An Australian Government Initiative



Joint Venture Agroforestry Program
R & D Plan
2004-2009

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Foreword

This is the second Research and Development Plan for the Joint Venture Agroforestry Program (JVAP). The JVAP is a partnership between Rural Industries Research and Development Corporation (RIRDC), Land & Water Australia, and Forest and Wood Products Research and Development Corporation. Additional funding has been provided for some activities by the Murray-Darling Basin Commission, the Grains R&D Corporation, the Department of Agriculture, Fisheries and Forestry, the Natural Heritage Trust and the Department of Environment and Heritage Australian Greenhouse Office. The JVAP also jointly funds some collaborative projects with CSIRO, the CRC for Plant-Based Management of Dryland Salinity, Greening Australia and Meat and Livestock Australia. RIRDC is the managing agent for JVAP.

The Plan has been prepared by the JVAP Management Committee. It builds on the strengths of the collaborative model developed under phase 1 and recognises the ongoing challenges facing the sector in meeting multiple needs. To date the Program has been successful with high recognition and support within the sector and natural resource management stakeholders.

In formulating the Plan we have drawn from the:

- review of priorities by Agtrans Research and Farm Tree Systems
- extensive consultation with tree growers, private forestry development committee representatives, land managers, farmer representative groups, researchers and government agencies undertaken by the Program managers and the Agtrans review
- consultations with JVAP partners and other agencies to determine their research priorities and to identify distinct roles and areas for collaboration.

The previous Agroforestry & Farm Forestry Plan had a strong focus on recognising the impediments to adoption of farm forestry and agroforestry, development of commercial species for agroforestry products in low rainfall areas, assessing the contribution of farm forestry to sustainable agricultural systems, and development of design principles for multipurpose agroforestry to meet commercial and environmental objectives, including biodiversity, salinity and other considerations. This new Plan has an increased emphasis on evaluation of agroforestry from a products, value-chain and market perspective, and providing the information that decision-makers need to consider and adopt agroforestry. The Plan continues research on integrated agriculture-forestry systems, with a commercial focus and including the quantification of environmental services. An integral part of the Plan is recognition of the dual roles of agroforestry and farm forestry – development of an industry, and integration of trees within farms and catchments to bring improved natural resource management through delivery of environmental services.

The Plan is for all stakeholders in the agroforestry industry and Australian government. This includes both traditional tree crop industries, and new ventures which plant woody perennials to achieve commercial, social and environmental benefits. The R&D outcomes are intended to feed into farm management practices and policy development by government. The Program complements the substantive support for farm forestry developed within the respective agencies and works closely with grower groups.

The Plan will be used by JVAP to guide the ongoing R&D investments that are made. The Plan will be implemented in accordance with the provisions of the *Primary Industries and Energy Research and Development Act* 1989.

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Joint Venture Agroforestry Program

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1. Purpose of the Plan

This Plan will guide R&D investment by the Joint Venture Agroforestry Program (JVAP) for the period 2004-2009. The core partners are Rural Industries Research and Development Corporation (RIRDC), Land & Water Australia, and Forest and Wood Products Research and Development Corporation (FWPRDC).

The Plan seeks to encourage collaboration on, and coordination of, agroforestry R&D between farmer organisations, wood and other forest product processing industries, the JVAP, R&D Corporations and various research agencies, government departments determining policy, community organisations, and others involved in the uptake of agroforestry research.

The goal is 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.

The Plan sets out the objectives of the R&D, and strategies to achieve these objectives. The strategies provide a guide for research proposals to the Program. Proposals for other activities will need to make a strong case for consideration by the R&D Management Committee.

Performance indicators are selected to assist monitoring of the projects and ensure the program remains focused and relevant. The Plan will be reviewed informally each year to ensure that the objectives and strategies are still the most appropriate for achieving the vision for the development of viable industries incorporating agroforestry.

