



Australian Government

**Rural Industries Research and
Development Corporation**

RIRDC Completed Projects in 2008 - 2009 and Research in Progress as at June 2009

RIRDC Publication No. 09/109

JOINT VENTURE AGROFORESTRY PROGRAM

RIRDC

Innovation for rural Australia



Australian Government

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Development Corporation**

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JOINT VENTURE AGROFORESTRY PROGRAM

October 2009
RIRDC Publication No 09/109

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ISBN 1 74151 908 X
ISSN 1440-6845

**RIRDC R&D Projects completed in 2008-09 and Research in Progress as at June 2009 – Joint Venture
Agroforestry Program**
Publication No 09/109

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Electronically published by RIRDC in October 2009
Print-on-demand by Union Offset Printing, Canberra at www.rirdc.gov.au
or phone 1300 634 313

Foreword

RIRDC produces Research in Progress summaries of continuing projects and those completed during 2008-2009. Our intention is to:

- give stakeholders early access to the results of ongoing and completed work to inform their decisions, and
- inform researchers of results to shape research directions.

The complete report on all programs is on our website at <http://www.rirdc.gov.au>

Joint Venture Agroforestry Program Research in Progress June 2009, contains short summaries of continuing projects as well as those that were completed during 2008–2009. The Joint Venture Agroforestry Program aims to build a knowledge base that underpins investment in agroforestry products and systems so that they move beyond demonstration phase to realising sufficient scale to be profitable industries. As part of this, agroforestry can deliver services and products relevant to natural resource management needs.

There are three sub-program objectives. These are:

- Identification and development of new or existing agroforestry products and services
- Developing product-market linkages
- Integration and optimisation of commercial, environmental and social factors

This report is an addition to RIRDC's diverse range of over 1900 research publications, which are available for viewing, downloading or purchasing online through our website: www.rirdc.gov.au. Purchases can also be made by phoning 1300 634 313.

Peter O'Brien
Managing Director
Rural Industries Research and Development Corporation

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1.1 JOINT VENTURE AGROFORESTRY PROGRAM – COMPLETED PROJECTS

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Develop agroforestry designs that optimize social, economic and environmental factors at the paddock, farm and regional-landscape scale

Project Title	Multi-purpose 'healthy' grazing systems using perennial shrubs
RIRDC Project No.:	PRJ-000824
Start Date:	2/14/2006
Finish Date:	1/26/2009
Researcher:	Dean Revell
Organisation:	University of Western Australia
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Objectives	<p>This project represents a broad range of activities that aim to develop profitable and sustainable integrated farming systems in the livestock-cropping zones of southern Australia. Integrated farming systems that incorporate shrubs will provide flexibility and resilience allowing producers to respond to environmental and economic drivers and manage risk in the farm business. This particular project aims to explore the use of shrubs as a feedbase for innovative and profitable grazing enterprises that are based on sound resource management principles including the management of dryland salinity soil erosion and adaptability to climate change. The particular aims of this project are to:</p> <ol style="list-style-type: none"> 1.Undertake systematic studies on existing successful perennial based grazing systems to show why these function successfully and to incorporate the findings into new system designs. 2.Model new farming systems that incorporate shrubs in different areas of the cropping-livestock zone. 3.Establish selection criteria for evaluating plants species that will form the functional building blocks of multipurpose grazing systems. 4.Screen candidate plants especially native woody perennials but also appropriate exotic plant species based on those selection criteria. 5.Test potential fodder shrub species for secondary plant compounds that (a) may provide opportunities for manipulating rumen microbial activity (eg reduce methane production) and control intestinal parasites or (b) possess antinutritional characteristics. 6.Design radically different grazing systems that (a) are built on the inherent capacity of ruminants to learn and select combinations of forages that optimise nutrient intake and avoid toxins (b) ensure persistence of the plant community and(c) improve biodiversity in the agricultural landscape and (d) ensure that the well-managed farm is economically viable. 7.Establish a pilot sites to test different configurations of candidate species. 8.Collaborate with FloraSearch projects.
Background	<p>This project represents a broad range of activities that aim to develop profitable and sustainable integrated farming systems in the livestock-cropping zones of southern Australia. Integrated farming systems that incorporate shrubs will provide flexibility and resilience allowing producers to respond to environmental and economic drivers and manage risk in the farm business. This particular project aims to explore the use of shrubs as a feedbase for innovative and profitable grazing enterprises that are based on sound resource management principles including the management of dryland salinity soil erosion and adaptability to climate change.</p>
Research	<p>We interviewed 40 producers in four States who have been using shrubs as part of their forage system, and catalogued some of their experiences, ideas and production systems. We have coupled this with whole-farm economic modelling to test a</p>

	<p>range of scenarios that impact on the optimal scale and the profitability of using forage shrubs.</p> <p>We have identified > 100 species of shrub with potential for use as part of a forage system; 50 species are well established at an evaluation site in SA (planted in 2006) and now replicated in Condobolin, NSW and Merredin, WA. We have also collaborated with nine regional groups across WA, SA, Victoria and NSW and have 15-20 species planted across a range of environments.</p> <p>We have developed a unique screening approach to assess, as widely as possible, the potential benefits that forage shrubs may provide.</p> <p>A grazing research site has been established at Badgingarra, WA, where 7 woody perennial species are on offer to livestock, together with perennial and annual pastures. Sheep selected a diverse mix of shrubs across a range of grazing pressures, and maintained weight without supplementary feeding over autumn (when liveweight loss or hand-feeding would normally be expected), as the shrubs effectively provided a 'standing supplement' within 18 months from planting. We have also investigated the influence of animal experiences on selection, and the potential for one of the shrub species to control intestinal parasites. We have shown that the dynamic between selectivity, amount eaten and production can be manipulated over time using grazing management.</p>
Outcomes	<p>A range of Australian native shrubs have fermentation characteristics (gas production, and/or VFA) comparable to a common supplementary fodder, such as oaten chaff. Within these, there were plants that had rumen-modulating properties such as reduced methane production. Plants were also identified as modifying rumen fermentation in other, beneficial ways, such as reduced protein breakdown or higher rumen pH. We have also identified that there is significant anthelmintic activity in many of the shrub species examined. This suggests that there is potential for some shrubs to provide a degree of activity against worms in grazing systems.</p> <p>The key issues that will impact on the profitable use of forage shrubs were quantified through bioeconomic modelling. We tested a range of scenarios, including commodity prices, establishment costs, shrub productivity and nutritive value, combinations of land classes (soil types), and carbon pricing. We focussed our work on the central wheatbelt MIDAS model rather than covering multiple regions. This allowed greater depth of scenario testing in the modelling given time and personnel constraints. Reliable data on shrub performance across different environments is not available, and was beyond the scope of this project. Instead, the modelling approach dealt with the broad issues relevant to the profitable use of perennial plants in grazing systems.</p>
Implications	<p>The successful use of mixed plant assemblies, including multiple shrub species and herbaceous plants should be underpinned by an understanding of grazing behaviour and the influence of management on diet selection and feed intake. Ultimately, systems will need to be designed and managed over time and space, which must take into account the dynamics between plants, animals and the environment.</p>
Publications	<p>Bennell, M., et al (in press) Selecting potential woody forage plants that contain beneficial bioactives. FAO/IAEA Special Publication. Ed. P.E. Vercoe</p> <p>Revell, D.K et al (2008) Opportunities to use secondary plant compounds to manage diet selection and gut health of grazing herbivores. Proceedings of the Int Grasslands/Int Rangelands Congress Hohhot, China, July 2008.</p> <p>Revell, D.K, et al (2008) "The in situ use of plant mixtures including native shrubs in Australian grazing systems; the potential to capitalise on plant diversity for livestock health". In: Harvesting Knowledge, Pharming Opportunities, Eds. JF Skaife and PE Vercoe (CUP, Cambridge) pp. 36-49</p> <p>Vercoe, P.E,et al. (2008) "Rumen microbial ecology: helping to change landscapes". Options Méditerranéennes, (in press)</p>

Norman H.C., et al (2008). Stable carbon isotopes accurately reveal short-term diet selection by sheep grazing mixtures of C3 annual pastures and saltbush or C4 perennial grasses. *Livestock Science* (in press).

Durmic, Z., et al (2008) "Australian native plant has a potential to protect ruminants from lactic acidosis. 6th Joint INRA-RRI Symp on Gut Microbiome, Functionality, Interaction with Host & Impact on Environment, Clermont-Ferrand, June , 2008

Hutton, P.G., et al (2008) Australian plants control induced acidosis in vitro. ". In: *Harvesting Knowledge, Pharming Opportunities*, Eds. J.F. Skaife and P.E. Vercoe (CUP, Cambridge) pp. 66-71.

Durmic, Z.,et al. (2007) Do Australian plants contain secondary compounds that can modulate rumen fermentation? *FAO 12th Seminar on Sheep and Goat Nutrition*, Thessaloniki, Oct 11-13, 2007

Revell, D.K. (2007) Self-medicating livestock, and how this relates to plant diversity for healthy animals and landscapes. *5th National Native Grasses Conference* (Mudgee, 2007) Pp. 131-137.

