TIMBER FROM A NEW GENERATION FOREST

THE WOOD UTILIZATION RESEARCH CENTRE

HARVEY

WESTERN AUSTRALIA

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

W.A.

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AIMS AND OBJECTIVES

Available sawlogs of mature jarrah and karri will be depleted in about 50 years. During this run down period, hardwood supplies increasingly will need to come from the new generation forests. The Department of Conservation and Land Management (CALM) can best contribute to the efficient use of Western Australia's timber resource by:

- Adapting forest management and silvicultural techniques to meet changing markets.

- Co-ordinating joint research projects between different sectors of the forest based industry.

- Researching new methods of seasoning, marketing, and sawn timber production not presently covered by other research institutions or private companies.

Departmental involvement in research into the use and production of sawn timber products should provide a clearer understanding of consumer needs, and in turn a more acceptable series of timber products.

THE WOOD UTILIZATION RESEARCH CENTRE

The Harvey Wood Utilization Research Centre (WURC) was officially opened on the 30th November, 1984 by the Hon. Dave Evans, Minister assisting the Minister for Forests.

The Research Centre has been established by the Department of Conservation and Land Management (CALM) to develop and examine new techniques for seasoning and marketing timber from Western Australia's regrowth forests and pine plantations.

Applied research will be conducted mainly into:

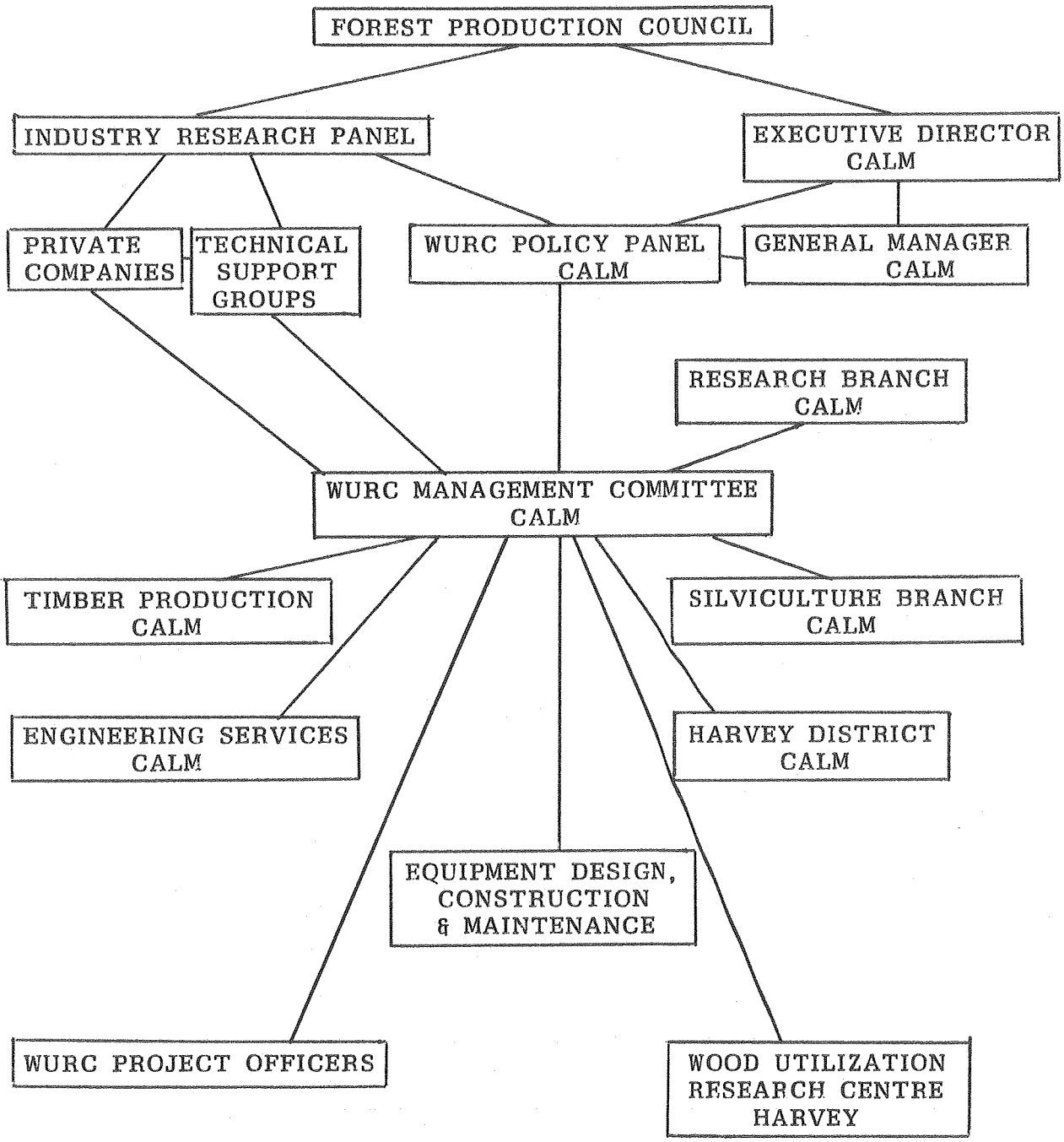
- Log storage and production of sawn timber products from small logs. Minimum size logs will be 1.2 m long, and 15 cm diameter at the small end.
- Use of a progressive tunnel kiln needed for the initial high humidity stages of seasoning sawn hardwood and round pine.
- Development of high temperature kiln schedules for the final stages of seasoning.
- Investigation of techniques for the economic processing of regrowth jarrah, karri, marri, and sheoak.
- Development and promotion of new products from local hardwoods.
- Promotion of sound practices for the use of radiata and pinaster pine, including fast-grown pine and small pine logs.