2. Background to the Joint Venture Agroforestry Program

The JVAP was established in 1993. It is an investment partnership by three R&D corporations: Rural Industries R& D Corporation (RIRDC), Land & Water Australia, and Forest and Wood Products R&D Corporation. Substantial funding has been provided by the Murray-Darling Basin Commission, the Grains R&D Corporation, the Department of Agriculture, Fisheries and Forestry, the Natural Heritage Trust and the Department of Environment and Heritage Australian Greenhouse Office. JVAP also jointly funds some collaborative projects with CSIRO, the CRC for Plant-Based Management of Dryland Salinity, Greening Australia, and Meat and Livestock Australia. RIRDC is the managing agent for JVAP.

Agroforestry has two key aspects: development of new commercial industries, and integration of trees in agricultural landscapes in commercial and semi-commercial configurations to achieve natural resource management benefits. The joint venture approach ensures that outcomes from agroforestry R&D expenditure are balanced amongst these benefits by focussing resources on an agreed set of priorities.

In the past twelve years, JVAP has provided approximately $23 million towards farm forestry and agroforestry R&D, with a similar leverage from industry and research partners. The JVAP invested $2.2 million per year on average in agroforestry R&D over the three years 2001/02-2003/04.

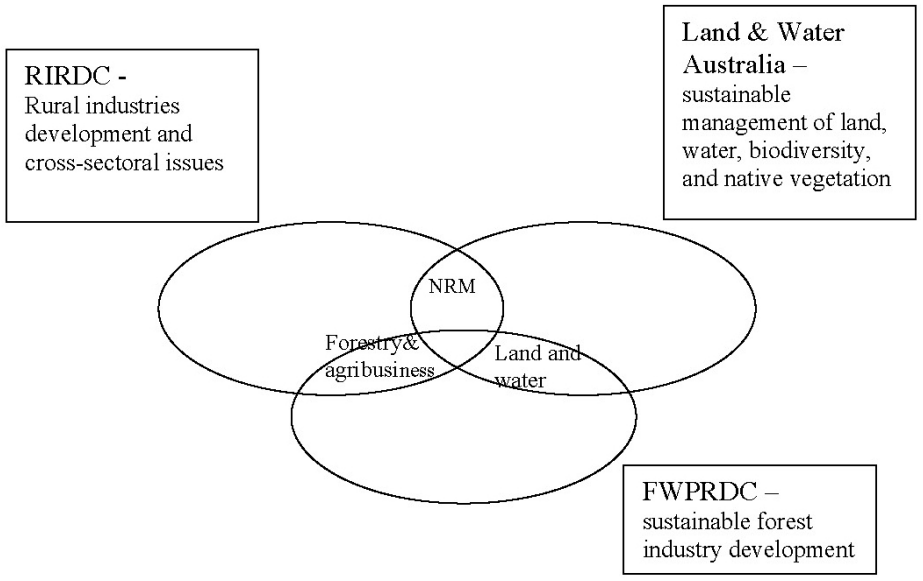


Figure 1. JVAP partners and their interests.

Guiding Objective

To provide knowledge to underpin profitable, sustainable and resilient agroforestry within Australian farming systems and landscapes.

The role of the JVAP

The key roles for JVAP, together with an indicative budget allocation are:

1. Investing in **research and development** to build a knowledge base that underpins the development of agroforestry industries (75%)
2. Improving the overall **coordination of agroforestry research** in Australia (10%)
3. Improving **information delivery** to increase decision-making capacity of all agroforestry stakeholders (15%)

The national coordination and information delivery roles are important complements to the R&D. JVAP aims to strengthen its national coordination role in agroforestry R&D, to improve awareness of relevant research and outcomes between partner agencies and others and to promote collaboration, where appropriate. JVAP outputs may be used by industry and regional bodies, Australian Forest Growers, Greening Australia, National Farmers Federation, government policy and others interested in developing this sector.

3. Products and industry development

Trees and other woody perennials can provide six main product streams and services: wood and fibre, eucalyptus oil and oil products, other extractives, energy, environmental services and carbon sequestration, and food and fodder (Box 1). The range of products and services have different relevance for different regions.

