Growth and Yield Modelling Project

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Welcome to the third Growth and Yield Modelling (GYM) Newsletter, designed to update developments and promote advances and outputs of this DFID funded Forestry Research Project now in the final year of its 3-year term.

The purpose of the project is to develop and apply an individual-based model to predict the growth and yield of tropical forests following management interventions. Different management options will be compared to evaluate the ecological and economic sustainability of management or silvicultural treatments. Interest in the project has been worldwide with 62 people from 24 countries having registered earlier versions of Symfor.

SYMFOR 99:

This contribution is by Dr Paul Phillips (IERM)

September of 1999 sees the release of Symfor 99. Many of the features that were requested following Symfor 98 have been implemented, including an improved growth module, more simple simulations of silvicultural treatments and improved graphics.

For those of you unfamiliar with Symfor, it is an individual-based forest simulator. That means it models forest behaviour at the level of individual trees – growth, recruitment, mortality, logging, damage through falling trees and skidtrails and other silvicultural treatments. It is designed to use data from one hectare permanent sample plots of mixed tropical forest in Indonesia, and would need to be recalibrated to be used on other forest types.

Mixed tropical forests are complex systems and any set of equations that attempts to simulate the forest's natural behaviour (the growth, recruitment or mortality processes) will be either equally complex or inaccurate. For this reason the process of calibration is also very complex, involving an advanced data analysis of large datasets.

Modelling tip: *You are not expected to calibrate Symfor yourself - use the latest (default) models of the natural forest behaviour.*

Skid Trail (rucksacks in foreground). Photo - Paul Phillips.

Symfor is designed to model forest behaviour so that the impact of silvicultural interventions on the forest can be estimated. Symfor users should change the choice of silvicultural intervention as appropriate (for example, reduced impact logging (RIL) with planned skidtrails, or Tebang Pilih Tanam Jalur (TPTJ - a proposed Indonesian silvicultural system for selective logging and replanting in strips)). The user should also set parameter values for the silvicultural operations (skidtrail width and cleared strip width, separation and replanting density, in the above example).

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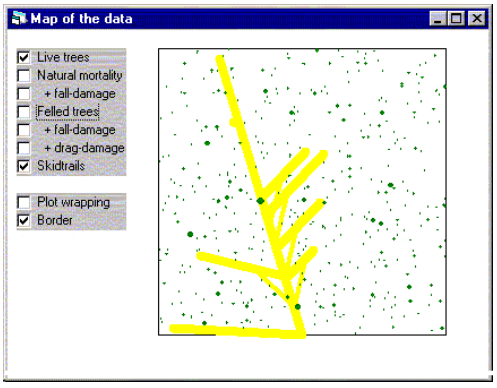
There is great flexibility in the choice of silvicultural treatment applied with Symfor, and the user is not restricted to prescribed treatments such as TPTJ or RIL.

Modelling tip: *in the "model settings" menu, select "model viewer". This is a diagram of the model. All the modules under the calc_treatment module affect the silvicultural treatment, so investgate these!*

To estimate the effect of treating the forest it is necessary to have a prediction of the state of the forest at some time after the treatment, and to compare that with the forest before the treatment. This involves data analysis of the starting data (input to Symfor) and the predicted data (output from Symfor). A first step in using Symfor, for a new user, should be to understand the input data by doing an exploratory data analysis (EDA). This simply means looking at aspects of the data graphically and as summary tables. The same analysis can be done on the output data, and the results can be compared to estimate the changes that have occurred.

So, you have some PSP data, you have done some EDA on your data and are confident about the content of the forest that the data describe. What do you do now? Prepare a Symfor input file from your data, and try running it! The tree input file needs the species group information, and the "utilisation group" information which can be obtained from the installation CD. Start Symfor, set the silvicultural simulation and parameter values as you want them, set up the output to produce the data you want, input your new input file and start the run.



Symfor display showing live trees and skid trails.

You can open displays to tell you about your simulated forest, and the changes that are happening to it over time. These are updated every 10 years. The plan view has recently been developed and shows a map of the trees, fallen trees, felled trees, skidtrails, damaged areas of forest and TPTJ cleared strips. When the run has finished, check the output data set exists and has the columns of data you expected it to.