Project Title	Farm trees: enhancing biodiversity nature conservation and natural pest control
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000538 7/30/2002 10/24/2008 Geoff Gurr The University of Sydney (02) 6360 5551 (02) 6360 5590 ggurr@csu.edu.au
Objectives	<p>To deliver an understanding of how biodiversity of small to medium scale tree plantations may be enhanced thus increasing nature conservation value and minimising pest problems. Guidelines will be produced on reducing the requirement for use of insecticide applications in the establishment of plantations. Benefits to adjacent crop and pastures will also be quantified providing an additional incentive for landholders to adopt agroforestry.</p>
Background	<p>Shelterbelts are widely used on agricultural land in many countries to provide shelter for livestock and crops and are particularly popular in Australia for catchment hydrology management. Much research has been conducted into such aspects but there is far less information available on the role of shelterbelts in conservation of wildlife and the enhancement of biological pest control. This is important because there is increasing recognition that relying solely upon nature reserves for conserving wildlife is inadequate. Agricultural uses dominate land area so efforts to conserve biodiversity need to be directed also at privately-owned farms. This need not, as is sometimes suggested in popular media coverage, be a burden on farmers; the biodiversity can provide valuable services to agriculture including pollination, nutrient cycling and pest control. The last of these is important in crops and pastures but also for shelterbelts themselves, which are often heavily attacked by pests, especially during establishment.</p>
Research	<p>Surveys were undertaken using 62 shelterbelts in the Central West region of New South Wales, Australia. An area search technique was used for birds and an acoustic detector for the remote recording of ultra-sonic calls for bats. The potential of birds to provide pest suppression on farms was investigated by conducting faecal analyses and experiments using exclusion cages. Insects and spiders were sampled from the field and additional experiments undertaken of their impact on pests within shelterbelts and in adjacent pastures.</p>
Outcomes	<p>Shelterbelts are shown to be valuable for bird and bat wildlife including vulnerable and threatened species. Shelterbelt aspects such as woody plant diversity and density, width, height and structural complexity were amongst those associated with enhanced bird use as were sites with low elevation. For bats, diversity and structural complexity of shelterbelts and the presence of nearby water bodies were important. Parasitic wasps (important biological control agents) were favoured by groundcover vegetation and the experimental addition of flowering plants showed promise in increasing pest parasitism. This important group of biological control agents was not confined to shelterbelts but 'spilt over' into adjacent pasture land, parasitising pest eggs. Experiments with <i>Eucalyptus blakeii</i> saplings placed into shelterbelts showed that growth was greatest in sites with high woody plant diversity and this appeared to be associated with enhanced levels of biological pest suppression by both arthropods and vertebrates. Many of the birds and all of the bat species identified were insectivorous and more detailed studies of the birds' faecal samples showed that pests such as the wingless grasshopper were commonly represented. Two scholars have been trained to PhD level in the course of this</p>

project.

Implications

This body of results will help landholders, especially those considering the establishment of new shelterbelts. They can benefit from the new knowledge about issues such as where in the landscape to position shelterbelts, width and overall size, the diversity of trees and shrubs, managing the groundcover vegetation. Researchers and those involved in policy, advisory and conservation roles will be better placed to understand this potential for shelterbelts and similar form of vegetation on farms (and other locations, such as public lands and roadsides) to conserve species, many of which have far greater benefits than sheer aesthetics, they may help keep pest populations in check.

Publications

Gómez-Virués, S, Gurr, G M. Raman, A. and Nicol, H I. Effect of flowering groundcover vegetation on activity of wasps in a shelterbelt in temperate Australia. *Bio-Control* (in press).

Gómez-Virués, S, Bonifacio, R. S. Gurr, G M. Kinross, C., Raman, A. and Nicol, H I. (2007) Arthropod prey of shelterbelt-associated birds: linking faecal samples with biological control of agricultural pests. *Australian Journal of Entomology*. 46: 325-331.

Project Title	Large-scale research investments for best practice farm forestry and vegetation management
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000574 7/1/2005 12/30/2008 David Lindenmayer Australian National University (02) 6125 0654 (02) 6125 0757 david.lindenmayer@anu.edu.au
Objectives	<p>Based on 2 large-scale natural experiments established over the past decade this project aims to capitalise on past JVAP investments to generate new insights and innovations to guide and integrate best practice plantation management, best practice farm forestry and biodiversity conservation. This JVAP project is an opportunity to draw together major past and ongoing studies to rigorously tackle questions associated with the management of remnant native vegetation and its associated biota when it is embedded within a plantation landscape mosaic. The work aims to:- Investigate the contribution of plantation forestry & farm forestry to sustainable management of natural resources. Develop cost-effective multipurpose plantation and agroforestry systems to meet commercial & environmental objectives.</p>
Background	<p>Over the past 13 years, two large-scale, long-term research programs at Tumut and Nanangroe in southern New South Wales have explored a wide range of questions associated with the integration of plantation management and the conservation of biodiversity. These study areas are characterized by extensive areas of Radiata Pine (<i>Pinus radiata</i>) that surrounded patches of remnant native eucalypt forest or woodland. A budget request was made to maintain the landscape studies of plantation management, and biodiversity response. were continue to be delivered over the next 3-5 years.</p>
Research	<p>This project has been based on an over-arching synthesis of 13 years of research programs at Tumut and Nanangroe which has produced over 80 major scientific articles. The synthesis of work has been produced as a textbook that brings together the key findings and from it a suite of key management recommendations has been prepared that aim to better integrate biodiversity conservation and plantation management. In addition, a meta-analysis of plantation and biodiversity studies worldwide was completed. This compared the biodiversity of plantations with the biodiversity of pasture lands. No significant difference between the two kinds of areas was found for any group except birds. In the case of birds, species richness was greater in plantations than in pastures.</p>
Outcomes	<p>The design of plantations and the practices used to manage them can have a significant effect on their value for biodiversity. Biodiversity conservation is an important part of plantation management and should be part of the design of new plantations. Balancing conservation values with other uses, such as wood and pulp production, becomes particularly relevant when extensive areas of land are involved. Give this, a major part of this project has been to generate a list of six key recommendations for the establishment of new plantations and the management of existing plantations so that such areas better accommodate the multiple values of wood production and biodiversity conservation.</p>
Implications	<p>This project has significant implications for the way plantations are designed, established and managed. The design of plantations and the practices used to manage them can have a significant effect on their value for biodiversity. Balancing conservation values with other uses, such as wood and pulp</p>

Publications

production, becomes particularly relevant when extensive areas of land are involved. Management of plantations to incorporate other values will, in many cases, involve trade-offs that will influence wood and pulp production. The extent to which this occurs will be dependent on the objectives of plantation management, the kind of biodiversity outcomes desired, and the scale at which these objectives are being considered.

BOOK

LINDENMAYER, D.B. *Lessons from the Tumut Fragmentation Study*. (2008). Cambridge University Press, Cambridge (in press).

SCIENTIFICARTICLES

LINDENMAYER, D.B., Cunningham, R.B., McGregor, C., Crane, M., and Michael, D. (2008). The changing nature of bird populations in woodland remnants as a pine plantation emerges: results from a large-scale "natural experiment" of landscape context effects. *Ecological Monographs*, 78, 567-590.

LINDENMAYER, D.B., Fischer, J., Felton, A., Crane, M., Michael, D., MacGregor, C., Manning, A.D., Muntz, R. and Hobbs, R.J. 2008. Novel ecosystems resulting from landscape transformation create dilemmas for modern conservation practice. *Conservation Letters*, 1, 129-135.

LINDENMAYER, D.B., Wood, J.T., Cunningham, R.B., Crane, M., MacGregor, C., Michael, D., and Montague-Drake, R. Effects of a changing matrix on vertebrates: a landscape experiment (*Landscape Ecology*) (in press).

LINDENMAYER, D.B. (2008). *Forestry*. Pp. 43-49 In: LINDENMAYER, D.B., Dovers, S., Hariss Olsen and Morton, S. (Editors). *10 Commitments: Reshaping the Lucky Country's Environment*. CSIRO Publishing, Melbourne.

LINDENMAYER, D.B. *Forest wildlife management and conservation*. (New York Academy of Sciences) (in press).

Pharo, E.J., LINDENMAYER, D.B. The response of individual bryophyte species to large-scale fragmentation in temperate forests. (*Biodiversity and Conservation*). (in press).

Youngentob, K., LINDENMAYER, D.B., Held, A.A., and Jia, X. A prospective study of the effects of foliage chemistry and landscape context on the distribution and abundance of arboreal marsupials near Tumut, New South Wales. In: Series Editors: Cartwright, W., Gartner, G., Meng, L., Peterson, M.P. *The 13th Australasian Remote Sensing and Photogrammetry Conference*. Springer Verlag series in Geoinformation and Cartography (ISSN: 1863-2246). (in press).

Project Title	Improved direct seeding establishment of commercial native plants through improved germination, moisture management and weed control
RIRDC Project No.:	PRJ-000868
Start Date:	6/18/2007
Finish Date:	6/22/2009
Researcher:	Geoff Woodall
Organisation:	Future Farm Industries CRC Ltd
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Fax:	(08) 9841 2707
Email:	gwoodall@agric.wa.gov.au
Objectives	<p>This project will generate new knowledge to address current limitations of direct seeding as a reliable establishment technique. The outcome will be better regional capacity to use direct seeding for landscape scale commercial and environmental revegetation. By gaining a fundamental understanding of the seed and germination biology of the target species, along with some new technologies to enhance their establishment success, the outcomes of the seed enhancement component of this research will be the development of a national program to deliver seed based solutions to overcome seed germination barriers for a profitable and productive broad-acre agroforestry and restoration industry.</p> <p>These two linked components will ensure that JVAP's objective "to improve the field establishment and survival of direct sown commercial woody crops species" will be achieved.</p>
Background	<p>This report is about improving the practice of direct sowing Australian native plants into agricultural landscapes with a focus on potentially commercial woody species. This is important as Australia urgently requires more robust and lower cost methods of establishing woody perennials into low rainfall agricultural areas. Low cost establishment is critical to a broader national agenda to efficiently roll out perennial vegetation into an increasingly arid agricultural landscape. The scale of the perennial rollout task is enormous.</p>
Research	<p>Four Eucalyptus species were the main subjects of this study as they represent a group of plants with considerable commercial potential but that practitioners have difficulty establishing from field sown seed. Some research was also conducted on acacias and melaleucas. A series of laboratory experiments were used to investigate germination characteristics and the effectiveness of enhancement strategies. Pot trials were used to investigate general germination biology and numerous field trials were used to investigate herbicide responses, best bet treatments, and the interaction between site preparation and soil moisture.</p>
Outcomes	<p>Species demonstrated difference in their temperature optima that must be considered by practitioners, particularly when identifying target environments and sowing times.</p> <p>Depth to sow each species in soils of differing texture is critical and the plasticity of species to sowing depth is variable.</p> <p>Herbicide tolerance information of widely used chemicals is now available for E. polybractea and E. loxophleba, old man saltbush and Acacia acuminata.</p> <ul style="list-style-type: none"> • All four species were tolerant of the full gradient of Eclipse indicating that normal rates for the control of common Brassica weeds may be used with confidence. • Broadstrike was also well tolerated by all four species over a wide range, allowing for the control of many small annual weeds and suppression of Doublegee and Wireweed

