Forest Research Timber Properties Programme
Annual Progress Report: March 2008

1. Sitka Spruce

1.1 Kershope Progeny Trial

This is a collaborative experiment between Forest Research, Napier University and Glasgow University on the volume recovery and timber properties of four progeny of Sitka spruce including Queen Charlotte Island (QCI)

All experimental work and analysis is complete and results are currently being written up in various formats. These include a Forestry Commission Information Note, a PhD by Paul McLean at Glasgow University and a full report on the experimental work by John Moore at Napier University (see Publications and Reports below). The papers and reports are being made available on the Timber Properties web page at http://www.forestresearch.gov.uk/fr/INFD-73PCJN. Further publications will include articles in scientific journals and a second information note on the detailed results of the testing of battens from the different progeny.

The key findings are that improved progeny can provide substantially increased sawlog and sawn timber production with no change in sawn timber performance. In fact with the best improved progeny there are indications that there is a reduced tendency to distort. These results are from the first generation (half-sib) of improved Sitka spruce and there are likely to be even greater benefits from more recent improved material (full-sib).

1.2 Baronscourt Spacing Trial

This is a large scale experiment on the timber performance of Sitka spruce at different spacings was carried out on the Baronscourt Estate in Northern Ireland. The site was planted in 1949 and respaced in 1960 to 5 spacings, 6'x 6', 6' x 12', 12' x 12', 12' x 18', 18' x 18' each of which was replicated 5 times.

All experimental work was completed during the year including testing of all battens at Napier University. The work has been reported at a number of seminars (Royal Forestry Society, ICF and SIRT) and a report on the work has almost been completed by Napier University. The results show that there are substantial changes in the timber properties and performance as the spacing increases. In particular, once the spacing increases beyond 6' x 6' (1.8 x 1.8m) there is a decline in MOE and MOR and an increase in knot size. For spacings beyond 6' x 12' (1.8 x 3.6m ≡ 2.6 x 2.6 m) the stiffness of the wood on average is too low for the timber to pass stress grading at C16. There were no differences in the distortion found between the different spacings although much larger values of twist were found in the juvenile wood compared to the mature wood at all spacings.

1.3 Timber Quality Modelling

The development of a Sitka spruce timber properties model (CONTQ_SS) has continued. Additional property models are developed and tested in the research version in Mathcad® and then incorporated in the WEB based version. The WEB based version can be accessed at https://www.eforestry.gov.uk/forestdss/ and registration obtained through Biometrics Division of Forest Research.

New property models have been developed for calculating grain angle, microfibril angle and clear wood MOE from pith to bark and with height in trees. In addition a new wood density model has been developed from the data obtained from the Kershope progeny experiment described above. At the same time BRE and Napier University have developed a suite of distortion, stiffness and strength models for sawn timber as part of jointly funded projects. The first of these models (BRE twist and MOE) have been incorporated in the Mathcad® version and are being tested to ensure rational results are obtained. Further batten model incorporation will now take place and when these have been shown to be reliable and robust they will be included in the WEB based model.

1.4 Non-destructive Evaluation

The use of non-destructive techniques such as stem straightness and acoustic measurements of standing trees and logs has been evaluated as part of normal industry practice with James Jones and Sons Ltd. The work shows that the stem straightness scoring system provides a very good measure of the log outturn from Sitka spruce stands whereas the acoustic measurements provide complementary information on the likely performance of the sawn timber. The systems can be readily incorporated into normal management practice as either part of a pre-harvesting inventory, roadside log evaluation or mill yard screening.

The exact manner in which these systems are incorporated will depend on the individual enterprise. Two seminars (September and November 2007) were organised to inform the industry of the methods and possibilities.

The use of additional acoustic measurements including directly on the log line or on the harvester head are planned for evaluation next year.

1.5 Production Forecasting

The 2005 production forecast has been used to the breakout of sawlogs into green and red logs across Scotland until 2050 for the FC estate. This has made use of 2 models for forecasting the stem straightness of stands at felling (North British model and dbh model). The mean straightness has been used to then predict the green/red log percentages according to 3 options: normal assortment, all log cut to 2.4m and all logs cut to 4.8m.

The forecast was initially tested for Cowal and Trossachs and then extended to the whole country. The 2 straightness models gave similar results but the choice of assortment had a large impact on the green log percentage, which went from around 14% if only 4.8m logs are cut to 65% if only 2.4m logs are cut.

In addition a forecast for Cowal and Trossachs of how the mean density and knot area ratio (KAR) of sawlogs, pallet logs and pulp logs will change from 2005 to 2050 was conducted using the CONTQ_SS model discussed above. The results show a slow reduction in wood density and a slow increase in KAR. Also the forecast mean straightness at a sub-compartment level is being mapped initially for the Trossachs and then this will be extended to the whole country. This allows managers to make their own forecast of the log assortments likely to be available from their forests.