Involvement by private companies is seen as essential in all these projects. Participation at all stages in research and development is sought.

STRUCTURE AND STAFFING

Wood Utilization Research Centre (WURC)

Structure



The Wood Utilization Research Centre draws from a number of Branches of CALM and is responsible to a policy panel comprising the Director of Research & Planning, the Divisional Manager of Services, the Divisional Manager of Operations, and the Director of Forests.

An industry research panel was recommended by the Timber Utilization & Marketing Task Force set up by the Government in 1983, and accepted by the Forest Production Council which advises CALM. The establishment of this panel awaits the appointment of an independent chairman.

Technical Support Groups comprising private company and WURC representatives are envisaged for each significant area of utilization research.

At present the CALM policy panel consists of:

Mr J.J. Havel - MSc (For) (Qld) Dip. For (Canb) Dip Ed
Director of Research and Planning

Dr F.H. McKinnell - PhD (ANU) BSc (For) Dip For (Canb)
Divisional Manager - Services

Mr S.J. Quain - BSc (For) Dip For (Canb)
Divisional Manager - Operations

Mr P.N. Hewett - BA BSc (Adel) Dip For (Can)
Director of Forests

The following team of staff are directly engaged in research:

Phil Shedley	BSc (For) Dip For (Canb). Co-ordinator, Industry liaison, manufacturing and marketing
Graeme Siemon	BSc (For) (Hons) PHD Scientific Specialist
Jack Bradshaw	BSc (For) Silvicultural advisor - Hardwood
John Kaye	BSc (For) Silvicultural advisor - Softwood
Des Donnelly	Senior Forester Technical specialist and equipment design
Gary Brennan	BSc (For) Research Project Officer
Greg Beange	AIT Mech Eng Mechanical Engineering
John Harding	BE (Civil) Structural engineering
Kevin White	District Forester Technical construction and research project officer

Lex Mathews	Forester, Harvey Manager
Alan Thomson	BSc (For) Forest Ranger Clerical and technical assistance
Don Challis	BA A/Forester Administration clerical and marketing
Daryl Peacock	Cert Civ Eng Mechanical and structural drafting

HISTORY

The Early Years

Since the first settlement of Western Australia in 1829 sawmillers, builders, furniture manufacturers, - the entire timber industry - have had access to a steady supply of large, high quality logs taken from a mature native hardwood forest. These native hardwoods, such as jarrah and karri, take between two and four hundred years to reach maturity.

Western Australian timbers were first marketed nationally and internationally in the latter years of the nineteenth century, and the type of timber sold was taken exclusively from the mature forest.

As a result techniques for seasoning were developed only for mature timber, and markets were established which expected only the type of product and qualities of timber available from mature hardwood sawlogs. Sawmills also became geared to processing the large logs available, and equipment installed could not handle logs beneath a certain diameter.