Implications	<p>Insect pests present in agricultural land were shown to cause major problems to all sown species investigated. Tolerance to red legged earthmite differed between species, ranging from <i>Acacia saligna</i> (death of most seedlings) to <i>Melaleuce atroviridis</i> (no observed damage). Few practitioners have equipment capable of delivering all aspects of best practice.</p>
Publications	<p>While this project has made a significant contribution towards improving the direct sowing of mallee eucalypts, it is unlikely that these gains form a sufficient foundation on which to build a new commercial establishment system for all species and circumstances. However, a commercially robust establishment system for <i>E. occidentalis</i> will eventuate from the research.</p> <p>Nil</p>

Project Title	Improving economics of small scale farm forestry processing for grower groups
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-002671 6/2/2008 6/15/2009 Andrew Lang SMARTimbers Cooperative Ltd 03 5596 2164 andrewlang@smartimbers.com.au
Objectives	<ol style="list-style-type: none"> 1. To analyse the figures from SMARTimbers Cooperative over the last four years (particularly the Joint Venture of 2005-07), and breakdown the figures down for separate steps of the supply chain. 2. To identify the cost structure of the process, identify the profit margins for each stage, the necessary profit margins to give an adequate commercial return both for each stage and overall, and the potential profit margins at each stage and for different products and degrees of processing. 3. To follow the physical handling and processing of the timber, and to identify inefficiencies and points of loss or points of unnecessary handling and causes of lower than optimal recovery of merchantable product (including production of shorts and defect material), and identify, investigate and propose possible solutions. 4. To look at the system of labelling and identification and to propose improved systems that help reduce costs or allow better identification and tracking of part packs or oddments 5. To report on options for milling and processing, analysis of processing data, operating margins for all steps established and rated against industry norms. As an outcome of this the SMARTimbers processing will be benchmarked against the literature and industry existing practice/examples from other processing and handling/storage systems. 6. To compile a report for RIRDC, publicise these improved systems for the benefit of other farm forestry groups, and develop an adoption pathway. <p>The overall objective of this project is to develop more predictable and more positive supply chain economics for small scale farm forestry so that investors' or growers' doubts about the returns for final product are reduced as an impediment to the adoption and expansion of farm forestry</p>
Background	<p>The practical guidelines and prescriptions for how small scale grower groups might profitably value-add their parcels of farm logs till now have not been available. This project and its report aims to partly fill that gap.</p>
Research	<p>The research includes the analysis of six years of invoices for log milling and timber handling from SMARTimbers cooperative's members. The results show the points of greatest potential improvement in handling and processing efficiency for SMARTimbers members, and by extension, for any grower groups.</p>
Outcomes	<p>The research clearly shows several points that will reward improvements in efficiency and of management. Specifically, these are in milling recovery percentages, and in handling at point of machining.</p>
Implications	<p>Farm forestry involves many tangible and intangible returns and benefits. Sawlog production is only one, but it is for most growers the key source of significant cash income that rewards initial investment. The example of SMARTimbers Cooperative shows that small groups can produce positive and commercial net returns from value-adding small parcels of</p>

Publications

logs provided that other aspects of quality, marketing and supply are properly addressed. The increasing scale of farm forestry and greater output can only improve the economics of farm forestry sawlog production.

The research involved with this project will be reframed to be published in hardcopy and electronic form to be made available to farm forestry groups and policy makers.

It will expand on the information in this report, and complement the other guidelines and reports produced by SMARTimbers, and this cooperative's parent body, Central Victorian Private Forestry Development Committee, to help stimulate expanding investment in farm forestry and to give a sound and rational basis for better recognition of farm forestry in policy frameworks.

Project Title	Catchment scale evaluation of Trees Water & Salt (previously CAL-8A)
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000808 7/1/2003 12/24/2008 Richard Harper Forest Products Commission richard.harper@fpc.wa.gov.au
Objectives	<p>(1) Improvement of existing catchment models for salinity prediction and tree placement in low rainfall areas. (2) Field test the principles recommended in Trees Water and Salt (TWS) for farmland revegetation using a sub-catchment scale revegetation experiment/demonstration planting near Wickelup Western Australia. Trees were established (2000) in an 80 ha sub-catchment using these guidelines and monitoring equipment has been installed as part of NHT-FFP project Putting Trees in Their Place (NHT 983297). (3) Evaluation of the suitability of seven other revegetation experiments for strategic measurement and modelling. (4) Improve existing models and the TWS guidelines for tree placement. (5) Extend the findings to landholders extension workers and policy makers.</p>
Background	<p>Salinity threatens over 11.8 Mha of productive land and significant biodiversity in Australia, and revegetation is often advocated as a means to stabilize or reverse the problem. TWS has provided a series of guidelines for tree establishment on Australian farmland. Despite this, there is still debate about where, and in what proportion, trees should be planted on farmland. This uncertainty has affected investment in farm forestry, and the primary output of this project will be better quantification of the viability of such plantings, and therefore a reduction in the uncertainty. There are no catchment scale plantings in the drier zone of Australia and the guidelines were generalized from knowledge developed elsewhere.</p>
Research	<p>The project will involve a measurement program using established instrumentation (weir, conductivity, neutron access tubes, piezometers) and annual measurements of tree growth in existing plots. Honours level students will undertake discrete data analysis projects, such as determining tree water use of different species, determining the effects of the treatment design on catchment response to rainfall and determining the proportion of recharge reduced by the different components of the revegetated system. Data will be generalized using existing models of tree water use and water movement across landscapes in order to provide enhanced guidelines for other catchments in similar biophysical provenances.</p>
Outcomes	<p>The major outcomes of this research were:</p> <ul style="list-style-type: none"> • The project design and protocols were used as the basis for a hydrological monitoring program established for the \$64 m Australian/Western Australian Government funded Strategic Tree Farming Project. 25 sites will be instrumented by mid-2009. • Seven years after tree establishment there was no evidence that partial reforestation was affecting site hydrology, even though there was evidence that soil moisture contents had been depleted to several metres. It was thus not possible to suggest modifications to “Trees, Water and Salt”. It is recommended that monitoring continue and this also include measurements of tree/crop interactions. • Tree growth and carbon sequestration was assessed. After 7 years, biomass production and carbon sequestration ranged up to 54 t/ha and 99 t CO₂-e/ha,

<p>Implications</p>	<p>respectively, with <i>Pinus pinaster</i> in belts. <i>Eucalyptus occidentalis</i> in salinized lower slope positions achieved around 33 t/ha (61 t CO₂-e/ha), with this yield being affected by stocking and site salinity.</p> <p>The implications of this research are:</p> <ul style="list-style-type: none"> • The need for long-term hydrological monitoring systems to determine landscape level responses to reforestation. • The potential for carbon sequestration and bioenergy production from integrated plantings in lower rainfall farmland. Sequestration on saltland was greater with trees than saltbush.
<p>Publications</p>	<p>Crombie, D.S., Smettem, K.R.J. and Harper, R.J. Using agroforestry to manage salinity in south-western Australia. Western Australian Natural Resource Management Conference, Bridgetown, WA 31 March – 3 April 2008.</p> <p>Harper, R.J., Smettem, K.R.J., Townsend, P.V., Bartle, J.R and McGrath, J.F. (in review). Broad-scale restoration of landscape function with timber, carbon and water investment. In “Forest Landscape Restoration: Integrating Social and Natural Sciences”, J. Stanturf (Ed) (Springer: New York).</p> <p>Johnsen, C., George, R.J., Harper, R.J. and Bren, L. Hydrological response to partial reforestation in south-western Australia. Salinity, Water and Society – Global Issues, local action. 2nd International Salinity Forum, Adelaide, 31 March – 3 April 2008.</p> <p>Pracilio, G., Smettem, K.R.J. and Harper, R.J. (2004). New soil survey technologies to map landscape properties relevant to perennial plant performance. Salinity Solutions: Working with Science and Society Conference. 2-5 August, Bendigo, Victoria.</p> <p>Robinson, N, Harper, R.J., Smettem, K.R.J. and McGrath, J.F. (2004). Tree placement strategies for salinity control in dryland farming systems of southern Australia. 13th International Soil Conservation Organization Conference (ISCO 2004), 4 - 9 July 2004, Brisbane, Australia.</p> <p>Smettem, K.R.J. and Harper, R.J. (in press). Landuse systems with balanced water use, In “Agroforestry for Natural Resource Management”, R.F. Reid and I. Nuberg (Eds). (CSIRO Publishing: Melbourne).</p> <p>Smettem, K.R.J., Harper, R.J. and Watanabe, F. (2006). Can concepts of ecological optimality provide guidance for predicting the performance of replanted perennial vegetation in dryland areas? <i>Journal of Arid Land Studies</i> 15, 367-370.</p>

Develop products and markets including environmental services, and new agroforestry systems to meet regional NRM objectives

Project Title	FloraSearch (stage 3) - Selection and development of multi-purpose perennia
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000463 3/31/2006 1/26/2009 Mike Bennell University of Western Australia bennell.mike@saugov.sa.gov.au
Objectives	<p>The over-arching aim is to develop new commercial broad-scale woody perennial crops for the 250 - 650 mm rainfall agricultural areas of southern Australia. These crops will assist in controlling recharge associated with dryland and stream salinity provide other natural resource benefits and form the foundation of viable large-scale rural industries. The third phase will build on the findings of the first and second phases of FloraSearch. Specifically it will: - Conduct extensive germplasm collection commence domestication programs and develop agronomic practices for top ranking 'development' (see definitions in Appendix 1) species. - Prepare a refined spatial model that integrates farm economics productivity biophysical parameters and existing infrastructure to enable regional analysis of new industries based on woody crops. - Continue to evaluate species suitability in response to newly emerging or technological advances in product areas (eg perennial based grazing systems bioenergy and mineral smelting utilizing charcoal). - In conjunction with the CRC project 05-10-004 (New Industry and Marketing) identify and establish linkages to industries that can utilise the feedstock produced through these new short cycle crops. Provide updated economic evaluation and modelling of identified opportunities to build a business case of new crop and product options. - Take a lead role in the development of new collaborative projects that support and complement the aims of FloraSearch eg. the development of grazing systems based on perennial species.</p>
Background	<p>FloraSearch 3 follows a detailed species screening process and extends preliminary spatial economic models of new woody crop industries developed through the FloraSearch 1 and 2 projects. It builds on the knowledge and methodologies developed in these earlier phases to enable more rigorous evaluations of species and woody crop industry feasibility and their potential for commercial development.</p>
Research	<p>FloraSearch 3 provides a refined and detailed review of native perennial species suited for development as short-cycle woody biomass crops in dryland regions of southern Australia. It has assessed the performance and suitability of highest priority species and industries, detailed and reviewed species suited for domestication, and undertaken spatio-economic analyses for a range of woody crop industry types (including a focus on bioenergy crops).</p>
Outcomes	<ul style="list-style-type: none"> - Evaluations of the performance and suitability of range of potential woody crop species. - Identification, prioritisation and reviews of species suited for woody crop development and domestication. - Development of generalised plant improvement and breeding strategies, and includes detailed approaches for 2 high priority species (Old Man Saltbush and Koojong Wattle).

