aerial photo) data format to the satellite data layers.

References

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