Between 1829 and 1918 timber cutting in the native forests was virtually unrestricted, and large areas of the best and most accessible forest were cut over by the mills. These areas were not brought under any form of management until the 1920s, and many needed extensive programs of thinning, or needed regeneration before they could become capable of again producing high quality timber.

The Advent of Managed Forest

The Forests Act was passed in 1918, and the remaining native hardwood forests were brought under the management of trained foresters.

Part of the task facing the newly formed Forests Department was to create a long-term balance between the amount of timber removed from the forest annually, and the amount it could grow. Under a management system designed to achieve this "sustained yield" the area of forest would not be reduced by logging, felled areas would be regenerated, and a steady and continuous supply of timber could be guaranteed.

With the forest maintained intact uses other than timber production were also viable options for the future.

As part of the system areas of forest were designated to be grown as crops for timber production. Jarrah and karri crops need to be grown on a cycle between 100 and 200 years in length, and in the course of their growth they may be thinned out several times to improve the growth rate and quality of the final crop. When the trees reach maturity the crop is felled to make way for the next generation.

The problem is the time span needed to produce a mature crop. A steady supply of timber needs to be provided to support industry and meet demand while the crop is growing. Unless there are large areas of mature forest that can be drawn upon sequentially over the 100-200 year cycle the demand must be met from elsewhere.

Native Forests in the Eighties

The area of forest managed for timber production has gradually decreased over the past forty years as other demands by society on the forest resource have increased in importance.

Forested land is needed to maintain the quality of water in catchment areas; recreation areas for camping, bushwalking, fishing, picnicking and sightseeing are in high demand; reserves for scientific study and conservation are needed; parts of the forest are under mining leases, parts held in quarantine to prevent the spread of plant diseases.

Large areas of forest, cut-over before the turn of the century, no longer contain enough mature trees to be economically logged. These areas that do remain are not supplying enough high quality timber to meet the demand.

The demand for locally produced timber is also expected to increase over the next fifty years as hardwood forests elsewhere in the world are cut out, and the State's population increases.

The availability of mature trees from Western Australia's hardwood forest is reducing. By 2020 timber from mature native hardwood will be virtually unavailable for most purposes. Even the forest thinned in the 1920's will not be ready for cropping until 2050. After that new crop areas will come regularly on-stream for production.

In the meantime we have a shortage.

A New Kind of Timber

To meet the increased demand and the shortfall in supply new timbers, new products, new seasoning methods, milling techniques, and manufacturing styles need to be pioneered.

A large proportion of the shortfall will be met with softwood timbers from radiata pine in the Blackwood Valley and pinaster pine plantations on the Swan coastal plain. Other softwood supplies are expected from private plantation growers, and farmers practicing agroforestry.

The limited supply of mature hardwood will need to be supplemented, and the answer lies in the 50-100 year old thinnings from the young crop forests.

Young jarrah and karri are totally new timbers on the West Australian market. They have significantly different characteristics from the older timber (e.g. lighter in colour).

The challenge facing foresters and the timber industry alike is to produce products acceptable to the market from these timbers.

New Generation Jarrah

The new generation timbers from the regrowth forests differ in many ways from their predecessors. They have the potential to supercede mature hardwood for many purposes, and outclass many timbers available on the world market.

Certain physical differences between the new jarrah and karri and the old may well initially affect market acceptance of the end product. They will also demand radical changes in the methods currently used to process sawlogs into timber.

- The logs are smaller: mills will have to re-equip or modify existing equipment to handle the new sizes.
- The reaction of the young timber to seasoning is different: new techniques need to be developed to evolve a satisfactory end product.
- Resistance to decay and insect attack may be lower in the new timber: methods of treating the timber may need to be modified.
- Mechanical strength and durability may be different from that of more mature timber: new products using the qualities of the new timber need to be evolved.
- A greater proportion of sapwood in the smaller sawlogs means a lower yield of heartwood timber from each log: mills will have to be prepared to process both heartwood and sapwood into marketable products. In mature trees the proportion of sapwood is very small, and traditionally it has either been discarded or regarded as an inferior product. Using modern seasoning and treatment techniques acceptable products can be produced from what was previously regarded as waste.

- The colour of the sawn product will be different from that of the mature timber.

