



Utilisation of Western Queensland Hardwoods as Speciality Timbers

**A report for the RIRDC/Land & Water
Australia/FWPRDC/MDBC
Joint Venture Agroforestry Program**

Compiled by T.J. Venn,
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September 2004

RIRDC Publication No 04/130
RIRDC Project No PN99.2004

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ISBN 1 74151 038 4
ISSN 1440-6845

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Published in September 2004
Printed on environmentally friendly paper by Canprint

Foreword

While not traditionally viewed as commercial timber species, western Queensland hardwoods from managed remnant woodlands have recently found application in high-value, niche markets such as fine furniture and musical instrument manufacture. While availability, small piece size and high levels of defect will limit the potential size of the industry, the inherent beauty of the wood of several of these species will command a premium price in specialised markets.

This investigation focused on characterising the extent and distribution of the resource, harvesting costs, recoveries, seasoning methods and markets, and on defining the commercial viability of production as a component of rural industries in these regions.

This project was funded by the Natural Heritage Trust through the Forest and Wood Products Research and Development Corporation (FWPRDC), and the Joint Venture Agroforestry Program (JVAP). The JVAP is funded by three R&D Corporations — Rural Industries Research and Development Corporation, Land & Water Australia, and FWPRDC – and the Murray Darling Basin Commission. These agencies are funded principally by the Australian Government. The FWPRDC is 50% funded by industry.

This report, a new addition to RIRDC's diverse range of over 1000 research publications, forms part of our Agroforestry and Farm Forestry R&D program, which aims to integrate sustainable and productive agroforestry within Australian farming systems.

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Simon Hearn

Managing Director

Rural Industries Research and Development Corporation

Acknowledgements

The impetus for this study principally arose from Mrs Jenny Crichton, a western Queensland landholder, who initially approached the CSIRO in 1990 with a proposal to assess potential opportunities for commercial utilisation of western Queensland hardwoods. Several years later, Mrs Crichton assisted in the development of the project proposal, *Utilisation of Western Queensland Hardwoods as Specialty Timbers*, written by Mr Myron Cause, wood utilisation scientist from the Queensland Forestry Research Institute (QFRI), part of the Queensland Department of Primary Industries' Agency for Food and Fibre Sciences. From 1997 to 1999, the Queensland Department of Natural Resources and Mines, the Desert Uplands Build-up and Development Strategy Committee, and the South West Strategy Committee funded wood property (chapter 3) and market research (chapter 8), and two seminars on western hardwoods held in Charleville and Barcaldine. This initial research was largely performed by Mr Myron Cause, Mr Gary Hopewell, Ms Leanne Stephens, Ms Ellie Fairbairn and Ms Katherine Whittaker. The majority of the research published in this report has been undertaken with Natural Heritage Trust funding through the Forest and Wood Products Research and Development Corporation (FWPRDC) over the period 1999 to 2002, which has been principally managed by Mr William Leggate and Mr Robbie McGavin of QFRI.

We would like to take this opportunity to thank the Queensland Department of Primary Industries, Natural Heritage Trust, and FWPRDC for their financial support of this research. We would also like to express our appreciation of the efforts made by the project steering committee, comprising Mr Henry Hinz, Mrs Jenny Crichton, Mr Michael McKellar, Mr Dennis Fahey and Ms Ellie Fairbairn, who generously gave their time and offered advice to assist the research. The members of this committee, with the exception of Ms Fairbairn, are the founders of the Outback Timbers Utilisation Committee.

The kind support and assistance provided by the following landholders is gratefully acknowledged:

- Robert and Jenny Crichton;
- Marcus and Barb Arthur;
- Michael and Helen McKellar;
- Dennis and Jan Fahey;
- Phil and Kate McKeering;
- Bob and Leslie Marshall;
- Margaret House;
- Bill Cripps;
- Jim and Jill Taylor;
- Niki and Raymond Bolam;
- Kingsley Ward;
- Mike and Jo Wells;
- Lesley and Andy Cowper;
- Maria Forest;
- Howard and Jean Hall;
- Frank Vannie; and
- John Chandler.