In high rainfall zones, there has been a significant expansion in plantations and farm forestry (for wood and fibre products) over the past ten years in Australia, with a substantial increase in the area of small grower plantations (Stephens 2001) (Figure 2). Small grower plantations (where the farmers own the trees and the land) total more than 67,000 hectares representing 5 per cent of Australia's plantation resource of 1.485 million hectares (as at September 2000) and are owned by an estimated 13,400 landholders. An additional 4,200 landowners are involved in farm forestry through joint venture and leasehold schemes with industrial, corporate or government growers. More than 50% of the farm forestry is blue gum (*Eucalyptus globulus*) planted for woodchip (refer Box 1). There is also evidence of an increase in the active management of privately owned native forests for commercial forest products and environmental services (Parsons 1999).

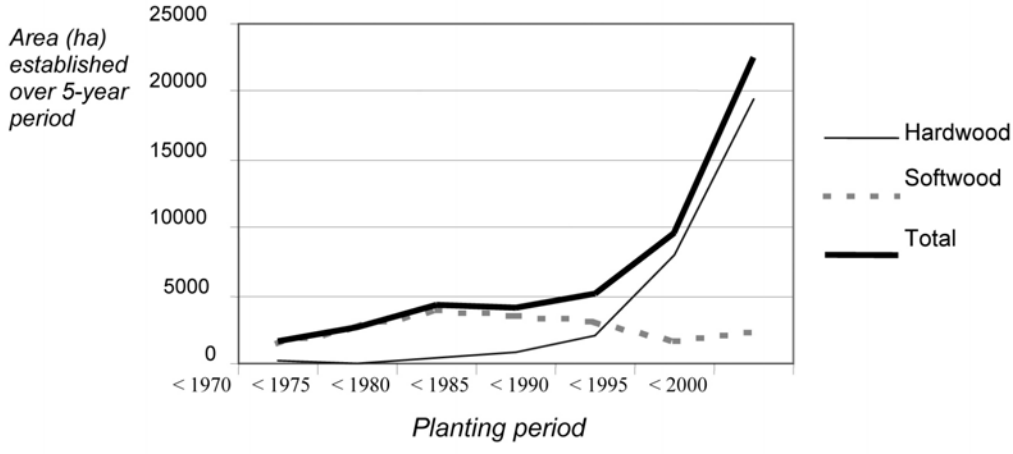


Figure 2: The increase in the area of independently owned small-grower plantation in Australia.

Source: Reid and Stephens (2006) modified from Stephens (2001).

Agroforestry has the potential to provide both public and private benefits (Appendix 1). The importance of its public benefits, especially from natural resource management, are recognised in Australian government policy (Appendix 2). Responsibility for planning and implementing regional natural resource management (NRM) now rests with regional NRM bodies, whose plans are accredited by the Australian Government and respective State/Territory Governments, leading to investment (funding) for these regions. Importantly, the Program has provided the NRM sector with confidence in the role of farm forestry and significantly influenced and informed the scope for plantings for a range of benefits. This is reflected in major demand in regional NRM plans, and the adaptation of technology to meet innovative needs.

There are three key factors which influence agroforestry's effectiveness for achieving natural resource management benefits:

- Production systems are not mutually exclusive – farmers often plant trees and woody perennials for a combination of reasons. All of the above products can contribute to overall farm profitability, as well as catchment health and the condition of local and regional natural resources.

- Scale is important. While small-scale planting can achieve on-farm natural resource management (NRM) benefits, larger-scale planting is required to achieve regional NRM targets such as lowering of water tables and reduction in dryland salinity. Products such as biomass, composites and extractives produced in low rainfall areas can support the development of a commodity-based large-scale industry with commensurate scale of harvesting and processing.

- Agroforestry systems need careful design and integration into the farming enterprise to optimise the commercial and environmental benefits. Depending on the scale and configuration of plantings and their position in the landscape, stands of trees can help in salinity management, or conversely cause undesirable reductions in streamflow. Trees can also be sited to protect livestock and crops from wind, buffer remnant vegetation and provide wildlife corridors. Therefore position in the landscape and planting design within farming systems are important.

These same factors influence the development of agroforestry industries, and necessitate R&D to provide clear economic and investment signals, and land management guidelines.