The Harvey Centre

The Forests Department softwood mill at Harvey closed in June 1982 due to reduced commercial viability and depressed markets. This made the pine high temperature kiln available and provided the opportunity for a joint jarrah seasoning project with Millars (Aust.) Ltd. After Millars changed hands, Bunning Bros. Pty Ltd continued with, and expanded the joint seasoning programme. It was apparent that the combined experience of production and research personnel from the Department together with a closer liaison with industry was needed if worthwhile applied utilization research was to develop.

The appointment in 1983 of the W.A. Timber Utilization and Marketing Task Force improved communications between foresters, timber processors and wood products manufacturers, and highlighted the urgent need for research.

During the 1983-84 financial year, a start was made on developing a research complex in the old softwood mill at Harvey.

Restructuring the Harvey mill to handle small regrowth hardwood logs as well as pine logs, started in December 1983, an experimental tunnel kiln was built, and construction of a laboratory scale high temperature kiln commenced.

EQUIPMENT

Saws

The Wood Utilization Research Centre mill has an overhead beam feed twin breaking down unit, and a band resaw. It is designed to handle either softwood or hardwood logs from 15 cm in diameter at the small end to 40 cm at the large end, and log lengths from 1.2 m to 6.0 m.

A wood chipper was selected for its compatibility with the research requirements of this mill. Its features are:

- Flexibility in chip size: a range of chip sizes from 15-35 mm with 2 knife disk, or 8-20 mm with 4 knife disk in either hardwoods or softwoods can be produced;
- Capacity up to 10 tonnes/hour.
- Small power requirement to drive chipper disk: the feed is controlled to prevent overload.
- All mill waste including sawdust and jarrah bark are efficiently handled.

Kilns

Two research tunnel kilns have been built at Harvey. They are designed for high humidity seasoning without heat input. Each has a fan blowing ambient air from the 'dry' end of the kiln to the green end, and one has an overhead ducting system to re-circulate cool moist air from the 'dry' end to the 'green' end.

A high temperature laboratory kiln was commissioned in April 1985, and is specifically designed to be compatible with the tunnel kilns. Its specifications are:

- Timber volume without weights up to 1.0 m^3.
- Timber volume with weights .575 m^3.
- Temperature range: ambient up to 180°C.
- Humidity up to 95 per cent.
- Air flow variable up to 5m/sec.
- Venting controlled by wet bulb temperature depression.
- Programmed wet and dry bulb temperature controls.
- Variable air speed control with programmed reverse cycles and automatic venting.

RESEARCH PROGRAMMES 1985/86

HARDWOOD

Silviculture Research

1. Silviculture/Utilization - Inglehope

This initial study was conducted during the operation which provided small jarrah regrowth sawlogs to WURC. The report on this project has been prepared, providing useful data on thinning regimes and on the product categories available. There is a need to research commercial methods in an attempt to reduce the high unit costs of hardwood regrowth logging.

Conversion Research

1. Moisture Content of Jarrah Mill Logs

Moisture content of jarrah mill logs was sampled between 19/3/84 and 31/3/85.

Logs supplied to Bunning Bros., Yarloop from the Harvey District as part of normal operations were sampled at butt and crown ends. The moisture contents ranged between 50-100 per cent.

Statistical analysis of the extensive data to determine the effect of various factors on moisture content variation is not complete.

2. Mechanical debarking trials using round hardwood timber

The Department and a minor forest produce operator are co-operating in a study of the productivity and general suitability of a Skillings

mechanical debarker. While debarking jarrah and marri for use as posts and other round products, stockpiling methods will be assessed, and C.C.A. treated posts will be compared with untreated posts in service. The trial has commenced.

3. Stockpiling

Stockpiling treatments to be tested will be storing with a range of scheduled water sprays, and storing dry. Recoveries will be compared with those from freshly sawn logs.

4. Sawmilling

The major research by WURC will be the sawmilling and seasoning of regrowth jarrah, karri and marri. Aspects of sawmilling include assessment of volumes and product recoveries using different stockpiling treatments and sawing patterns for each species. The effectiveness of different sawing patterns in reducing bow and spring will be assessed.

5. Ecologiser Trial

Tree and Plantation Services Pty. Ltd. imported a portable chipper-canter, the "Ecologiser" for processing pine thinnings.

This machine was hired for a day to process a quantity of jarrah, karri and marri regrowth logs to test the machine's attributes and limitations with hardwoods.