The project benefited substantially from the following timber product manufacturers who readily allocated their valuable time to discussions with QFRI research personnel:

- Robert Dunlop Woodcraft –Robert and Kym Dunlop;
- F.H. Wiesner –Frank Wiesner;
- M & M Jewellery –Morrie McCarthy;
- Maton Guitars –Patrick Evans;
- Rare Woods –Chris and David Poole;
- Rings of Time –Eric Lewis;
- Rice and Sons –Len and Christine Rice;
- The Portable Sawmill Association – the late Murray Goodman;
- Proveneer –Robin Edge and Earl Murray;
- Ken Jackson –woodturner; and
- Krugers -Stuart Rodger.

The considerable input and support provided by the following researchers is also greatly appreciated:

- Matt Armstrong, QFRI;
- Ashley Cause, QFRI;
- Myron Cause, formerly QFRI;
- Terry Copley, QFRI;
- Damian Cotter, QFRI;
- Ellie Fairbairn, Queensland Department of Natural Resources and Mines (DNRM);
- Chris Fitzgerald, QFRI;
- Gary Hopewell, QFRI;
- Felix McDonald, QFRI;
- Andy McNaught, QFRI;
- Allie Muneri, QFRI;
- Jack Norton, QFRI;
- Graeme Palmer, formerly QFRI;
- Adam Redman, QFRI;
- Sandy Roberts, QFRI;
- Howard Rodgers, DNRM;
- Leanne Stephens, QFRI;
- Scott Swift, QFRI;
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Executive Summary

Traditionally viewed as an impediment to agricultural development, western Queensland hardwoods have recently found application in high-value, niche markets, including musical instrument manufacture. Many primary producers in the South West Strategy and Desert Upland regions of Queensland are seeking to diversify their grazing businesses with alternative or supplementary income streams and are keen to investigate opportunities to manage their remnant woodlands for timber production. However, there is a dearth of information about the timber resource, appropriate processing techniques, costs, markets and likely returns, which is stifling investment in this emerging rural industry. This research has aimed to remove much of the uncertainty surrounding opportunities for small-scale processing of western Queensland hardwoods. In particular, this investigation has focussed on:

- the timber resource, including its spatial distribution, estimates of merchantable wood volume and quantification of the wood properties of selected species;
- costs and recoveries of harvesting and portable sawmilling operations;
- appropriate seasoning methods and likely drying times;
- graded (saleable) product recoveries;
- potential markets for western Queensland hardwoods, including appropriate product types, quantities demanded and prices; and
- the commercial viability of western Queensland hardwood production, including a comparison with grazing.

Dozens of western Queensland hardwood species are potentially suitable for processing into products for niche markets; however, the wood property analyses and market research presented in this report has focussed on the following eleven: *Acacia aneura* (mulga); *A. cambagei* (gidgee); *A. coriacea* (desert oak); *A. excelsa* (ironwood); *A. nilotica* (prickly acacia); *A. shirleyi* (lancewood); *Archidendropsis basaltica* (red lancewood); *Corymbia similis* (Queensland yellowjacket); *Eremophila mitchellii* (sandalbox); *Eucalyptus populnea* (bimble box); and *Grevillea striata* (beefwood). Budget constraints necessitated the limitation of research into standing merchantable volumes, timber processing and commercial viability to two species only. mulga and gidgee were selected because of their wide distribution, potentially large sustainably harvestable volumes and promising timber properties.

Undertaking preliminary timber inventories and employing the most comprehensive vegetation maps available, estimates of standing timber volumes have been made for western Queensland mulga and gidgee woodlands. The estimates indicate that total merchantable (sawlog, roundwood and craftwood) volumes are low (5 m³/ha to 15 m³/ha), which reflects the poor stem form of these species and past land management practices. Wood property research confirmed that, compared with other Australian and overseas timbers, western Queensland hardwoods are unique, particularly with regard to their high air-dry densities (1,000 kg/m³ to 1,300 kg/m³) and hardnesses (14 kN to 18 kN). Many of these species are deemed legally susceptible to the lyctid borer (*Lyctus brunneus*); however, this research has indicated that, with future studies, some species could be reclassified as non-susceptible. The gluing properties of all but three species were found to be satisfactory.