2. Scots Pine

2.1 Scots Pine in North Scotland – Markets and Products

A market development study evaluating potential new market opportunities for Scots pine timber was commissioned from Napier University CTE and conducted by Ivor Davies. Thirteen products were assessed against a number of technical and commercial criteria to identify those with the greatest potential for value added market development. The products highlighted were massive wood construction (Brettstappel), external cladding, garden and landscaping products (focused on the potential for wood modification by chemical or thermal treatment), playground equipment and stress laminated timber bridges. The final version of this report will shortly be published on the FR website, and an article summarising the results together with those from the Scots pine utilisation study and the BRE re-engineering project has been drafted for publication in Forestry & Timber News or similar.

In addition Forest Research staff assessed and felled Scots pine timber for inclusion in the BRE studies on re-engineering and higher machine grade settings. Collaboration with BRE in this project area has continued throughout the year, with BRE colleagues participating in the Scots pine in North Scotland steering group meetings.

2.2 Timber Quality Modelling

In October 2007 Dave Auty started a PhD "Developing a timber quality model for Scots pine (*Pinus sylvestris* L.) applicable to a range of silviculture including conversion to irregular structures". This work is partly funded through the Scottish Forestry Trust. A preliminary literature review has been completed and Dave spent a week in Joensuu, Finland to learn assess the applicability of various Finnish Scots pine growth models to Scottish conditions. Twelve sample stands in north Scotland covering three age classes have been selected and will be assessed (growth, branching, competition) during the period April – October 2008. Nine sample trees will be felled in each stand and discs and short logs will be cut for detailed evaluation of wood properties and mechanical testing on small clear samples.

2.3 Non-destructive Evaluation

As part of the Scots pine timber quality in North Scotland project three sample stands were studied to evaluate the potential of a number of non-destructive timber quality assessment methods (stem straightness score, branching assessments, standing tree and log acoustic tools) for prediction of log grade out-turn, sawn timber mechanical properties and appearance grade. Stem straightness score and height of lowest dead branch were found to be the best measurements for predicting green log yield and will be used in a survey of Scots pine timber quality. A model predicting sawn timber stiffness from HM200 log acoustic measurements was developed and logistic regression analysis is being used to suggest threshold HM200 values for different machine grade strength classes. Sawn timber stiffness was weakly correlated with ST300 standing tree acoustic measurements and with various branching measurements, at an individual tree level. Further data analysis is ongoing. Work to date is based on acoustic stiffness assessments of battens: more detailed bending tests are ongoing at Napier CTE to evaluate static MOE and MOR.

A survey of Scots pine timber quality in Scots pine stands in Grampian and Highland conservancy areas will take place from May – October 2008.

3. Lodgepole Pine

3.1 Sourfelling Study

The major part of this work was completed and a final report produced for Highland Birchwoods. The results show an increased drying rate for trees with branches left off after felling although drying rates varied considerably during the year. Some additional work is almost completed to obtain extra data to refine the drying model that has been developed.

4. Forest-Wood Chain

4.1 WoodValue

Shaun Mochan attended the initial meeting of this project in Berlin in February 2008. Work is ongoing with Tom Connolly and Stephen Bathgate to develop a web-based questionnaire that will be used by all the participating countries to collect information about costs and revenues throughout the forestry wood chain. In addition an experiment plan has been drawn up for a detailed study of costs and revenues at all stages of a typical timber harvesting and processing operation, from buying a standing sale through to the end-product, based on a site being worked by James Jones who are partners in the project. The next project meeting will be held in May 2008 in Finland.

4.2 EFORWOOD

Work has concentrated on providing data on forest conditions for the whole of the UK and the development of representative wood chains for South Scotland. These wood chains represent typical upland spruce silviculture with and without thinning and currently go from establishment through to delivery to primary processing mill. The chains are being populated with indicator data in order that runs can be made using the TOSIA model to see how different sustainability indicators change with silviculture and with time under different forecast scenarios.

4.3 Modelling Benefits of Trait Selection

Bruce Greaves from Australia visited NRS for 2 weeks with funding provided by the Scottish Forestry Trust. During this period he put together models to investigate the financial benefits of selecting for a number of different traits (dbh at 10 years, pilodyn penetration, stem form, branching and acoustic velocity). The initial results suggest that selection for diameter growth was the most valuable trait but further works is required to confirm this. In addition Bruce developed some initial models for calculating the carbon balance and greenhouse gas emissions along the wood chain. These models are already being used to populate the indicators required in the EFORWOOD TOSIA models.