- Evaluations of key economic and production influences on industry feasibility using an oil mallee production system case study in Western Australia.
- Spatial economic evaluations of woody biomass crops for bioenergy production across the dryland regions of southern Australia.
- High spatial resolution (1 hectare) production and economic evaluations for a range of woody biomass crop options and industries for a regional case study (Upper South-East SA)

Implications

This research provides a solid base for development of several Australian species for woody crop production in the medium to lower rainfall regions of southern Australia. This work underpins species selection and domestication strategies for new crop types suited to Australia's dryland agriculture zone. The successful development of these new crop species can greatly diversify and improve agricultural landuse in many parts of southern Australia, and provide several additional natural resource management benefits.

The Regional Industry Potential Analysis methodology developed within this project has been recently adopted and modified to undertake other spatio-economic analyses for other industries and regions across Australia (e.g. JVAP Regional opportunities for agroforestry project, Polglase et al. 2008) and used to inform analyses for the Garnaut Climate Change Review (Garnaut 2008, Chapter 22 Transforming Rural Land Use).

Publications

Bartle, J., Olsen, G., Cooper, D. and Hobbs, T. (2007). Scale of biomass production from new woody crops for salinity control in dryland agriculture in Australia. *International Journal of Global Energy Issues*. 27(2): 115-137.

Bryan BA, Ward J, Hobbs T. 2008. An assessment of the economic and environmental potential of biomass production in an agricultural region. *Land Use Policy* 25(4): 533-549.

Neumann, C.R, Hobbs, T.J., McKenna, D.J., George, B., Bennell, M.R. and Kemp, O. (2009, in review). Evaluating the performance of low rainfall woody crop species. *Australian Journal of Agricultural Research*.

Project Title	Green ants as biological control agents in agroforestry
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000665 12/20/2005 5/29/2009 Keith Christian Charles Darwin University keith.christian@cdu.edu.au
Objectives	<p>The objectives of the project are to (1) investigate the role of green ants in controlling a range of insect pests in tree plantations specifically the shoot borer (2) clarify the mechanism of the ant control on the main insect pests (3) develop a cost-effective and sustainable tree-ant farming system and (4) provide recommendations for successful growth of valuable timber species within the family Meliaceae.</p>
Background	<p>African mahogany and red cedar trees are quality timber tree species that can be grown very well in many areas of Australia. Field surveys revealed that most mahoganies were heavily branched at lower levels, which would greatly reduce timber production, and growing shoots were damaged by a range of insect pests. Apart from the shoot borer, <i>Hypsipyla robusta</i>, which is recorded as a serious pest, there is little information available about insect pests and diseases on African mahoganies in Australia. It is not known whether pests are partly or fully responsible for the formation of multiple branching at lower levels, or how it might be possible to reduce the damage caused by the main pests.</p> <p>Researchers at the Charles Darwin University (CDU) have identified the green ant, <i>Oecophylla smaragdina</i>, as a powerful bio-control agent of over 50 pest species in tropical crops and trees. The CDU researchers have developed several integrated pest management (IPM) programs that use green ants as a major component to manage the insect pest assemblages of cashew and mango crops. Compared to conventional methods, the IPM programs result in higher quality fruit, lower costs of production, higher profits, the ability to produce 'organic' products, and benefits to the environment and human health. Given the feeding behaviour of insect pests in agroforestry, green ants are likely to be effective in controlling a range of pests, including the shoot borer.</p>
Research	<p>This research was conducted through field and laboratory experiments, together with field and laboratory rearing and observations, on two tree species (African mahogany and red cedar) at two locations (Northern Territory and northern Queensland). African mahoganies were investigated in the Northern Territory, while red cedar trees were studied in northern Queensland. A total of 13 field experiments and 6 laboratory experiments were done over a period of three years (2006 – 2009) at 6 sites (2 in the Northern Territory and 4 in Queensland).</p>
Outcomes	<p>A total of 19 species of pests attacked different parts of African mahogany trees. Among these pests, the fruit spotting bug, the field cricket, the shoot borer and the yellow looper were the most important, causing considerable damage to the growing shoots, resulting in the formation of multiple shoots.</p> <p>A total of 26 species of natural enemies of mahogany pests were found, and among them, the green ant was the most important species.</p> <p>Green ants were very effective in controlling a majority of mahogany insect pests, including all the main insect pests and most minor pests.</p> <p>Eighty two percent of three-year-old mahoganies developed multiple shoots at lower levels (< 2 m), and the pest damage was the most important factor, accounting for 59% of the multiple shoots. Compared to the treatment without green ants, the ant treatment produced 40% fewer pest-caused multiple shoots, which was due to the effective control of pests by green ants.</p>

Implications	<p>Based on the data collected during a period of three years with regular pest monitoring, a total of 36 clones were identified as being resistant to shoot borers. This is an unexpected result in this project.</p> <p>Although green ants were effective in controlling the shoot borer on African mahoganies, they were not effective in controlling this species on red cedars.</p> <p>The developed sustainable tree-ant farming system for African mahoganies will add 40% more value to timber grown this way in the Darwin area.</p> <p>When green ants are used to control the main insect pests in mahogany plantations, chemical spray with insecticides is no longer needed. This will significantly reduce air, soil and water pollution to the environment.</p> <p>Green ant aggressive behaviour is well known. For the initial introduction of green ant colonies, low-cost ant clothing is required. For plantation management, plantation staff, in general, do not need to have direct contact with green ants. Also, green ants have no impact on arthropod diversity and other general predators and parasitoids.</p> <p>African mahoganies are widely grown in many south-east Asian and African developing countries. In these areas, mahoganies are severely attacked by insect pests, including shoot borers. When this information is made available, it can play an important role in mahogany timber production in these countries.</p>
Publications	In Preparation.

Project Title	The bio-economic potential for agroforestry in northern cattle grazing systems
RIRDC Project No.:	PRJ-000915
Start Date:	11/30/2007
Finish Date:	7/29/2009
Researcher:	Ed Charmley
Organisation:	CSIRO
Phone:	07 4923 8174
Fax:	07 4923 8222
Email:	ed.charmley@csiro.au
Objectives	<p>This project will contribute directly to the goals of the Joint Venture Agroforestry Program through a better understanding of the bio-economic potential for agroforestry development in the low rainfall areas of central Queensland (eg 500-750 mm per annum). In particular, the project addresses a number of key long term strategies identified in the JVAP R&D Plan for 2004-2009.</p>
Background	<p>Whilst there is now a growing understanding of the bio-economic interactions driving plantation hardwoods, there is little known about the economic outcomes of establishing complementary agroforestry and silvopastoralism in northern Australia's lower rainfall zones (600-750 mm annual rainfall) including central Queensland.</p> <p>Silvopastoralism may offer landholders considerable advantages over traditional grazing systems in terms of income diversification, environmental benefits through increased woody vegetation cover and areas of stimulated versus constrained pasture growth. RIRDC commissioned this investigation to better understand whether an agro-forestry production system produces better financial and environmental outcomes than an extensive grazing system.</p>
Research	<p>The economic feasibility of six agroforestry options were evaluated using discounted cash flow analysis, regional costs and prices for both livestock and forestry products, and a purpose built bioeconomic model calibrated for central Queensland. Tree growth data investigated included the TRAPS woodland monitoring system, various plantation trials managed by QPIF and private industry, spatial tree cover and productivity indices from the National Forest Inventory and physiological growth models such as 3-PG. These data were used to derive an indicative range of possible wood yields. Pasture yields for given tree basal areas were calculated or obtained from recent agroforestry scenarios using the GRASP/AussieGRASS pasture growth models either developed for central Queensland or observed from direct grazing trials.</p> <p>The resultant measures of enterprise profitability (NPV) were used to compare the silvopastoralism options compared to extensive grazing management systems. The modelling assumed each scenario was managed to maintain or enhance land condition utilising best management grazing and silvicultural practices.</p>
Outcomes	<p>Central Queensland appears to have large areas of land suitable to agroforestry or silvopastoralism systems. Of the land identified as suitable for agroforestry purposes, 3.3 Mha was within a 50 km radius of existing timber mills.</p> <p>The decision to clear regrowth and retain timber strips as part of a silvopastoralism grazing systems would have left the grazier marginally out of pocket (-\$1701) on the eucalypt land and \$14,732 worse off on brigalow land.</p> <p>The decision to clear brigalow regrowth and plant spotted gum strips for the</p>

purposes of harvesting electrical transmission poles, whilst continuing to graze would have left the grazier \$209,087 better off than clearing all the regrowth and continuing to graze only. If the grazier had instead opted to plant spotted gum for pulp production whilst continuing to graze, the NPV would have been \$99,155. Whilst the timber pulp model provided a reasonable return to the grazier the sensitivity of the results to price and yield changes dramatically altered the outcomes and provided significant levels of down-side risk. The inclusion of potential carbon sales dramatically alters the economic consequences of retaining regrowth strips. Excluding methane emissions, the grazier would be \$84,107 or \$136,989 better off in the case of brigalow and eucalypt lands respectively by retaining regrowth strips and selling sequestered carbon when compared to conventional grazing systems. Even when methane emissions were included in the analysis, the decision to retain regrowth strips, continue to graze and sell sequestered carbon net of methane emissions left the grazier \$48,820 better off in the case of brigalow and \$112,876 better for eucalypt land.