Portable sawmilling studies undertaken with mulga and gidgee suggested that standing sawlog volumes (minimum small end diameter under bark of 125 mm and 1.2 m in length) are in the vicinity of 1 m³/ha in western Queensland woodlands. In this study, harvested sawlogs were generally about 2 m in length with centre diameters over bark of 20 cm. Defects, for example, caused by insect and fungal damage, were found to be common in the logs. Nevertheless, green-off-saw (GOS) recoveries of 34.6% and 27.6% were achieved from mulga and gidgee sawlogs respectively. Total variable cost of harvesting and portable milling mulga and gidgee in western Queensland is estimated to be between \$730/m³ GOS and \$980/m³ GOS, and shown to be highly sensitive to imputed labour cost and GOS

recovery. The land tenure from which logs are harvested is also demonstrated to have a large impact on total variable cost. Processing costs for mulga and gidgee were found to greatly exceed typical costs of sawing east-coast Queensland hardwoods.

The suitability of unprotected air-drying, protected air-drying, solar kiln, dehumidifier kiln and conventional kiln drying was assessed for mulga and gidgee. Solar and dehumidifier kilns seasoned 25 mm boards to 12% moisture content within four to eight weeks, while air-drying required between nine and 27 weeks. The conventional kiln generally seasoned 25 mm boards within one to two weeks. Seasoned mulga and gidgee boards were appearance graded in accordance with *AS2796 – 1999 – Timber – Hardwood - Sawn and Milled Products*, which indicated high feature grade recovery in the order of 10% of log volume. Wane, insect damage and decay were found to be primarily responsible for this low appearance grade recovery. Seasoning grading¹ indicated that unprotected air-drying resulted in higher levels of drying degrade in boards than protected air-drying, solar and dehumidifier kiln-drying. There was no appreciable difference in seasoned board quality between the latter three seasoning methods. Appearance grading of conventional kiln-dried material indicated that the drying schedules adopted could produce boards of sound appearance quality, when the thickness of those boards was not greater than 25 mm. However, high levels of drying degrade were common in boards exceeding 25 mm in thickness, indicating a need for new conventional kiln schedules to be developed for western Queensland hardwoods. A financial analysis incorporating the opportunity costs of air-drying, found air-drying to be the most economically efficient seasoning technique for mulga and gidgee in western Queensland. Where a kiln is required, for example, because product specifications require it, this study highlighted that a solar kiln is likely to be the best investment option for a landholder.

Veneer production has the potential benefit of maximising the value of a timber resource through higher appearance recovery than is possible with solid wood products. Commercial veneer manufacturers have stringent billet quality specifications and preliminary investigations have indicated that supplying western Queensland hardwood billets of such quality would be extremely difficult. A small-scale veneering trial was conducted with mulga, which resulted in the majority of veneer leaves containing unacceptable levels of defects (*e.g.* splits, grain tear, knots and decay) for standard veneer manufacture. Nevertheless, sections within the veneer leaves may be appropriate for special applications where small pieces of veneer can be utilised.

In an effort to ascertain likely markets for western Queensland hardwoods, a postal survey was sent to 225 Australian and international wood product manufacturers, and discussions were held with several current and potential consumers of western Queensland hardwoods. Currently traded volumes of sawn western Queensland hardwoods were found to be small and unlikely to be more than about 200 m³ per annum. Several reasons for the lack of uptake of these species were provided, including ignorance about the resource, the scarcity of information about their timber properties and a poor supply chain. Nevertheless, the majority of respondents expressed great interest in stocking or experimenting with western Queensland hardwoods. Parquetry flooring manufacturers, small-scale furniture manufacturers, musical instrument manufacturers and timber merchants were found to be the most likely purchasers of western Queensland hardwoods in the future. It was asserted by respondents and interviewees that dried, roughsawn western Queensland timber prices would initially be in the vicinity of \$1,500/m³ to \$3,000/m³. However, a potential opportunity for small volumes (perhaps only tens of cubic metres per annum) of the highest quality boards to be sold to domestic and international musical instrument and knife handle manufacturers at prices equivalent to between \$20,000/m³ to \$30,000/m³, was also frequently highlighted.

