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Branching out

from the Canadian Forest Service
Laurentian Forestry Centre

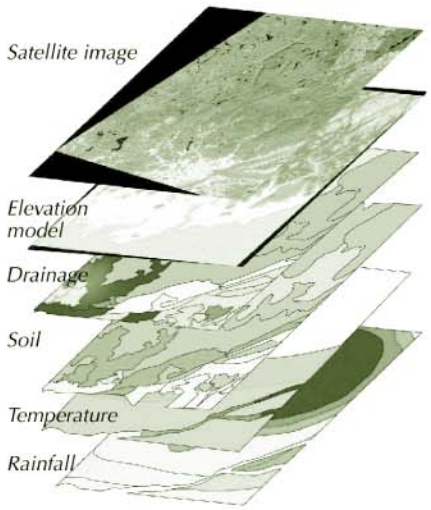
ECOLEAP: ESTIMATING PRODUCTIVITY, FROM LEAF TO LANDSCAPE

Evaluating forest productivity is the cornerstone of the forester's work. However, such events as an insect infestation, a fire or difficult climatic conditions affect the dynamics of ecosystems (photosynthesis, transpiration, etc.) and change the forest growth within a region from one year to the next.

The goal of the ECOLEAP[1] project, initiated at the Canadian Forest Service's Laurentian Forestry Centre in 1996, is to develop new tools for estimating forest productivity, even for sites where routine calculations cannot be done.

ECOLEAP's work focuses on two main objectives:

- a better understanding of environmental factors influencing the productivity of Canadian forests (boreal and sub-boreal);
- the development of tools that predict forest ecosystem productivity with sufficient accuracy to be useful to foresters.



The development of spatial layers relevant to forest productivity calculations.
Photo: R. Fournier

To attain these objectives, one needs to pay heed to growth process measurements: photosynthesis, transpiration, allocation of carbon to the various parts of the tree, decomposition of leaf litter, nutrient cycles.

The challenge is not only to measure these processes, but also to develop ways of integrating them at the stand level and translating them into annual biomass growth values that can be verified in the field.

Here are a few important tools developed through ECOLEAP's efforts:

- *Biophysical site index ($SI_{biophysical}$)*
  Developed in co-operation with the ministère des Ressources naturelles du Québec, this mappable productivity index takes into account climate, soil texture and stand structure.
- *FineLEAP*
  A predictive model of net primary production (NPP = photosynthesis - transpiration) at the level of the tree crown (leaves), on which stand-level models are based (StandLEAP). The NPP estimate is the basis for estimating stand commercial productivity.

1 Extended COllaboration for Linking Ecophysiology And forest Productivity.

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Measurement of tree transpiration.
Photo: C. Moffet

- *StandLEAP*
  This tool is used to map the NPP of whole regions; it uses values from FineLEAP to tie this estimate to field measurements of growth processes.

- *TreeLEAP*
  This tree-scale version of the StandLEAP model is used to estimate the effect of thinning and insect defoliation on tree growth and mortality. This model should facilitate the transition from NPP to commercial productivity.

- *Mapping biomass in Canadian forests*
  A method of estimating forest biomass that integrates geographic information and remote sensing techniques with existing databases on forest ecosystems and inventories.

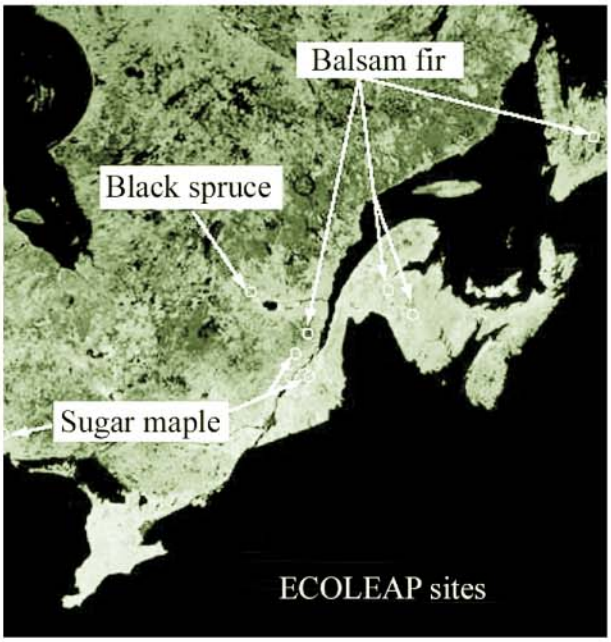
The ECOLEAP project also focuses on the effects of climate change on forests' ability to fix atmospheric carbon or retain carbon already fixed in trees and soil.

Its research activities are focused on gaining a better understanding of the way carbon is distributed throughout the forest ecosystem[2].

Finally, the development of tools for detection and mapping of landscape changes after clearcuts or fires by means of satellite images is intended to enhance our ability to estimate changes in forest carbon stocks.

THE TEAM

ECOLEAP has been made possible by the teamwork of Canadian Forest Service – Laurentian Forestry Centre (CFS-LFC) specialists and of collaborators from the four other CFS centres in Canada as well as other government agencies. The project also depends on a network of scientific partners consisting of university researchers from Canada and abroad.



Location of ECOLEAP research project experimental sites.
Photo: P.Y. Bernier

USEFUL LINK

ECOLEAP
www.cfl.cfs.nrcan.gc.ca/ecoleap

FOR FURTHER INFORMATION, PLEASE CONTACT:

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2 Carbon distribution is not the same in every part of the tree. For example, the fine roots can absorb nearly 50% of the carbon taken up by the tree, while often only 25% remains in the trunk.

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