Implications

The project addresses a number of key long term strategies identified in the JVAP R&D Plan for 2004-2009, including:

- on a regional basis assess existing and potential volume and continuity of product supply from agroforestry and farm forestry, including planning and marketing needs; and
- address landholder and investor decision making needs in developing cost-effective multi-purpose agroforestry systems to meet commercial and environmental objectives, including whole-farm economics, farm forestry design options, and decision making tools.

The results of this research will help promote greater awareness of the economic value of trees in extensively grazed landscapes in northern Australia and should assist future investment decisions by landowners.

This research provides a "proof of concept" on the economic and environmental merits of silvopastoralism in northern Australia and in particular the potential contribution silvopastoralism may be able to make in meeting Australia's carbon emission reduction targets via the CPRS.

The results of the research also suggest there is potential for silvopastoralism grazing systems to be used as a low cost land restoration tool in central Queensland. Replacing traditional grazing systems with a silvopastoralism systems incorporating retained tree strips may provide an alternative land restoration strategy for brigalow and eucalypt lands in D or C condition that has the added benefit of additional biodiversity and water quality outcomes.

Publications

Stephens ML and Stunzner A (2008). Small scale forestry management in Central Queensland, Australia: an emerging model of public-private partnerships. In: Buttoud G (ed.) Small-scale Rural Forest Use and Management: Global Policies versus Local Knowledge, IUFRO International Symposium, Gerardmer, France, 23-27 June 2008, pp. 215-222.

Stunzner AE and Stephens ML (2008). Silvopastoral potential in Central Queensland: a case of looking for the wood in the trees. In: Proceedings of the Australian Rangeland Society 15th Biennial Conference – A Climate of Change in the Rangelands, Charters Towers, 28 September - 2 October 2008, CD-Rom.

Project Title	Genetic improvement for naturally durable hardwood posts
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000799 6/1/2006 1/26/2009 David Bush CSIRO 02 6281 8323 david.bush@csiro.au
Objectives	<p>The objective is to assess the scope for creation of genetically improved varieties of two naturally-durable low rainfall eucalypts tailored to naturally-durable post production; particularly vineyard posts. Though commercially focussed, the overall drivers for this research are environmental: firstly there is a need to develop commercial products to encourage wide-scale planting of deep-rooted woody vegetation suited to Australia's sheep-wheat belt and secondly; there is a need to lessen the use of toxic materials in Australia's agriculture and horticulture industries. Substitution of copper-chrome-arsenic (CCA) posts with naturally durable ones has the potential for significant positive impacts.</p>
Background	<p>Re-establishment of deep-rooted woody vegetation in Australia's low rainfall sheep-wheat belt may afford a variety of environmental benefits including sequestration of carbon, remediation of dryland salinity and enhanced biodiversity. However for the planting to be established at the scale required to make a significant impact, production of commercial products from the plantings may be an important driver. Amongst the most prospective species for this purpose are sugar gum (<i>E. cladocalyx</i>), swamp yate (<i>E. occidentalis</i>) and spotted gums (<i>Corymbia</i> spp). Vineyard trellis posts might be produced within about 8-12 years from these species and/or be sourced from thinnings of a longer-term sawlog crop.</p> <p>The Australian vineyard industry relies on wooden posts to support vine trellises. The majority of posts used at present are CCA-treated pine and are prone to breakage from mechanical harvesters. Untreated pine is not sufficiently durable to last the 25 years in-ground that is required of a vineyard post. New vineyards and replacement of posts creates demand for approximately 5.5 million posts per year, costing over \$30 million. Naturally durable posts for other farming and horticultural enterprises (especially organic farming) would also be desirable. Clearly there is a sizeable potential market, and a significant opportunity for entry of a new, environmentally sustainable product.</p>
Research	<p>Research was undertaken on wood properties related to natural durability properties of the three species. This included assessment of heartwood proportion, extractives content and a rapid assessment of susceptibility to biodeterioration from three fungi (brown and white rots). The research was undertaken on 8-year old (post-sized) plantation-grown trees from genetics trials situated in the target planting zone for this application. The sampling strategy undertaken allowed us to determine overall fitness for the product (vine posts) and whether there is genetic variability in these traits, that would allow for progressive improvement through selection and tree breeding.</p>
Outcomes	<p>The research has shown that one of the three species tested, <i>E. cladocalyx</i>, has good potential for production of naturally durable posts. It has good overall durability, and moreover, there is significant genetic variation in all of the traits assessed. It would be possible to further improve heartwood proportion and resistance to decay through selection and tree breeding. We also found that while there is significant variation in the traits studied in the <i>Corymbia</i> species, the overall durability of young-aged material is too low to warrant further</p>

Implications

consideration for this application.

This study has identified a potential product from a key low rainfall species (*E. cladocalyx*), that can be produced within a comparatively short time frame (probably 8-12 years on typical sites). This is an important development, because while this species is likely to produce high-quality sawlogs, a disincentive to investment is the long lead-time to final harvest (probably more than 25 years). A commercial product available from thinnings earlier in the rotation would greatly improve the economics of growing *E. cladocalyx* plantations. Production of pulpwood and/or other composites from thinnings is not likely to be feasible given the high density of the wood, and high extractives content (as demonstrated here).

The move towards food production systems which are free from chemicals is an important driver for Australia's viticulture and farming sectors and desirable in export markets. Also, disposal of CCA-treated vine trellis posts is an increasing problem, especially with the trend towards mechanical harvesting that has led to higher breakage rates. The potential for naturally durable posts as replacements and for new vineyards is therefore substantial. Naturally durable *E. cladocalyx* posts may be a solution to the marketing perception, disposal and strength problems that exist with CCA-treated *P. radiata*. Though other materials such as cypress pine and non-wood alternatives (steel, concrete) exist, plantation-grown wood that also accrues environmental benefits where it is grown may be a preferred alternative.

Publications

Bush, D. and McCarthy, K. (2008) Scope for genetic improvement of natural durability in low rainfall eucalypts for vine trellis posts. RIRDC, 45pp.

Facilitate new policy and institutional arrangements that stimulate agroforestry investment

Project Title	(NHT) Prioritisation of regional opportunities for agroforestry investment
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000736 3/19/2007 12/24/2008 Philip Polglase CSIRO (02) 6281 8204 (02) 6281 8312 Philip.Polglase@csiro.au
Objectives	<p>1. Collate and integrate existing national and regional information relevant to agroforestry investments and research opportunities including spatial layers describing growth potential infrastructure and broad economics for a range of species products and markets in Australia. 2. Recommend regions of highest priority for investment in agroforestry and its industries and the points of intervention for research within a systems framework of agroforestry production and processing enterprises. 3. Work closely with collaborators (URS and FloraSearch) to maximise synergies and efficiencies in project implementation.</p>
Background	<p>Agroforestry may confer many commercial and environmental benefits. How it is implemented is often an economic exercise, modified by community attitudes and social acceptance. A major impediment to expansion of agroforestry in the marginal regions of Australia, where the net environmental benefits are likely to be greatest, has been the inability to quantify and present the economic case. Investment in agroforestry, as with any type of investment, often comes down to risk identification and management.</p> <p>There are a large number of potential agroforestry systems and many regions across Australia in which they could be established. There is therefore a strong argument that investment in R&D of these systems and underpinning market drivers needs to be well focussed to maximise the efficiency and effectiveness of funding. This research aims to synthesise spatial information on the productivity and economics of agroforestry systems in Australia and compare the outputs with market opportunities for agroforestry and inferred support from the regional NRM bodies and other groups. It targets a range of potential investors in agroforestry (private enterprise, governments and regional bodies) to help with decision making. It also aims to help identify future investment needs for research to assist the JVAP with planning.</p>
Research	<ul style="list-style-type: none"> - Assessed regional priorities for Natural Resource Management (NRM) investment in agroforestry through review of Catchment Management Authority (CMA) plans and surveys of regional Private Forest Development Committee (PFDC) and Australian Forest Growers (AFG) representatives - Developed scenarios for 10 agroforestry systems in Australia - Collated and compile an extensive data set on productivity and site conditions for agroforestry species across Australia - Used the growth data to calibrate and validate the 3-PG2 model of forest growth and carbon sequestration - Built a generic, economic model of agroforestry profitability, taking into account the opportunity costs of the agricultural enterprise - Assessed the potential impacts of agroforestry plantings on biodiversity enhancement and water interception - Combined the data within a spatially-explicit framework for interrogation and interpretation to develop recommendations on prospective regions and systems

<p>Outcomes</p>	<p>needing further investigation. This will help inform investment decisions by the JVAP and other relevant stakeholders, and</p> <ul style="list-style-type: none"> - Provided a spatial data base and framework that can be used for further scenario development and exploration of potential agroforestry opportunities with different user-defined inputs and assumptions. - Agroforestry can be competitive with agriculture in some regions and for some forestry systems - Pulpwood systems and hardwood sawlogs look promising in several regions, mainly because of the relatively short cycle time for pulpwood systems and the relatively high price for hardwood sawn timber and pulpwood products. - Transport distances and product price are important in influencing profitability. Large-scale expansion of agroforestry systems will therefore be constrained by distance to existing processing or handling facilities. - Northern Australia and the east coast show promise for expansion of agroforestry systems and industries due to the often low profitability of agriculture and potential fast rates of tree growth - Dedicated bioenergy and ITP systems are not profitable at present unless they are very close to processing facilities. This is due to the high cost of production relative to low product price for wood energy - Carbon farming looks promising due to the relatively low cost of production (no harvesting, transport) relative to a possibly high product price. This indicates that new forests can be grown in many locations and for multiple environmental outcomes. - Maximizing rates of forest growth remains one of the most important determinants of profitability and thus where agroforestry research can have high impact.
<p>Implications</p>	<p>Further investigation is needed in the following areas:</p> <ul style="list-style-type: none"> - Northern Australia. There is a paucity of growth data and in this region. Growth here may be greatly influenced by incursion of pests (such as termites, borers), diseases and fires. - Potential biodiversity plantings in south-east Qld., south-east Australia, south-west WA. These are large areas and warrant further investigation as to suitability of soils, availability of land, growth of existing vegetation and water impact issues. - Growth prediction in a changing climate. All scenarios performed used average, historical data. - Growth data and prediction for dryland species and environmental plantings, where there is currently little information. - Carbon accounting and prediction. In particular capability is needed for down-scaling of predictions to: (i) Hillslope level, for prediction across the landscape, and (ii) Annual time-steps, so that carbon can be estimated and therefore traded at relatively short intervals if required - Breeding and silviculture to maximise growth. The main factors influencing profitability of harvested systems are land value, growth rates, product price and transport costs. Maximising growth rates is thus one area where research in the biophysical sciences can make a difference.
<p>Publications</p>	<p>Nil</p>