Feedback from domestic and international respondents to the postal survey highlighted opportunities for exporting western Queensland hardwoods, especially to North America and Europe. It was asserted that, with a well-funded, well-directed marketing campaign, the international demand for

¹ A grading technique developed by QFRI to assess drying degrade, which facilitates assessment of the suitability of different drying techniques for particular timbers.

high-quality western Queensland hardwood boards could greatly exceed the Australian market. Ringed gidgee, in particular, was believed to have high export potential. It was highlighted that ecolabelling of western Queensland hardwoods would be beneficial for marketing overseas.

Employing the portable sawmilling, seasoning, grading and market information generated by this research as base case values, financial analyses of eight small-scale western Queensland hardwood production scenarios were performed and returns compared with grazing. The net present value of clearing remnant woodland for grazing cattle in the South West Strategy and Desert Upland regions of Queensland was estimated to be in the vicinity of \$20/ha to \$40/ha. Specific scenarios that have been modelled include selling green roughsawn timber, a landholder co-operative manufacturing parquet flooring, and a scenario producing dried and dressed boards for high-value markets, including for knife handle and musical instrument manufacturers. Under base case assumptions, only the latter scenario generated returns competitive with grazing, with the net present value of managed remnant woodland estimated at between \$60/ha and \$80/ha. When small improvements in western Queensland hardwood processing efficiency over the base case are assumed, then the landholder co-operative parquet flooring scenario becomes competitive with grazing. If it is assumed that, in addition to improvement in processing efficiency, western Queensland hardwoods can be sold at a 20% price premium over the base case market price, then green roughsawn timber production was found to be competitive with grazing.

Portable sawmills have been identified as an effective method for graziers or others with limited timber industry experience, to value-add western Queensland timbers with minimal financial risk. Knowledge and experience gained throughout the project has indicated that, from the range of portable chainsaw mills, bandsaw mills and circular mills, the latter type are likely to be the most appropriate for small-scale production of western Queensland hardwoods.

It has been concluded that management of remnant western Queensland woodlands for hardwood production could potentially create a new rural industry generating substantial financial and environmental benefits. There was found to be considerable scope for future investigations into the western Queensland hardwood industry to maximise the benefits from sunk research expenditure, including a resource assessment incorporating studies on woodland regeneration and the potential for sustainable management, opportunities for agroforestry, appropriate processing techniques, markets and marketing, and a total economic valuation of the western Queensland hardwood industry.

1. The Scope of this Research on Utilisation of Western Queensland Hardwoods

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This chapter presents the background and objectives of the current research into processing opportunities for western Queensland hardwoods. Landholders have displayed considerable interest in developing businesses based on the remnant woodlands on their properties; however, uncertainty about the resource, production processes, costs and markets has stifled investment. This research investigates these key issues with the aim of reducing or eliminating this uncertainty.

1.1 Introduction

There is a substantial timber resource in western Queensland that has been traditionally viewed as an impediment to agricultural and pastoral development. These timbers have been used on-farm for purposes such as fencing and firewood; however, small volumes have been used for specialty applications (e.g. musical instrument manufacture), where high prices have been paid. It has become evident that many hardwood species of western Queensland possess unique timber properties, such as high-density, and attractive colours, grain and figure (Hall *et al.* 1972; Fairbairn 1999). Nevertheless, the scarcity of straight-boled trees, their typically small stem diameters, the prevalence of timber defects, remoteness from major markets and lack of information about the resource and potential markets, have impeded the establishment of a more substantial industry based on western Queensland hardwoods. If these timbers could be marketed effectively and sold to consumers who demand timbers with these unique properties, then market prices could be achieved that would make management of remnant stands for timber production attractive to landholders. Opportunities may subsequently arise for western Queensland landholders to diversify their incomes and establish a new rural industry. There may also be flow-on environmental benefits to the wider community as a result of reduced land clearing.

Suppliers of western Queensland hardwoods to high-value markets are often not landholders themselves, and reportedly make only small payments to landholders in return for access to timber resources. Many landholders would like to become more involved in the supply of western hardwoods and potentially obtain a greater share of the high returns that can be generated by the sale of these species into niche markets. However, the literature suggests that people are, in general, risk averse and that uncertainty about future outcomes will drive people away from potential investments. Typical of many new industries, there is a dearth of information about production costs and likely returns to processing western Queensland hardwoods. Although several enterprises currently process these species, obtaining objective and meaningful cost and revenue information is difficult. The Queensland Forestry Research Institute (QFRI) has identified demand from western Queensland landholders for an independent assessment of the commercial viability of milling western hardwood timbers in the

South West Strategy and Desert Uplands regions of western Queensland. The research presented in this volume has focussed on these regions, which are illustrated in Figure 1.1.