Uptake of agroforestry is likely to be affected by prices of competing commodities. For example, as world oil prices rise, bioenergy options become a more realistic alternative. Other factors that affect agroforestry industry development include domestic and international sawlog and woodchip prices and a lack of effective agroforestry product supply and marketing. R&D cannot readily influence trade

prices, but it can provide tools and techniques to allow industry to respond to opportunities.

Agroforestry provides the opportunity to address natural resource management issues and create commercial returns on a wide range of landscapes. This diversity is also one of the challenges for large-scale industry development. The scope for development in some regions will be affected by policy and markets.

Development of agroforestry needs champions and leadership in industry and government. Agroforestry and NRM are both long term commitments, therefore sustained investment and supportive institutional arrangements are needed. For example, previous horticultural and forestry tree crops (e.g. *Pinus radiata*) have taken years of investment to select appropriate genetic stock and develop commercial systems of silvicultural management. Partnerships between industry and natural resource management (NRM) will be important to ensure that this happens. JVAP will encourage industry investments within JVAP projects.

Box 1. Products and services from agroforestry.

- **Wood and fibre products** – such as sawlogs, posts, poles, pulpwood, veneer and composite products. Trees are grown on-farm in:
    - Woodlots and plantations, or
    - Shelterbelts to protect crops and livestock and improve yields, with the option to harvest the tree products.
- **Oil and oil products** – *Eucalyptus* oil is currently used for pharmaceutical products. JVAP research over the past ten years has developed new short rotation systems, to produce *Eucalyptus* oil along with other products and services. These short rotation systems are:
    - fast-grown woody perennials such as oil mallee, grown in alley belts or blocks and harvested at 3-5 years age, using a coppice system for production of combinations of eucalyptus oil, biomass, activated carbon or charcoal;
    - phase farming of trees over several years, alternated with traditional agricultural farming. In this system, trees are used to periodically lower water tables in regions prone to dryland salinity, thereby allowing continued agriculture in the subsequent phase. Ideally, the trees also produce a commodity.
- **Extractives –** *Eucalyptus* oil, lignin and other tree components can be converted to secondary products, such as anti-foulants and degreasers, for industrial purposes. We do not yet have identified markets for secondary products in Australia. Current possibilities being examined are the conversion of 1,8-cineole into secondary products for industrial application; extraction and use of sideroxylonal for industrial applications; conversion of lignin (a component of woody tissue) for use in large-scale industrial products; and biomass conversion for energy and liquid fuels. Developing commercially feasible extraction techniques for secondary products is also part of this research.
- **Energy –** Biomass from trees can be converted to energy. Trees are grown in woodlots, plantations or alley belts.
- **Environmental services and carbon –** Woody perennials are integrated into the farming system for provision of ecosystem services including carbon sequestration and improved farm sustainability. Forest stands or woodlands are retained or planted for:
    - carbon sequestration
    - reduction or prevention of soil and water erosion
    - reduction or prevention of dryland salinity
    - shade and shelter
    - habitat for the predators of insect pests
    - biodiversity
    - visual amenity and enjoyment.
- **Woody perennials as food and fodder -** integrated into the farming system for selective harvest, improved farm sustainability, and provision of environmental services. Examples include:
    - fodder crops managed together with pasture for livestock production
    - bush food production.

4. Research Directions

The development of viable and resilient agroforestry options requires innovation through strategic R&D. The dual roles (NRM and industry development) and the existing and potential geographic spread of agroforestry and farm forestry in Australia mean that agroforestry has broad R&D needs, that are separate from traditional forest industry development. As discussed previously, achieving successful multiple use outcomes can depend on the scale of operation, and in some cases there may be long delays between planting trees and reaping the commercial and natural resource benefits.

JVAP's R&D achievements

Over the past twelve years, JVAP has funded a wide range of research, including tree improvement, biodiversity assessment, testing and evaluation of plantation-grown wood, new products from native species, and evaluating the role of trees in lowering water tables to reduce the effects of dryland salinity. Some key research achievements are shown in Box 2.