Improve information delivery and increase decision-making capacity of all agroforestry stakeholders

Project Title	Assessing the extent ecological condition wood values and other tangible
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000570 12/1/2001 4/1/2009 John Field Australian National University 02 6125 3566 02 6249 4807 John.Field@anu.edu.au
Objectives	A methodology (toolbox) for assessing the extent nature condition and health of dry sclerophyll forests using remote sensing and GIS procedures. Conservation biodiversity and timber values are all integral to the research.
Background	There is little tangible information on these forests, how they are managed and for what. Most of them are in a poor condition ecologically and commercially but there are prospects for improvement.
Research	The research was done as coordinated series of studies, primarily by research students in the process of gaining their degrees. A variety of techniques were used, from mail surveys of owners, to field measurements of their forests, to sophisticated analysis of satellite-derived data and other spatial information. A computer based toolbox was developed to incorporate the results and provide a practical landholder based decision support tool.
Outcomes	The main outcomes of this research were 4 very successful Honours theses (all 1st class) and a PhD thesis that has been widely acclaimed. In addition the research work has been integrated into the “Dry Sclerophyll Forest Toolbox” which will assist landowners to learn more about their patch of private native forest and what might be done with it to improve its value, whether for conservation or commercial purposes.
Implications	This work will be quite important in informing all involved in the management of private forests, whether as owners or advice-providers and policy makers. For the first time they will have a tool which can provide information on forests at the farm-level. The research described here could be replicated in other regions but not simply extrapolated since many of the results are specific to the region.
Publications	Field, J.B., Turner, B.J., and McElhinny, C. 2008. A Native Dry Schlerophyll Forest Management Toolbox – what can be done and what can’t. Aust For Growers Conf., Albury, NSW, Oct. Pp 128-132 Field, J.B., Mc Elhinny, C. and Brack, C. 2008. Private native forestry, biodiversity conservation and disturbance. Australian Network for Plant Conservation 7th National Conference, Mulgoa, NSW. Apr. Pp 16 McElhinny, C., Gibbons, P. and Brack, C. 2006. An objective and quantitative methodology for constructing an index of stand structural complexity. Forest Ecology and Management 235: 54-71. McElhinny, C., Gibbons, P., Brack, C. and Bauhus, J. 2005. Forest and woodland stand structural complexity: its definition and measurement. Forest Ecology and Management 218:1-24. Roberts, S., Chartres, C., Field, J. and C. McElhinny. 2006. Private native forests, Southern Tablelands of NSW: Silvicultural treatments revisited. Proc., Aust Forest Growers Conference, Launceston, Tas. Pp. 378-383.

Turner, B., Huang, Z., Simpson, C. and Hunn, A. 2007. Remotely sensing the dry sclerophyll forests of the Southeastern Highlands. In: [ANZIF]. 2007. The 2007 Institute of Foresters of Australia and New Zealand Institute of Forestry Conference, Programme, Abstracts & Papers, Coffs Harbour, Australia. Pp 395-403.

Plus many others...

Project Title	The role, values and potential of Private Native Forestry
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-003056 4/23/2008 5/29/2009 Mark Parsons Bureau of Rural Sciences 02 6272 4034 Mark.Parsons@brs.gov.au
Objectives	<p>The key questions that the Terms of Reference require that the review address are:</p> <ul style="list-style-type: none"> • What do we know about private native forestry (including extent and history of use)? • What do private native forests provide? • What are the areas of community concern, why are they a concern, and what are potential solutions? • What is the current condition, type and quality of resource from private native forests, and the landowner intent? • What is the potential contribution of private native forestry, and value in economic, social and environmental terms, including for ecosystem services and stewardship. • What management and policy conditions are required to optimize this? • What further information and extension do we need? <p>Output is a final report 20-30 pages in length including relevant photos (minimum 300 dpi), figures and tables, proofed and submitted to RIRDC in JVAP final report template. The final report will overview existing knowledge on the role, value and potential of private native forests as outlined in the Terms of Reference, and cite relevant JVAP, BRS and other literature.</p>
Background	<p>Private native forests have been used for wood supply and other values since European settlement. They are an important resource environmentally, socially and economically, and are worth careful management, although there are strongly held and widely divergent views on how they should be managed. Although there is now adequate information on their area, there is still little information on their quality and on how they are managed.</p>
Research	<p>This report draws together information from many published and unpublished studies that provide information on the role, values and uses of Australia's private native forests. It focuses primarily on the private native forests where wood production is one of the management objectives.</p>
Outcomes	<ul style="list-style-type: none"> • Knowledge of how landowners want to use their forests is far from complete, it appears that a substantial proportion want to manage their forests to provide timber and other products and services in the long term. • Private native forests (PNFs) provide a significant proportion of Australia's native forest timber supply, but we have insufficient information to assess whether the rate of harvest is sustainable. • Assessment tools are available to develop timber resource estimates for PNFs and non-timber products and environmental attributes. • The effects of further timber harvesting, grazing and other activities on forest structure, biodiversity and habitat values will depend on the type and prior condition of the forest and the intensity of the activity. Case studies show that carefully managed timber harvesting and grazing are unlikely to be deleterious and that in many forests thinning is likely to be beneficial in the medium to long term. • Demonstrating that timber production from PNFs is sustainable may help

address political obstacles to development of markets, especially for low quality logs. Environmental certification of collectives of private native forest owners and/or of the industries dependent on them would help respond to concerns.

- Approaches to the widely different opinions about use of PNFs typically involve effectively transferring private land into the public land nature conservation system or regulating forest use. It might be more cost-effective to provide landowners with financial incentives to achieve conservation objectives. Programs that aim to do that are already offered by Australian governments.
- Education, extension and research activities would increase community acceptance of private native forestry as a sustainable and beneficial industry.

Implications

Government agencies can identify from this report those regions where there is a serious dearth of information on the sustainability of current harvesting regimes. Private Forestry Development Committees and relevant state and regional authorities can use the report to target extension activities and management tools to private native forest operators. In particular, we have identified the following:

An education program to raise awareness of the values of native vegetation and native forest is needed.

Comprehensive assessments of the environmental, grazing and timber values of private native forests are needed at a regional level.

Research is needed to assess whether the rate of harvest from private native forests is sustainable.

Assessment tools for private native forests should be actively promoted to private native forest managers, including people pursuing business opportunities for Indigenous forests.

Processes developed by Australian Forest Growers and the National Association of Forest Industries to facilitate collective private forest certification should be endorsed and promoted by the appropriate regulatory authorities.

Government programs that offer incentives for nature conservation on private land should be expanded to encourage private native forest management to achieve conservation objectives and socio-economic objectives.

Specific areas of research required include mapping and assessment of the ecological vegetation classes of private native forests; assessment of biodiversity attributes and timber resources; assessment of the financial and economic values of private native forests; assessment of alternative ways to facilitate sustainable use of private native forests; long-term monitoring of the impacts of timber harvesting, grazing and other uses.

Publications

Nil

Project Title	JVAP Highlights Report
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-004341 10/17/2008 3/31/2009 John Powell Optimal ICM 02 6226 5298 jpowell@optimalicm.net.au
Objectives	To produce a report highlighting JVAP research over the past 15 years.
Background	The report was commissioned by JVAP to increase public awareness of the role, value, and potential of farm forestry and agroforestry, and to highlight the significance of JVAP.
Research	The author produced the report through a desktop study in consultation with JVAP Research Managers, the JVAP Technical Advisory Committee (TAC), and agroforestry experts. More than 200 research reports, papers, articles and websites were reviewed. The TAC has accepted the report as an accurate assessment of JVAP's 'body of work'.
Outcomes	Over its 15-year life, JVAP has provided national leadership, funding support and coordination to build confidence in agroforestry's capacity to enhance agriculture while providing public benefits. Key messages from JVAP include: except for short-rotation pulpwood, the profitability of 'traditional' farm forestry is marginal in higher rainfall areas; in medium to low rainfall areas, 'traditional' farm forestry is for the most part unprofitable; emerging markets in carbon sequestration, bioenergy and biofuels have the potential to profoundly change the profitability of farm forestry; there are encouraging signs that the lack of early financial returns from 'traditional' farm forestry are being overcome by technologies that enable high-value products to be produced from short rotation pulpwood and pruned sawlogs; the 38M hectares of private native forests have significant potential to augment diminishing hardwood sawlog supplies from public native forests. Priority issues for a future woody crops R,D&E program are: (i) tree crops for carbon sequestration and biomass-related industries; (ii) high-value wood-based industries in the wet tropics and timber products in the dry tropics; (iii) the social trajectories and relevant knowledge, attitudes, skills, and aspirations of communities who may become involved in growing tree crops; (iv) integrating knowledge from (i), (ii) and (iii) in holistic assessments of the outcomes of industry scenarios and designs; (v) unlocking the potential of private native forests; (vi) knowledge sharing.
Implications	The report is a necessary first step in synthesising possibly 6000-10,000 pages of information down to about 90 pages, without omitting any important findings. A series of more user-friendly extension products should be produced, tailored to audiences' needs.
Publications	Powell, J.R., (2009). Fifteen years of the Joint Venture Agroforestry Program: Foundation research for Australia's tree crop revolution. RIRDC Publication No 09/xxx, RIRDC, Canberra.