1.2 The Purpose of this Study

This project was conceived with the aim of empowering western Queensland landholders with information about the potential to develop an alternative income stream from the timber resources on their properties. The research is intended to remove some of the uncertainty surrounding the opportunities for processing western Queensland hardwoods and aid landholder decision-making about future management of their properties and directions for their businesses. Specifically, project objectives were to provide information about:

- the timber resource, including its spatial distribution, estimates of merchantable wood volume and quantification of the wood properties of selected species;
- costs and recoveries of harvesting and portable sawmilling operations;
- appropriate seasoning methods and schedules;
- graded (saleable) product recoveries;
- potential markets for western Queensland hardwoods, including product types, quantities demanded and prices; and
- the commercial viability of western Queensland hardwood production, including a comparison with grazing.

To make the findings of this study accessible and adoptable by landholders, all research has focussed on processing opportunities appropriate for small-scale operations. For example, harvesting and portable sawmilling trials have been undertaken with a farm truck, tractor and a portable sawmill. Seasoning trials assessed the merits of air drying versus solar kiln and dehumidifier kiln drying, the latter two being low-cost kiln drying technologies. Finally, financial assessments of potential enterprises have been made assuming two-person operations and the types of equipment utilised in QFRI's research trials.

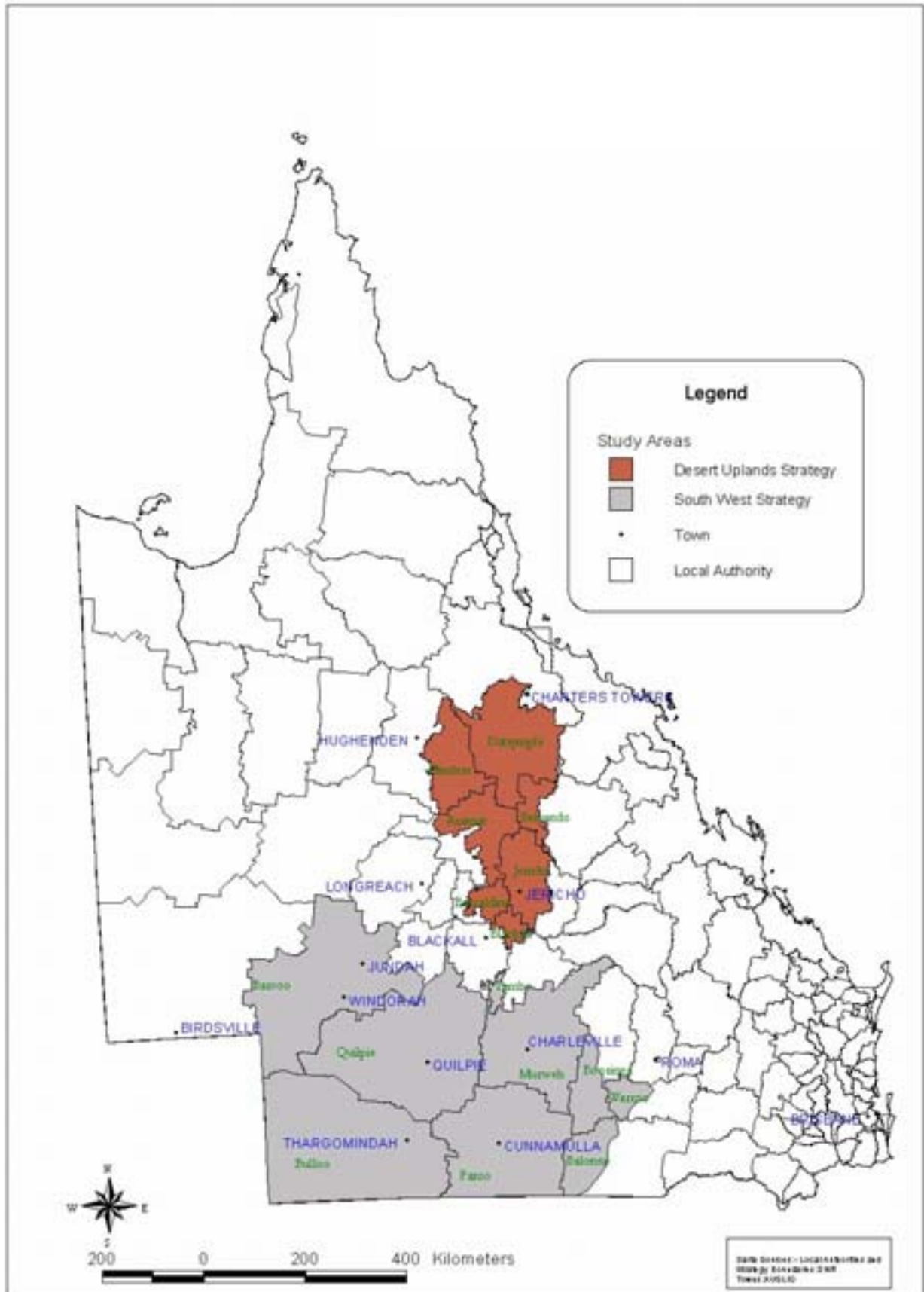


Figure 1.1 Study areas in Western Queensland

1.3 Western Queensland Hardwood Species Examined in this Study

There are dozens of hardwood species in western Queensland with timber properties potentially suitable for a range of products, including high value, specialty markets. However, budget constraints necessarily limited the focus to a manageable number of species. Information on wood properties and market opportunities has been collected for the following 11 species:

Table 1.1 Western Queensland hardwood species examined in this study. Source: Cause *et al.* (1989) and Fairbairn (1999).

Scientific name	Trade name	Local name
<i>Acacia aneura</i>	mulga	mulga
<i>Acacia cambagei</i>	gidgee	gidyea, gidya, gidga
<i>Acacia coriacea</i>	desert oak	dogwood