Now you can start doing some serious modelling using the "multi-run" facility. In the forest, there are many events that are impossible to predict with any accuracy, such as lightning strikes or individual tree-fall. These are known as stochastic events, and can be modelled by using random numbers to simulate when and where they happen. Because of these, each time Symfor is run it will produce slightly different results, just as if you monitored the changes in two areas of identical forest you would find different results from each. To get around this apparent problem you must run Symfor many times for each scenario you want to simulate. The multi-run facility can do this for you, and all you have to do is take averages of the output data to get a reliable result.

Modelling tip: *use the output variables "outputreason", "dumpnumber" and "runnumber" to distinguish between your output datasets within one output table*

The next question most people ask is, "How do I get the result I want?", and the answer lies in the question. Ask yourself, "What number(s) or graph(s) do I want to compare with the pre-simulation data?", then think what variables you can output from Symfor that will help you calculate that.

Symfor is a tool to help a data analyst understand the implications of a particular silvicultural treatment for their forest. To be able to use Symfor successfully, you must already be able to analyse data and be familiar with the data you are using with Symfor. Then Symfor is a powerful tool for you to help decision making.

Symfor 99 will be superceded by the final version of Symfor in a few months, but is the most advanced version to date. It includes skidtrail design, TPTJ, logging damage around the tree base and advanced options for selecting which and how much timber to extract. Many current silvicultural systems can be modelled with Symfor 99, including RIL, TPTI and TPTJ. The latest versions of the tree growth, recruitment and mortality functions are also included.

Additional information about the project and a internet download of Symfor 99 are available from
http://meranti.ierm.ed.ac.uk/g&y/
Alternatively a CD of Symfor 99 is available from Tonya.Brash@ed.ac.uk or write to
Tonya Brash,
I.E.R.M. (Agriculture Building),
Kings Buildings,
West Mains Rd.,
Edinburgh,
EH9 3JG, UK

Project Management and Organisation:

The University of Edinburgh:

The Growth and Yield Modelling Project is managed by staff at Edinburgh University.

Dr van Gardingen leads the project. He is responsible for delivery of outputs, reporting and co-ordination between project partners.

Dr Phillips is extending an existing growth and yield model (Symfor).

- Dr Paul van Gardingen
  +44 131 535 4066 p.vangardingen@ed.ac.uk
- Dr Paul Phillips
  +44 131 535 4009 paul.phillips@ed.ac.uk

Institute of Ecology and Resource Management:
The University of Edinburgh
King's Buildings
West Mains Road
EDINBURGH EH9 3JG
United Kingdom
Fax: +44 131 667 2601

http://meranti.ierm.ed.ac.uk/g&y/home.htm

Institute of Terrestrial Ecology:

The Institute of Terrestrial Ecology (ITE) in Edinburgh are modifying one of their models (Hybrid) to improve the growth relationships used by Symfor. ITE are also responsible for the statistical analysis of PSP data.

- Mr Gerry Lawson
  +44 131 445 4343 GKL@ite.ac.uk
- Dr Andrew Friend
  +44 131 445 4343 ADF@ite.ac.uk
- Mr Ron Smith
  +44 131 445 4343 RIS@ite.ac.uk

Institute of Terrestrial Ecology:
Edinburgh Research Station
Bush Estate
PENICUIK
Midlothian EH26 0QB
United Kingdom
Fax: +44 131 445 3943

http://www.nmw.ac.uk/ite/edin/edin.html

Forest Research Institute, BPK Samarinda:

BPK Samarinda are responsible for the provision of the datasets and application of the growth and yield modelling system in Indonesia

- bpk-smd@smd.mega.net.id

Director, BPK Samarinda
Jalan A Wahab Sjahrani Sempaja
Samarinda
PO Box 1206
INDONESIA
Tel/Fax: +62 (0)541 42037

Centre for International Forestry Research

The Growth and Yield Modelling project is linked to CIFOR's Criteria and Indicator Project to develop and evaluate C&I for yield regulation in sustainably managed forests.

- Dr Ravi Prabhu
  R.Prabhu@cgiar.org

CIFOR
P.O. Box 6596 JKPWB,
Jakarta 10065
Indonesia
Phone: +62 251 622 622
Fax: +62 251 622 100
Web Site: http://www.cgiar.org/cifor

ECTF

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