

50th ANNIVERSARY OF NZFRI

The development of modern silviculture in New Zealand

1997 brings the 50th anniversary of the New Zealand Forest Research Institute (FRI). Over the time it has been in existence, FRI has been involved in a wide spectrum of research including genetics/tree breeding, soils, tree physiology, and forest health, and utilisation. The research in each of these areas has been instrumental in shaping the way that the forest sector has evolved in New Zealand. The following article looks at one particular component of FRI's research which has brought about the silvicultural practices which are common today. The article is an extract from a book by John Kininmonth, "A History of Forestry Research in New Zealand". The book will be launched in conjunction with the 50th Anniversary of FRI on April 1, 1997. (Editor)

The technical and economic basis for the development of modern silviculture of radiata pine had its beginning in 1961 when Dennis Richardson, then the new



Two men biomass sampling a stand of Douglas-fir (*Pseudotsuga menziesii*) in the South Island. Photo: NZFRI

Director of Research, set new priorities for research. One of the changes was to give exotic-forest silviculture an 'economic

flavour', and he set up a new research group, that became Economics of Silviculture, with Bob Fenton as its initial dri-

1 April 1997

THE REUNION

A day to meet up with old friends and to celebrate FRI's achievements over 50 years. A number of books will be launched on the day, including a compilation of 'Characters of FRI' – those memorable people whose exploits have ensured their names will not be forgotten in the annals of FRI history. A plaque commemorating all those who have worked for the Institute over its 50 years will be unveiled by Priestley Thomson, the first Officer in Charge of the Forest Experiment Station. The AGM of the Institute of Forestry will be held on campus on the afternoon of the Reunion, and the day's festivities will culminate in a 'starlight' dinner and dance.

2 April 1997

FORESTRY CELEBRATION DAY

A sector-wide function during which everybody involved with, or dependent on forestry will have the opportunity to participate. Lindsay Poole, the oldest living ex Director-General of Forests will unveil a memorial on the FRI campus recognising the 100th anniversary of the first Government plantings. The Prime Minister of the day will then formally open the function at the Rotorua Convention Centre followed by the presentation of the Forest Research Pioneer

We invite ALL people with an interest in the forest industry, and their partners, to participate in all Jubilee events.

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Awards, before the afternoon session commences. Andy Kirkland will open the occasion with a definitive address in which he will make public for the first time his personal views on the public and private ownership of plantations, their creation, management, and marketing. Speakers from New Zealand, Asia, Australia, North, and South America will follow, giving their views on research, financing forestry, and future markets. The cultural highlight of the week will be the performance of the Auckland Philharmonic Orchestra in the Redwood Grove, a unique event that all participants and their partners will be keen to attend.

3-4 April 1997

FRI 50TH JUBILEE INTERNATIONAL FOREST RESEARCH CONFERENCE

The 50th Jubilee Conference will address some of the key issues facing the forest industries over the next decade. The purpose is to provide some thought-provoking presentation and an initial forum for debate on matters which will help shape forestry in the years to come. Prestigious speakers from New Zealand and overseas have been invited to participate.

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ving force. The first task of the group was a cost analysis and profitability forecast of alternative silvicultural regimes, coupled with analysis of the effects of site variables such as topography, site quality and distance from markets.

An initial economic model was developed to serve as a framework for testing the effects of changes in individual cost components. Fenton had worked closely with Conservancy foresters whilst he was a Technical Officer at Conical Hill sawmill and had published an economic analysis of tending *Pinus radiata* in Southland with C.H. Brown soon after coming to FRI (Fenton and Brown, 1963). This paper pointed out that tending had to be 'timely' for the costs to be justified and also identified that log size and sawing costs have a major effect on the economics of forestry. As sawmilling was the principal utilisation outlet, there was a need to define the optimum size of log, and to relate log size distribution to sawing costs in different types of sawmill, as well as to production costs such as tending and harvesting.

It was known that thinning and pruning practices varied greatly between regions, and where utilisation studies had been carried out, clear timber or clear veneer yields had been disappointing, usually because of lateness of treatment. These issues were covered in the first thinning and pruning symposium held at FRI (Brown and Bunn, 1963) which "discussed the current state of knowledge, practice and progress in development of thinning and pruning forests of exotic trees, with particular reference to *Pinus radiata*".

Among the large number of presentations from FRI and industry was one by Fenton and his co-workers, Wink Sutton and John Drewitt, on clearwood yields from radiata pine which showed the importance of log size and its relationship to the diameter of the knotty core. Another paper at this conference by Fenton was entitled Returns from Tending. In this paper, based on his earlier Southland work and data from a central North Island land-use study, he concluded that "tending pays very handsomely indeed".

