

Forest modeling using Woodstock at North Forest Products – Tasmania, Australia

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Remsoft's Invited Author Series

As part of our commitment to support education and innovation, and showcase some of the unique applications for Woodstock and Stanley, Remsoft has invited 6 key forest planners to write a short article highlighting unique and interesting approaches to forest management planning using Woodstock and/or Stanley.

This is the second article in the series.

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Introduction

North Forest Products (NFP) is a private forestry company based in the State of Tasmania, Australia. It is fully owned by North Ltd., a diversified Australian-owned mining and forestry company operating in both Australia and overseas.

NFP manages 126,000 hectares of freehold plus harvests wood from Government and privately owned land throughout Tasmania. It currently supplies over two million tonnes per year of hardwood and softwood veneer, sawlogs and pulpwood to domestic mills and export markets. One of NFP's primary goals is to establish a world class eucalypt plantation estate and the company is currently establishing over 5,500 hectares of *E nitens* and *E globulus* annually. At June 1998, NFP owned or controlled over 43,000 hectares of eucalypt plantations making it Australia's largest hardwood plantation owner.

At North Forests Products, Woodstock is used to:

1. Model potential harvest volumes from freehold, government owned and private native forest and plantations.
2. Carry out "what if" analyses of alternative forest management scenarios.
3. Carry out forest valuations of the existing business and potential new business opportunities (e.g. acquisitions).

Woodstock was purchased in 1994 after it came up with the following scorecard:

- ✓ flexible tool that could be adapted to a number of modelling problems;
- ✓ able to be used as both a forest simulator and optimiser
- ✓ could handle large problem sizes;
- ✓ provided features/functions designed to make forest modelling easier;
- ✓ strong reporting ability;
- ✓ Easy to use;
- ✓ good user support system and development path;
- × able to accept input data in a number of formats;
- × strong links to Arc/Info GIS.

The Problem

For this technical paper a description is given of a modelling task carried out in 1998 to value a large softwood plantation resource in Australia. NFP was involved in a tender process bidding for this resource that had a book value of over Aus \$300 million.

Problem details

- The timetable for bid was very tight - there being only three weeks to obtain base data, build and check model, run various scenarios and report results. Thus a model was needed that could be run quickly.
- The resource being modelled comprised 107,000 hectares of softwood plantation scattered over a very large geographic area. There was a large range of ages, site qualities and treatment histories (450 development types).
- Seven sawlog and one pulplog products were possible from any stand.
- There were commitments to 16 major customers over periods ranging from 1 to 15 years. When any one stand was harvested it's sawlog products would go to one customer and its pulplog to another.
- Modelling had to optimise financial return. Thus cost and revenue data had to be

incorporated. As well, given the model outcome would form the basis of a bid price the outcome had to reflect a true value that took into account the operational and other constraints that tend to diminish an optimal LP solution.

The Solution

The solution is described for each section of the Woodstock model.

Landscape Section (MODEL.lan)

Eight landscape themes were defined. These are listed in Table 1 on the following page.

Yield Section (MODEL.yld)

Product yield tables were generated for each croptype based on inventory and growth data supplied by the current forest owner (data verified by independent consultants). Unfortunately, data was only supplied for thinning events in defined years. However this did have the benefit of reducing model size as thinning was forced to occur in a particular year. To allow financial optimisation margin (revenue less costs), yield tables were prepared for each product x customer x location x harvest method combinations. Irrelevant combinations were given a yield of zero dollars. Complex yield tables were used to calculate total product margins per hectare for each customer.

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Table 1. Landscape themes

Landscape Theme	Description
Croptype (150)	Current condition, site quality, regime combinations. Used to link to yield tables
Location (9)	Broad forest location used for reporting and cost allocation
Royalty Zone (5)	Affected revenues
Management (2)	One rotation (no replants) or ongoing management
Species (2) - Collapsed	Species
Regime (4)	Number of thinning events prior to clearcut
Harvest Method (2)	Ground or cable harvesting
Condition (5)	Current thinned status

Actions Section (MODEL.act)

One replanting action was defined for all forest. In order to potentially supply one of up to 16 customers from any stand, 16 sets of thinning and clearcut actions were defined. This was a new approach as our previous experience was with the supply of one customer or processing plant that meant that only one thinning and clearcut action was required.

Transitions Section (MODEL.tra)

A large number of transitions were required for this model largely because of the number of actions. For each croptype a current and future yield table was provided and replant transitions were written to cater to these combinations as well as thinning and clearcut transitions for each customer.

Outputs Section (MODEL.out)

We chose to do as much reporting as possible from the Woodstock

ACTIVITY file using a database reporting tool or pivot tables in MS Excel™. This helped to cut down the number of outputs requiring definition and simplified what can be a large and difficult Woodstock file to understand and document. For this model the output file was over 1000 lines long mainly because of the need to define similar sets of outputs for 16 customers.

Outputs from the Woodstock model were summarised in Excel™ pivot tables ready for input into a more sophisticated Excel™ based financial model.

MODEL.pri

The objective was to maximise total discounted margins for supply of wood to all customers. Constraints were used to ensure that currently contracted sawlog or pulplog volumes were available to existing customers.

The size of this model meant that the “unlimited” version of Cwhiz

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was required. The model was run on a P2 400 PC with 128MB of RAM. The run time of CWhiz was VERY dependent on optimum allocation of RAM. For this model the quickest run times were achieved if the XUNIQUES (memory reserved to hold unique, non-zero values) variable and the XMAXW (memory allocated for execution of CWhiz) variables were set to just over the amount required. This left maximum RAM for other system processes to occur without use of virtual memory. We used the "CWhiz memory" output on the Woodstock matrix generation screen and the "Possible Reduction in Working Memory" value produced at end of CWhiz run to refine XMAXW. Optimising RAM in this way reduced run times by about 50%.

Results

The model was used successfully to carry out a number of essential tasks in the bid process:

- current book value was validated;
- confirmation that existing customer supply contracts

About the Author

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could be met;

- allowed various "value adding" scenarios to be assessed and hence allowed calculation of an indicative bid price.

Follow-Up

A problem that was not satisfactorily resolved was how best to adjust the optimum financial values provided by Woodstock downward to reflect the almost inevitable affect of real-life operational inefficiencies. Given that the results of these runs were potentially going to be used to determine a bid price then a high degree of certainty that realistic solutions were being obtained was required. Although a product like Stanley, when used with Woodstock allows at least the spatial constraints to be considered, experience shows that results from these modelling tools are invariably compromised as they are implemented operationally. Taken with this caveat Woodstock was an effective tool to assist solve this forestry problem.



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