Used at slow feed speeds, the Ecologiser handled all species without significant problems.

Dimensioning was impressive but limitations on log length and diameter would rule out commercial use being made of this machine.

The squared baulks will be resawn at WURC later this year.

Seasoning Research

1. Experimental Progressive Tunnel Kilns (green to f.s.p.)

Mature Jarrah (Bunnings/CALM joint project)

The Forests Department dried 75 x 25 mm mature jarrah in one of the tunnel kilns, without the developing of seasoning checks in the winter months. As drier spring/summer conditions occurred, timber degradation (surface checks, bow and twist) was observed on a number of boards. The drying conditions inside the kiln that produce timber degrade must be quantified. This work will lead to the development of a critical drying rate and the design of kiln facilities to modify the climatic conditions.

Further work is planned with seasoning 50 mm, 75 mm and 100 mm thick mature jarrah and other species. A data logging system is required to continuously log and store all the required climatic conditions, with a computer to calculate climate histories (inside and outside the kiln) over time, timber degradation over time, and to relate these two continuous variables.

2. Regrowth Timbers

The jarrah, karri and marri regrowth logs sawn at the mill will be seasoned from green to f.s.p. in the experimental tunnel kilns, to identify if seasoning behaviour of the different species is consistent.

The initial stage will be to compare the seasoning behaviour of regrowth jarrah with that of mature wood.

3. Laboratory High Temperature Kiln

Work carried out in the commercial high temperature kiln highlighted the excessive cost of conducting research in a plant of this size mainly because of diesel fuel costs. This high cost in operating and potential product degrade, severely restricted the development of optimum drying schedules.

The laboratory H.T. kiln will now be used to replace the commercial kiln for testing a range of species. Commissioning trials are completed.

4. Load Cell

The determination of the end point of high temperature drying has yet to be resolved. The experimental high temperature kiln was designed so that a load cell can be used to monitor moisture loss while timber dries, presumably more easily than with conventional oven drying of samples, and more accurately than with moisture meter use.

5. Microwave drying

The use of a microwave oven to determine final moisture contents was assessed as an alternative to oven drying, taking fifteen minutes as compared to 24 hours. Accuracy with the microwave was $^{+}/_{-}2$ per cent and further tests slowing the rate of drying are proposed, to improve this accuracy.

6. Sheoak

Sheoak has the potential to be an important furniture timber.

A joint sheoak *(Allocasuarina fraserana)* seasoning project is being conducted with sawmiller Mr G. Saunders of Collie, a furniture manufacturer, Inglewood Products Group of Malaga, and the Department. This project is designed to test the utilization and marketing of sheoak trees below the current commercial standard, with the view to increasing the resource available for high value furniture for export.

This work is comparing air seasoning, tunnel kiln seasoning, dehumidifying and high temperature kiln seasoning of heartwood and sapwood material from mature trees that are severely fire scarred and trees with no fire scars (containing sapwood around the entire stem). The seasoned timber will be used to construct outdoor furniture. Different timber finishes will be used on the outdoor settings and they will be placed in different climatic environments (Harvey, Dwellingup, Perth and Singapore). Samples are also being tested in an accelerated sunlight simulator at WAIT. The suitability of the outdoor settings to the different climates will be monitored.

Further work will be done to determine the susceptibility of sheoak sapwood to *Lyctus* attack.

7. Freeze Drying

Some technical assistance and advice was given to a small company which produced solid jarrah drum shells (musical) and using a freeze dryer. The results were not encouraging.

Dressing and Grading Research

1. Furniture Specification

A co-operative study between the Guild of Furniture Manufacturers, the Forest Products Association, and the Department led to the development of an Industry Standard Specification for Furniture Grade Hardwood which was acceptable to all parties.

2. In-grade Testing

In-grade testing of hardwood structural timber is required because it is more efficient than the previous major approach of basing stress grades on the strength of small defect-free specimens, with allowances for defect. The proofgrader at Harvey will be used for assessment of bending properties of regrowth jarrah, karri and marri, and to compare these with mature timber of the same species.

Wood Properties Research

1. Strength Tests

Strength tests in bending and compression of small defect-free specimens of a species provide a strength group, which is used with specific defect limits to give the relevant stress grades in visual stress grading methods. Tests of regrowth jarrah, karri, marri are planned, with specimens from mature logs used as a control. The Department of Civil Engineering, WAIT, will carry out the testing programme.