Project Title	Review of JVAP 2004-09 and development of a future five year plan
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-003495 8/25/2008 4/29/2009 Mark Stickells Future Farm Industries CRC Ltd 08 6488 1429 08 9380 1140 mstickel@agric.uwa.edu.au
Objectives	<ol style="list-style-type: none"> 1. Review and report on the performance of JVAP's investment in research, development and extension for the period 2004-05 to 2008-09. 2. Assess the need for future research, development and extension initiatives in farm forestry requiring the support of a specialised farm forestry R&D program. 3. Prepare a draft 5 Year Plan for the program in line with the RIRDC template. 4. Identify possible partners and opportunities for partnering, collaborative projects and funding.
Background	<p>The JVAP has been a partnership since 1993, between the Rural Industries Research and Development Corporation (RIRDC), Land and Water Australia (LWA) and Forest and Wood Products Australia (FWPA). From 1993–2008, JVAP invested around \$29 million, and leveraged an equivalent amount from research providers and industry. The annual research budget varies with funding provided to JVAP, and ranged from \$1.2 to \$3 million.</p> <p>It is usual practice for RIRDC and the other partners to periodically review major programs in their portfolio (such as JVAP). The Review Task was conducted by a team of external consultants. There was a particular need to review the role for and research needs of agroforestry and woody crop production systems in agricultural landscapes because of the influences of climate change and government policy changes with respect to carbon and energy.</p>
Research	<p>The work plan for the Review was developed in two phases — one to evaluate performance from 2004–2009, and a second to consider the needs of a future program, in terms of both content and structure of a new program.</p> <p>The review team combined desktop analysis with formal and informal consultation with current and potential stakeholders. The formal stakeholder consultation took the form of workshops held in key locations (Brisbane, Canberra, Melbourne, Adelaide and Perth). The review team drew heavily on input from the JVAP Technical Advisory Committee.</p>
Outcomes	<p>The review team found that JVAP has been largely successful in providing national leadership, funding support and co-ordination for research (and extension) activities designed to foster investment into the planting of trees and shrubs within agricultural systems. Operational deficiencies within the Program could largely be offset by a concerted effort to synthesise and communicate the outcomes of recent research and development activities.</p> <p>The review team found a strong industry consensus that increased opportunities for woody crops on farm were likely and this would create an on-going demand for research support and flow of information.</p> <p>In order to address the underlying issues and needs of a larger and wider audience, a new program was outlined by the review team. Three separate objective strands or themes were identified to deliver these overall objectives:</p> <ol style="list-style-type: none"> 1. Grow the resource base — what species should be grown in what locations/regions, and how should plantings be managed to achieve desired goals 2. Deliver innovative production and ecosystem benefits — develop processing

and product opportunities created by the resource base, and developing means to deliver returns from novel applications of the forest resource, such as environmental services, as well as improved integration of novel applications into agricultural systems and landscapes

3. Communicate the knowledge base — to all elements of the target audience, to allow more informed planning and operational decisions at catchment, landscape and regional levels, as well as at an individual farm level. Effective dialogue is required between program management and all groups of stakeholders, in order to ensure that community values, attitudes and aspirations relating to tree crops are designed into research projects.

Implications

Based on their findings the review team recommends that a new Program be established in place of the concluding JVAP activities. It recommends that its draft five year plan forms the basis for discussion and negotiation amongst prospect funding and research partners during 2009/10 with a new five-year initiative from 2010–2015. During 2009/10 the work and achievements of the past five years should be synthesised where needed and communicated to stakeholders.

Publications

Final report and draft strategy completed

Project Title	A revised private native forestry metric to assess forest structural change
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-002688 12/5/2007 1/26/2009 Ross Peacock Macquarie University (02) 9850 8191 (02) 9850 8245 rpeacock@rna.bio.mq.edu.au
Objectives	To further develop and test a revised biodiversity metric applicable to examining the sustainability of private native forestry.
Background	<p>Biodiversity surrogates and metrics are routinely applied in natural resource management for vegetation assessments, valuing ecological resources for tendering and monitoring habitat change resulting from no management or active management such as restoration works. The majority of their development has focussed on the vegetation management context, relatively little work having been conducted to assess their utility in monitoring biodiversity and structural diversity in managed production forests. This report addresses this aspect of biodiversity surrogates and metrics by undertaking Habitat Hectares and Biometric site assessments across a chronosequence of unlogged and logged forest stands in southern Tasmania and examining trends in the surrogates and metrics over time.</p>
Research	<p>The project methods were to:</p> <ul style="list-style-type: none"> •Review current approaches to measuring and describing stand structural diversity and its summary via existing ecological measures of diversity •Undertake a stratified field survey of an existing chronosequence of silvicultural regeneration and matched mature forest in southern Tasmania, collecting the necessary field measurements required to derive the Habitat Hectares and Biometric site condition and site value scores and measures of stand structural diversity •Derive Habitat Hectares and Biometric site condition and site value scores for each sampled forest stands in the southern Tasmanian chronosequence •Derive alternate measures of stand structural diversity focusing on tree size, density and characteristics of fallen woody debris (logs) •Examine the relationship between the site condition, site value and measures of stand structural diversity to stand age since the initiation of the silvicultural regeneration. •Combine the measure(s) of stand structural diversity with the site condition and site value scores to derive a revised private native forestry metric.
Outcomes	<p>The chronosequence of silvicultural regeneration in southern Tasmania dating from the 1940s represents one of the longest chronosequences available anywhere in Australia of consistently logged and regenerated forests. It provided an excellent opportunity to test the extent to which biodiversity surrogates and metrics could summarise key changes in forest condition over time, an opportunity which has been lacking with previous attempts at relating forest management to biodiversity surrogates. Both Habitat Hectares and Biometric scores exhibited a linear relationship to age since harvesting, a trend which has not been demonstrated elsewhere in the scientific literature. Furthermore, an examination of a wide range of structural diversity indices indicated that one of the simplest to measure, the standard deviation of tree diameter, had the strongest relationship to stage age, and could be readily incorporated into a revised biodiversity metric.</p>

Implications

Biodiversity surrogates and metrics have a clear role in reporting a forest manager's performance against criteria concerned with the maintenance of productive and healthy ecosystems. As a preliminary study which utilised an existing field research infrastructure the current report has been able to test the degree to which Habitat Hectares and Biometric could summarize key structural, floristic and habitat changes which occur as a regenerating forest develops in ecological maturity. Both metrics, with minor modification, can be utilized using established field and analysis protocols to gain an understanding of the condition of a forest relative to a benchmark or reference state. This is a key requirement in many native vegetation frameworks, and increasingly is also one required of a private forest manager.

Publications

Nil

Project Title	Australian Master TreeGrower: Building capacity for integrated vegetation management on private land
RIRDC Project No.:	PRJ-000613
Start Date:	1/20/2006
Finish Date:	7/29/2009
Researcher:	Rowan Reid
Organisation:	The University of Melbourne
Phone:	(03) 9250 6827
Fax:	(03) 8344 4665
Email:	rfr@unimelb.edu.au
Objectives	Private forest management (including the commercial production of tree products and services) is an essential tool in overcoming many NRM problems related to biodiversity, salinity, nutrient loads, animal welfare, crop productivity and economic diversification. The Australian Master TreeGrower is a participatory farmer and stakeholder education and extension program that not only increases the area of forestry on private land, but also the commitment of landholders to improving forest management for both conservation and profit. This project will result in 1) a greater scale and diversity of multipurpose vegetation management activities on private land, 2) enhance integration of public and private vegetation management activities across landscapes, 3) more relevant vegetation research and development projects and more effective dissemination of results, and 4) greater recognition and support for agroforestry initiatives in regional NRM plans.
Background	The Australian Master TreeGrower Program (MTG) has delivered more than eighty 8-day MTG courses across Australia involving more than 1700 participants, 100 presenters and 30 partner organisations. During the course of this latest 3-year program the MTG has also worked with the Otway Agroforestry Network and other groups to develop and pilot the Peer Group Mentoring concept in which experienced landholders are engaged to support and assist other farmers in their agroforestry activities. In his capacity as national program coordinator, Rowan Reid has also worked with regional networks, catchment management authorities, state agencies, industry groups and others to assist them develop and deliver agroforestry and native vegetation management related policies and programs. In addition to this, the MTG has contributed to more than 100 field days, conferences and seminars, provided refresher courses and field days for past participants, and provided a telephone/email information support service for past participants and the general public.
Research	In 2007, Wayne Deans, an anthropologist, was engaged by the MTG program to undertake a thorough evaluation of the MTG program including a review of past evaluations, course participant before and after surveys, observations of program activities, discussions with partner organisation and regional program coordinators and a statistically valid telephone survey of past participants. Then, using the data gained for Dean's research, and drawing on the many independent reviews of the MTG and comments provided by past participants and others associated with the program, the MTG approach is tested against the 27 social principles of extension developed by Vanclay (2004).
Outcomes	The results demonstrate that the MTG program is very much more than a short educational course for farmers: The Australian Master TreeGrower Program is an outstanding example of an integrated extension program aimed at supporting farmer adoption of complex and multifaceted natural resource management practices. There are lessons arising from the MTG for those involved in natural resource management extension, policy and research. To support the adoption of

Implications

complex and multifaceted land management practices extension programs and activities must engage farmers, interest groups and government agencies over an extended period of time and acknowledge the contribution and interests of all those involved. In particular, the review of the MTG program highlights the importance of farmer-to-farmer communication and the development of information networks that provide a mutually respectful communication link between landholders and the researchers, policy makers, industry and government agencies that influence their land management decisions.

Agroforestry and other complex natural resource management practices require comprehensive, multifaceted and integrated extension packages that are credible to the farming community and independent of particularly industry or government agendas. The role of the university as the custodian of the program suggests that there is a role for academic educational and research organisations in the development and delivery of agricultural extension, especially when they are able to form mutually supportive partnerships with state and regional organisations.

For governments and industry seeking changes in private land management in order to achieve environmental or economic outcomes this research highlights the importance of forming constructive partnerships with other organisations and groups - even if they represent an alternative interest - and present extension programs that are primarily focused on assisting landholders achieve their own goals first. The extent to which this will lead to greater production of forest products or improved environmental outcomes will partly depend on the ability of governments and industry to facilitate or directly deliver real rewards to those who, either working alone or in partnership with others, deliver the benefits being sought.