<i>Acacia excelsa</i>	ironwood wattle	ironwood
<i>Acacia nilotica</i>	prickly acacia	prickly acacia
<i>Acacia shirleyi</i>	lancewood	lancewood
<i>Archidendropsis basaltica</i>	red lancewood	dead-finish
<i>Corymbia similis</i>	Queensland yellowjacket	Queensland yellowjacket
<i>Eremophila mitchellii</i>	sandalbox	buddha, false sandalwood
<i>Eucalyptus populnea</i>	bimble box	bimbil box, poplar box
<i>Grevillea striata</i>	beefwood	beef oak, beef silky oak

The timber processing trials and financial analyses have been limited to mulga and gidgee, because of their wide distribution, potentially large sustainably harvestable volumes and promising timber properties.

1.4 Layout of the Report

Due to the contributions of various people throughout this study, this report has been prepared as a series of co-authored chapters. In spite of severe data limitations, Chapter 2 reviews total merchantable stand volumes, the spatial extent of mulga and gidgee in western Queensland and provides a discussion of some sustainability issues. Chapter 3 reports research into key wood properties of 11 western Queensland timber species, which has been published in Fairbairn (1999).

The outcomes of QFRI harvesting and portable sawmilling trials with mulga and gidgee, including a detailed estimation of the variable costs associated with producing green-off-saw timber, are presented in Chapter 4. In Chapter 5, the results of seasoning trials with mulga and gidgee are examined, and a financial assessment of air, solar kiln and dehumidifier kiln drying methods reported. The graded recovery² of mulga and gidgee boards milled and dried in Chapters 4 and 5 is presented in Chapter 6. Chapter 7 reports the findings of an investigation into the feasibility of producing sliced veneer from mulga.

Potential markets for western Queensland hardwoods are examined in Chapters 8 and 9. In Chapter 10, the findings of earlier chapters are employed in financial analyses of several western Queensland hardwood production scenarios. Comparisons of estimated returns are made with grazing.

² Graded to the Australian Standard AS 2796 – 1999 – Timber – Hardwood - Sawn and Milled Products.

For landholders interested in entering the western Queensland hardwood industry, factors to consider when purchasing a portable sawmill are outlined in Chapter 11. Chapter 12 reviews the findings of earlier chapters and details suggestions for future research to encourage growth of the western Queensland hardwood industry.

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