2. Durability Testing

Durability ratings of most Australian species were originally based on tests of samples from mature logs. The CSIRO Division of Chemical and Wood Technology will use its Accelerated Field Simulator to test the

durability of a range of Western Australian timbers, both regrowth and mature native species, exotic eucalypts and pines. Native species include: jarrah, karri, marri, wandoo, WA blackbutt, sheoak; exotic specimens include yellow stringybark, tallowwood, red mahogany, spotted gum, river red gum, and radiata pine and pinaster pine heartwood. Five randomly selected trees will be selected from over the geographic range, and nine specimens of outer heartwood taken from each tree.

3. Determination of fibre saturation point and shrinkage characteristics of jarrah, karri and marri regrowth

A limited study of jarrah specimens had indicated a fibre saturation point of 28.5 per cent, with a range from 25 to 31 per cent. It is considered essential that all pieces of structural timber be seasoned below f.s.p. before high temperature drying, to prevent collapse which degrades the timber. The estimation of f.s.p. of these regrowth species is therefore desirable. Shrinkage characteristics need to be compared with those reported in the current major reference of Kingston and Risdon (1961) (Division of Forest Products, Technolog. Paper No. 13).

4. *Lyctus* susceptibility

Karri was classified originally as being non-susceptible to *Lyctus* attack, but recently attacks have been reported. The major factor influencing *Lyctus* attack is the size of the vessels, and whether the female's ovipositor can be inserted. Tests of regrowth karri at the CSIRO in Highett, are proposed, to assess whether the *Lyctus* susceptibility rating is correct.

5. Treatability of jarrah transition wood

When the change of sapwood to heartwood occurs in trees, a band of transition wood, which is intermediate in durability between sapwood and heartwood, occurs at the boundary. The penetration of preservative in this transition wood in jarrah was assessed using chemicals prescribed in the Australian Standards, to determine if commercial treatment resulted in an acceptable protective envelope. A report has been prepared.

Product Development and Marketing Research

1. Dowelled Two-piece sleepers

This trial was initiated by Westrail in 1982 with co-operation by the Forests Department, Forest Products Association, Koppers (Aust) Pty Ltd and sawmillers.

The aim of this trial was to test the possibility of using small diameter logs of both softwood and hardwood to produce dowelled two-piece railway sleepers.

The method was to saw a single 130 mm square piece from each log to include the heartwood and as much sapwood as possible. Two pieces dowelled together with 4 steel dowels formed a composite sleeper.

All pieces were pressure preservative treated, half with creosote/furnace oil mix and half with straight furnace oil.

Limited laboratory testing carried out by Westrail indicated that strength characteristics were comparable with one piece sleepers of the same species.

Sufficient sleepers were placed in track to enable a statistical analysis of performance.

The trials have been carried out in stages. The first stage developed grade rules, dowelling techniques, hardwood seasoning, treatment and laboratory testing. Twenty-two composite sleepers of radiata pine, pinaster pine and mature jarrah were used for developmental testing.

The second stage produced 100 radiata pine, 100 pinaster pine and 100 two-piece sleepers. These were dowelled and air seasoned followed by various preservative treatments. These pieces were placed in the track in the Goomalling-Northam test line section in May 1984.

The third stage produced a further 50 of radiata pine and 50 pinaster pine sleepers, half to be dowelled and half to be left undowelled. All pieces were high temperature dried at Harvey to establish if twist could be controlled. These pieces were seasoned successfully. After the single pieces were dowelled, all were treated and placed in the test track area by Westrail. This work was completed in March 1985.

The fourth stage is progressing and involves the testing of young karri, marri and jarrah regrowth logs. These will be milled at Harvey in the near future.

Residue Utilization Research

The efficient use of both forest and mill residues is essential to improved timber utilization, particularly with small regrowth hardwood logs, where costs of harvesting, sawmilling and seasoning are high, and sawn recoveries are low.

The major research carried out was the co-operative trial with Pyrotherm Ltd. whose gasifier showed great potential for reducing conventional energy costs assorted with seasoning. A report has been drafted for publication.

The next step is to complete a literature review and conduct a comprehensive market analysis.

A requisition has been lodged for the conversion of the existing diesel fired kiln furnace and steam boiler plants, to a combustor burning wood residues from the sawmill.