Publications

- Reid, R. (2007) Multipurpose Tree Growing – Helping farmers do what they really want to do. Case study of a partnership between the Otway Agroforestry Network and the Australian Master TreeGrower Program. Paper presented at the Tamar Biodiversity Conference, Launceston 26 to 28 June 2007.
- Reid, R. (2008a) Tree change - The Australian Master TreeGrower phenomenon. RIRDC Publication 08/129
- Reid, R. (2008b) Farmer forestry – liking the time and realising the opportunity. Paper presented at the Australian Forest Growers Conference, Albury 2008
- Reid, R. (2009) Trees in Grazing systems. In Nuberg, I., George, B. and Reid, R. (eds) (2009) Agroforestry for natural resource management. CSIRO. pp219-238
- Reid, R. (2009) Wood as a farm product. In Nuberg, I., George, B. and Reid, R. (eds) (2009) Agroforestry for natural resource management. CSIRO. Pp143-160
- Reid, R. 2009 Growing high quality sawlogs. In Nuberg, I., George, B. and Reid, R. (eds) (2009) Agroforestry for natural resource management. CSIRO. Pp161-182
- Nuberg, I, Reid, R. And George, B 2009 Agroforestry as integrates natural resource management. In Nuberg, I., George, B. and Reid, R. Eds (2009) Agroforestry for natural resource management. CSIRO. pp1-20
- Harper, R., Smettem, Reid, R., Callister, A., McGrath, J. And Brennan, P. (2009) Pulpwood production. In Nuberg, I., George, B. and Reid, R. Eds (2009) Agroforestry for natural resource management. CSIRO. pp219-238
- Reid, R. (Unpublished) Who are the Australian Master TreeGrowers?: Guidelines for the development and delivery of regional Australian Master TreeGrower courses. <http://www.mtg.unimelb.edu.au/coordinators.htm>
- SEE PUBLICATION FOR MORE

Project Title	(NHT) Communicating sustainable forest management for the private forest
RIRDC Project No.:	PRJ-000869
Start Date:	1/31/2006
Finish Date:	1/26/2009
Researcher:	David Fisken
Organisation:	Central Victorian Farm Plantations
Phone:	(03) 5331 4589
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Email:	dfisken@netconnect.com.au
Objectives	<p>The overall aim of the project will be to provide well-organised, pro-active and targeted workshops to effectively communicate practical silvicultural and sustainability principles, including the results of recent private native forest (PNF) sustainability projects, to landholders and relevant Natural Resource Management bodies including local government and Catchment Management Authorities.</p> <p>Two-day workshops are planned for both East Gippsland and Central Victoria as these regions have the most active management of the PNF resource in the State. Workshops will utilise regionally specific existing and newly prepared forest management material as a basis for promoting the sustainability of private native forestry and will be delivered by a core team of experts. Workshops will be targeted to audience requirements.</p> <p>The project will also develop and publish a publication "Guidelines for the Management of Private Native Forest in Victoria", of similar style but expanded from the Gippsland native forest guidelines.</p>
Background	<p>The Victorian private native forest estate is of significant size and potentially able to supply a worthwhile level of timber resource to the processing industry. Many landowners lack the skills and understanding to manage their forests to improve timber production capacity, let alone preserve or enhance biodiversity and other environmental values.</p> <p>The regulatory framework applying to private native forest management is seen to be daunting, complex and expensive to engage with. Landowners, local government, CMAs and State agencies all have some difficulty dealing with PNF management issues.</p>
Research	<p>Two regional stakeholder workshops were held in 2006 in Colac and Orbost. The workshops sought to communicate practical silvicultural and sustainability principles, including the results of recent PNF sustainability projects, to landowners and relevant Natural Resource Management bodies including local government and Catchment Management Authorities. The workshops also enabled discussion of the Victorian Government Native Vegetation Framework and planning regulations as they apply to PNF management.</p> <p>Following these workshops a decision was made to revise, update and extend an existing Gippsland based landowner's guide to PNF management, to enable the publication to be of relevance to landowners across Victoria.</p>
Outcomes	<p>Workshops:</p> <ul style="list-style-type: none"> • well attended by landowners, local government officers and CMA representatives; • discussion of sustainable PNF management found considerable common ground; • landowners interested in protecting and enhancing environmental values of their forests as much as production opportunities; and • keen desire for more information on PNF management and regulations.

Implications**Landowners Guide:**

- Victoria wide publication is required;
- new regulations and concepts such as Habitat Hectares to be addressed;
- revised Code of Practice for Timber Production to be incorporated;
- issues such as carbon sequestration and water usage now of greater relevance.

Experience with this project would suggest that a better understanding of the principles of sustainable forest management and appropriate silviculture is desired by many owners of private native forest. Improved PNF management skills should lead to enhancement of the production and environmental values of these forests.

A more supportive approach to PNF management by regulatory authorities could enable landowners to justify investment in enhancing a range of forest values, with consequent wider NRM benefits and potential regional economic benefits.

Publications

Sustainably Managing Private Native Forests – a Guide for Victorian landowners

Research in Progress - 2008-2009

Develop agroforestry designs that optimize social, economic and environmental factors at the paddock, farm and regional-landscape scale

Project Title	Competitiveness of <i>Acacia saligna</i> in alleys; root morphology and physiology
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000474 7/1/2003 11/30/2009 Robert Sudmeyer The State of Western Australia represented by the Director General of Agriculture (08) 9083 1129 (08) 9083 1100 rsudmeyer@agric.wa.gov.au
Objectives	The aim of this research is to improve the knowledge base upon which scientists and land managers can draw when designing farming systems incorporating trees. Specifically this project will establish a trial site where it will be possible to test the hypothesis that acacias planted in alleys are less competitive with agricultural crops than eucalypts with similar form. Further funding will be sought after year one so that the trial site can be used to assess the relative competitiveness of <i>Acacia saligna</i> and an <i>Eucalyptus polybreactea</i> in terms of tree growth and adjacent crop growth and so by gaining an understanding of the inherent root morphology of the two tree species how this is modified by competition with annual species and how the acacia/eucalypt and crops interact in terms of nutrient and soil water balances.
Current Progress	The research site was established on Esperance Downs Research Station in 2003. The soil is 70-80 cm of sand over clay (Basic, Mesonatric, Yellow Sodosol). Survival and growth has been assessed in spring from 2004-2008, with biomass measurements taken from 2007 to 2009. In 2009, above-ground biomass was 147.2 and 48.0 dry t/ha for the acacia and mallee respectively. Neutron moisture meter access tubes were installed to 2 and 3 m in June 2006, with monthly monitoring commencing in November 2007 to Feb 2009. Soil water content was less adjacent to the acacias compared to the mallees. Tree sap flow was monitored from February 2008 to February 2009. Initially sap flow was greater in the acacias but by 2009 was similar in the acacias and mallees. Soil coring to determine root length density was done in April 2008 with 1200 samples taken. Root length density was generally greater for the mallees but differences were only statistically significant at 8 m. Barley was sown in the alleys in 2008, with yield and nutrition data collected. Crop losses were greater adjacent to the acacias reflecting the greater acacia biomass and water use compared to the mallees. The final report is in preparation.

Project Title	Hydrological impacts and productivity interactions of integrated oil- malle farming systems
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000477 3/1/2002 11/30/2009 Kim Brooksbank The State of Western Australia represented by the Director General of Agriculture kbrooksbank@agric.wa.gov.au
Objectives	This project will result in improved design management and prediction of landscape-scale impacts of integrated agricultural systems that incorporate short rotation coppicing tree species in terms of productivity expectations and salinity control in the medium to low rainfall zones.
Current Progress	Over the past six months, good progress has been made on this project, and we are on track to deliver the final report at the end of this year. The detailed hydrogeological report for Coorow is currently in draft form, and the final tree measures are being undertaken at the Gibson site during the month of May. Some IP issues were encountered regarding the parameter set for a CSIRO growth model we will be using, but this has now been resolved. The root excavation work is progressing well with all field work now completed, and results will be incorporated in the final report. This will be the first dataset on this subject to be made publicly available. There have been no issues arising over the past six months that will affect the timely completion of this project, and all stakeholders are engaged and satisfied with the rate of progress.

Project Title	Productivity of mallee agroforestry systems with various competition management regimes
RIRDC Project No.: Start Date: Finish Date: Researcher: Organisation: Phone: Fax: Email:	PRJ-000729 10/1/2005 3/17/2011 Adam Peck Department of Environment & Conservation (08) 9334 0111 (08) 9334 0367 adam.peck@dec.wa.gov.au
Objectives	<p>To measure biomass growth of unharvested oil mallees and the coppice productivity of mallees subject to four harvest regimes and root pruning. To determine the lateral extent of the competition zone adjacent to mallee belts and crop yield and estimated pasture production within the competition zone for the management regimes described in objective 1. To use these data to assess the economic returns from integrated mallee/agriculture systems with various harvest and competition management regimes. Develop robust guidelines for managing integrated mallee/agriculture systems to maximise economic returns.</p>
Current Progress	<p>We have finished the autumn 2009 coppice harvest. All sites were non-destructively measured except Johnson's and Saddler's, where only uncut control trees were measured due to very poor coppice growth and survival. Out of 19 sites, we chose 10 where coppice was sufficiently healthy to regrow and was commercially viable (5 dry tonnes/ha/year MAI). These included 3 sites in the north, 5 in the south and 2 in Esperance. The remaining 9 sites will continue to be measured and assessed for future harvests. The 3 and 4 year harvest intervals may therefore alter to become 4 and 5 year or even 5 and 6 year harvest intervals. Although this will make comparisons between sites more problematic it reflects the fact that plantings vary greatly in productivity and hence harvest frequency.</p> <p>The MAI of harvested sites ranged from 5.5 to 31 dry tonnes/ha/year. The regression equations are very accurate for most sites. Some regressions will however need to be recalibrated to more accurately predict biomass, since for larger coppice the estimates are far too high.</p> <p>Fencing the remaining unfenced sites is a priority to avoid grazing. I am trying to get this completed by the end of June 2009.</p>

JOINT VENTURE AGROFORESTRY PROGRAM

RIRDC Publication No. 09/109

The Joint Venture Agroforestry Program aims to build a knowledge base that underpins investment in agroforestry products and systems so that they move beyond demonstration phase to realising sufficient scale to be profitable industries. As part of this, agroforestry can deliver services and products relevant to natural resource management needs.

There are three sub-program objectives. These are:

- Identification and development of new or existing agroforestry products and services
- Developing product-market linkages

- Integration and optimisation of commercial, environmental and social factors.

The Rural Industries Research and Development Corporation (RIRDC) manages and funds priority research and translates results into practical outcomes for industry.

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