Sawing studies were an effective means of determining the effects of silviculture on log quality (e.g., size of knots, whether knots were live or dead, yield of long-length clears) and value. Felling trees in the forest and dissecting nodes was an alternative means of checking for the depth of the clearwood sheath. As was pointed out at the symposium, there was a dearth of suitably-tended stands in state forests from which to check the effects of tending on clearwood yields. The best were found in smaller private forests, and



A tree root survey of six-year-old radiata pine was carried out by NZFRI at Tikitere Forest Farm Block Q in 1979. Pictured is a general view after medium pruning. Photo: NZFRI

sawing studies from these forests were described by Brown (1965). Later studies provided information on second-crop tended stands and sawlogs from production thinning. An important innovation introduced in early grade studies at FRI was to record the defects in each board rather than merely assigning an overall grade based on current grading rules (Fenton, 1966). The resulting database could be reworked if grading rules changed or if

some special analysis was required. It also avoided the personal bias inherent in allotting grades, which might vary within and between studies.

Over the next decade intensive effort went into collecting detailed information on all facets of forest growing, harvesting and sawmilling for use in economic modelling for, as Fenton said in his 1966 paper, the models were only based on the (relatively limited) data available at that time. By the late 1960s, the research team included John Tustin, Ryde James and Mat Grainger, as well as Fenton and Sutton. Several important field studies were underway, including studies to examine the effect of initial spacing on branch size, effects of the number of pruning lifts and the proportion of green crown removed on the height and diameter increments of selected pruned dominant trees, and the yields and economics of production thinning. Much of the accumulated experience was embodied in the silvicultural proposals for production of board grades which became known as the direct sawlog regime (Fenton and Sutton, 1968). This regime involved early thinning to waste, thus avoiding the disadvantages of production thinning, and a three-lift pruning to 18 to 20 ft (5 to 6 m). It was recognised that over 80% of the net value of final-crop trees is in the two bottom logs. With the butt log pruned, emphasis needed to be placed on the characteristics of the second log when selecting crop trees. Advantages



NZFRI research has led to improved breeds of *Pinus radiata*. This photo was taken in 1988. Photo: NZFRI

were also seen in utilising the often un-nodal habit of radiata pine to achieve worthwhile yields of factory grade (clear cuttings) from the second log.

A second pruning and thinning symposium was held in 1970 (James *et al.*, 1970). By then there had been important changes in industry, in particular a greatly expanded planting programme, an increasing emphasis on radiata pine, and – in practice – a much higher proportion of stands being pruned. Among the 60 papers presented were ones from FRI showing that live branches increase in diameter in response to thinning (James and Tustin, 1970), that branch size increases as initial spacing increases (Sutton, 1970), and (once again) that production thinning is unlikely to be profitable (Tustin, 1970). Another subject that came up here, as it had over the years, was the lack of a size/price gradient for sawlogs, making it difficult to give full weighting to the advantages of a regime that yielded larger logs.

Within the next few years, Fenton (with various co-authors) had published a large number of papers giving a comprehensive coverage of the economics of growing radiata pine including the implications of growing for different markets, e.g., log export. These papers were published together in two of the 1972 issues of the New Zealand Journal of Forestry Science (e.g. Fenton and Dick, 1972). By then the basis of modern silviculture was



Waipa sawmill workers at the Waipa laminating plant in 1960. Photo: NZFRI

well established although, with the complex interaction of so many variables, defining specific regimes required considerable further effort by way of field trials and analyses.

There was still considerable scepticism among forest growers about some of the procedures that were shown to be desirable economically and the Director General of Forests expressed concern at the proliferation of different silvicultural regimes in use. Researchers realised that, with the large number of variables

involved and the vast amount of data becoming available, better tools were needed to assist the forest manager in decision making. Computer-based modelling was suggested by Russell Grant, one of the members of the group involved in economic analysis.

This approach was successfully used by the Radiata Pine Task Force set up in 1979 with FRI and industry input and led by Wink Sutton. Industry funded an interactive PDP 11/34 computer and the task force developed the Silvicultural Stand Model (SILMOD). With the model it was possible to simulate the growth of a hectare of radiata pine, together with the harvesting, transporting and sawing of that stand, in a few seconds, a task that had previously taken weeks (Whiteside and Sutton, 1983). An important advantage was that the sensitivity of output to any one variable could be easily tested, and users could enter their own specific cost figures. This model helped to consolidate the era of 'new crop radiata', the implications of which had been well described in a paper on the nature of the resource by Harry Bunn (1981).

SILMOD was replaced later by STANDPAK based on work of the Conversion Planning Project Team (Kininmonth, 1987). In this model the earlier work was extended, with some functions being refined and others added, including a newly-developed set of standard log grades (Whiteside and Manley, 1987) and a range of processing options. STANDPAK is now widely used throughout the forest industry.