SOFTWOOD

1. Dehumidification Trial

This trial was under contract from Radiata Pine Research Institute, in co-operation with Wesfi Pine Pty Ltd at Dardanup. The objective was to comprise heart-in pine dried by dehumidifying with similar material seasoned by high temperature drying. Juvenile wood (from 12 year old trees), juvenile wood with heartwood formation (from 18 year old trees) and mature wood provided the sample. Bow, spring and twist were seasoned after drying and dressing. The R.P.R.I. have arranged for stability testing of a sub-sample in C.S.R. controlled humidity chambers in Sydney. Preliminary results indicate that dehumidification is not as effective as high temperature drying.

2. Effect of rate of growth on marketing of finished product

The current practice is to use second thinnings at age 18 years as a major source of sawmill logs. A shortfall of supply has been predicted in the early 1990's. A study is proposed of the effect of rate of growth on graded recovery (i.e. marketability of finished products) to assess whether sawlog-sized trees younger than 18 years could be used to reduce the shortfall.

3. Moisture content variation in pine, from standing trees to sawn seasoned timber

Seasoning behaviour of pine timber is adversely affected by increasing variations in moisture content between standing trees. It is proposed to monitor moisture content in the tree at the time of logging, through green-off-saw to the seasoned condition, to record patterns of variation.

4. Wood properties and conversion of pine grown in agroforestry stands

Increasing volumes of fast-grown pine are being produced in agroforestry stands and fuel reduced buffers. It is desirable to continually monitor wood properties, and essential to assess sawmilling and seasoning behaviour, and graded recoveries. We have limited data at present, which come from a sawmilling study of "silviculture 70" grown pine, but a further sawmilling study is required.

5. Conversion study to compare "pedigreed" pinaster pine with general Leirian strain

Several conversion studies of the original Landes provenance and Leirian pinaster pine subsequently planted in the State have been made.

The benefits of the tree breeding program which produced the "pedigreed" pinaster pine will be confirmed by a sawmilling study when practicable.

6. Sawn graded recoveries of timber milled from pine logs from different thinning treatments

This completed study compared radiata pine given "Silviculture - 70" treatment, which involves heavy non-commercial thinning, with conventionally thinned and unthinned material. It demonstrated the advantages of the "Silviculture - 70" schedule in producing fast-grown sawlogs. A report has been prepared.

FUTURE DEVELOPMENT

Public Interest Project

The programme of research which has been approved in principle will take an extended period of time given the present limitation on funds.

The Forest Production Council has submitted a proposal through the Department of Industry, Technology and Commerce for a Research and Development Public Interest Project. They have recommended the Wood Utilization Research Centre as an appropriate body to conduct the research into the processing of "new generation" jarrah.

The value of this proposal is $4,600,000 and would enable much of the research work to be completed to the research level in four years.

Expansion Required

Silviculture/utilization of Hardwoods

Regrowth forest must be managed efficiently to increase the volume of sawlogs available by silvicultural treatment. Logging trials are essential to find a system which minimizes the cost of thinning and harvesting small diameter logs. Other Departmental staff and industry will need to be involved.

Residue research

The next stage in residue research is to test the adaptability to other industries of the wood-fired Pyrotherm gasifier as a means of producing quality charcoal.

Other Species (including exotic eucalypts)

The major research involvement is sawmilling and seasoning of regrowth jarrah, karri and marri. When that research is largely under control, trials of exotic eucalypts such as red mahogany, yellow stringybark, Tasmanian blue gum, and spotted gum can be done.

Product Development

It is likely that future development will involve the fabrication of products from relatively small components.

Marketing

Market surveys need to be expanded in all areas of utilization research in order that the projects relate to consumer demand.

The development of National and State marketing plans for the forest based industries should be promoted.

Promotion and information sheets

There is a need for printed information on various aspects of timber utilization, considering the increasing interest in this field. Topics would include seasoning, insect pests, fungal attack, preservation, specific uses, etc. Preparation of these sheets can be implemented without adversely affecting the main research programme.

Training

Following approaches by the Western Australian Timber Industry Training Committee, the facilities of WURC at Harvey will be available as a "Forest Industry Skills Centre" for training purposes. Three of the WURC group are members of a steering committee set up to supervise a trial training program at Harvey. The objectives are for training to culminate in certificate qualifications, and to improve communication.