An IUFRO symposium, New Approaches to Spacing and Thinning in Plantation Forestry, was held in Rotorua in 1989 (James and Tarlton, 1989). This provided a forum for a review and dis-



A NZFRI trial at Whaka Forest in 1981. Some of the legumes in the spaced-plant trial eight months after planting out. Photo: NZFRI

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The introduction of silvicultural practices involving lower initial stocking and early thinning to waste opened up new opportunities for agroforestry and have allowed it to grow ever since (Knowles, 1991). A symposium held at FRI in 1986 reviewed the then state of knowledge from research and its application by industry (Maclaren, 1986). The agroforestry research programme pioneered research into the planting of trees on fertile farm sites, a trend which now accounts for a high proportion of total new planting at more than 50,000 ha per year. The benefits of combining farming and forestry on these sites were demonstrated by a series of trials. This included the world-famous Tikitere trial, established jointly in 1973 between FRI and the Ministry of Agriculture and Fisheries. Techniques first applied in agroforestry have been extended to improving the productive capability of shelterbelts, and special models have been developed to handle the complex interaction between the forestry and agricultural components of agroforestry. Trials on traditional forestry sites demonstrated the benefits of oversowing with grasses and legumes, including *Lotus*



Pruned and thinned *P. radiata* photographed in Kaingaroa Forest in 1973. Photo: NZFRI

maku, which restrict weeds while providing soil nutrients and forage. These tech-

niques are now widely applied.

Contact with industry has been



A vessel at Mt Maunganui Wharf, with large stacks of logs in the foreground. Photo: NZFRI

strengthened during the last decade by the setting up of a research cooperative and a collaborative now joined into the Forest and Farm Plantation Management Cooperative. This provides industry input to applied research while the main thrust of the programme continues to be the design, installation and measurement of large-scale silvicultural trials. These trials have been established on a wide range of sites, and inclusion of the results into management tools such as STANDPAK will further strengthen the value of this package for the many forest managers and planners who are now licensed users. One of the major recent applications of STANDPAK by forest growers has been the accurate scheduling of stands for pruning and thinning, facilitated by the development of the EARLY growth model (West *et al.*, 1982) and functions to predict diameter over stubs (Knowles *et al.*, 1987). In recent years, there has been a change in the pattern of forest establishment with an increasing number of small private growers. A Radiata Pine Growers' Manual has been produced which is helpful to all growers but especially those new to the industry (Maclaren, 1993).

Increasing effort is now being devoted to research on the silviculture of Douglas-fir which has emerged as a strong second to radiata pine in planting for the future. This and other changes in the forestry sector, such as the increasing interest in the growing of particular clones or breeds of radiata pine for specific end products, will require considerable research to determine growth and quality implications and to provide new models to help industry.



Peter Hall (NZFRI technician) high pruning *P. radiata* at Kaingaroa in 1988. Photo: NZFRI

Conversion of farmland is expected to account for an increasing proportion of new planting and this increases the matrix of silviculture/site interactions that must be understood. It also increases the need for refinement of whole-farm planning to optimise the contributions from the agriculture and forestry components within the diversity of spatial patterns that are possible.

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FRI's 50th Jubilee 'Forestry Festival'

An evening performance by the Auckland Philharmonia Orchestra under the Rotorua Redwoods is expected to be the highlight of the Forest Research Institute's 50th Jubilee celebrations in April.

Planning is well-advanced for the four-day "Forestry Festival", which will be a mixture of informal opportunities for old friends to meet and refresh shared memories, and thought-provoking presentations from well-known New Zealand and overseas speakers on the future of forestry.

Over 1000 people are expected to gather in Rotorua for the jubilee and centenary events. Several hundred expressions of interest have been received from forestry personnel as far afield as Myanmar, Singapore, Laos, Chile, and Canada.

"Some 2000 people have worked for FRI since it began research operations in 1947, and we are expecting many of those ex-staff members to re-converge on Rotorua," said John Groome, Jubilee Convenor.

"By a lucky coincidence, 1997 also

marks the 100th anniversary of government involvement in plantation forestry in New Zealand. We are inviting all people who have an interest in the industry, be it as growers, investors, contractors, manufacturers, exporters, or consultants, to join with us in acknowledging the achievements of the sector to date, and to plan for some of the challenges and opportunities that face us as we move into the 21st century."

The four-day event includes the FRI Reunion, a "Forestry Celebration Day" and a two-day international conference. The latter two events will provide a stimulating forum for debate on issues concerning the future of plantation forestry in New Zealand. Distinguished New Zealand and international speakers have confirmed their attendance at the Jubilee forum.

FRI would like to hear from anyone interested in attending any or all of its Jubilee events; for more information please phone 0800 737 327.

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