JVAP's research has been undertaken in all States and territories of Australia and represents most agricultural zones with more than 600 mm rainfall per year (sometimes as low as 250 mm).

JVAP research has produced over 160 research reports and agroforestry guidelines, which are available in hard copy and via the RIRDC web site. In addition, summaries are available in the Short Report and Research Update series. JVAP material is used in determining government policy, and by farm forestry advisors, researchers, universities and the Master TreeGrowers training courses, among others.

RIRDC has recently undertaken a triple bottom line evaluation of projects in the Agroforestry and Farm Forestry Program. Many projects related to agroforestry are difficult to evaluate or are undervalued because they require an estimation of the value of non-market benefits. Nevertheless, the recent analysis estimated internal rates of return ranging between 11 and 24 percent per project (Bauer and Gordon 2003).

On a more qualitative basis it can be argued that the successful integration of agroforestry into Australian farming systems can deliver large public and private benefits, and this is relected in NRM regional plans and state farm forestry strategies. However there remain significant knowledge and public perception gaps that could impede the realisation of these benefits (Appendix 3).

Investment in the JVAP's integrated set of R&D priorities will address some of these gaps and therefore has the potential to realise a substantial positive benefit:cost ratio.

Setting Future Priorities

In early 2002, the Centre for International Economics evaluated RIRDC's Agroforestry and Farm Forestry Program R&D portfolio from 1990 to early 2002 (including JVAP) and its expected impact (Bauer et al. 2003). The evaluation broadly characterised the spread of projects by research stage and industry investment.

Broadly, funding allocation to research stage was (Bauer and Gordon 2003):

- 43% on the investigation stage of R&D (basic or fundamental research),
- 31% applied R&D, and
- 26% on industry development (through communication, extension of information and innovations to potential users).

Funding allocation per stage of industry investment was:

- 81% on evaluation of sustainable development and industry competitiveness
- 4% on R&D for markets and processing
- 15% directly on communication, technology transfer and industry training and development (however components of communication and technology transfer were part of projects in other categories).

At the end of the Five Year Plan 1999-2004, a review of R&D priorities was conducted.

R&D needs for agroforestry and priorities for JVAP were evaluated in 2003 by Agtrans Research and Farm Tree Systems (2003). The review included extensive consultation with tree growers, farmer representative groups, private forestry development committee representatives, land managers, researchers and government agencies. Key issues identified were: 1) demonstrating commercial options for agroforestry through analysis and design; 2) ensuring ecosystem services are quantified and appropriately valued; 3) improving product-market linkages; 4) facilitating new policy and institutional arrangements to stimulate agroforestry investment; and 5) improving information delivery to increase decision-making capacity of all agroforestry stakeholders. Further information is in Appendix 3.

The view was that research now needs to focus on achieving commercial industries and targeted environmental outcomes, through providing the tools and techniques to engage investors, rural advisors and regional NRM groups.

Box 2. The Joint Venture Agroforestry Program – key R&D achievements

- **Early investment in blue gum** (*Eucalyptus globulus*) research by JVAP contributed to industry uptake – there has been a significant expansion in blue gum plantations in Australia; managed investment scheme companies raised over $750 million in 2004-2005, mostly for blue gum establishment.
- **Oil Mallee** – A JVAP scoping study and subsequent R&D funds, led to substantial investment by Western Power in building the pilot Integrated Wood Processing plant at Narrogin in the Western Australian wheatbelt. The pilot plant will test integrated production of energy, eucalyptus oil and activated carbon using biomass from purpose-grown mallees – of which more than 10,000 ha have been established in the wheatbelt in configurations that also help to halt the rise of highly saline groundwater. A successful plant of this type will generate regional power supply and new sources of revenue and employment for the region.
- **JVAP contributed to early carbon accounting research** –international markets plus the establishment of a carbon market in 2004 in New South Wales have resulted in contracts for significant plantations for carbon sequestration.
- Early work on **markets for ecosystem services** contributed to establishment of pilot markets for environmental services in Victoria and New South Wales, and a national Market Based Instruments research program.
- The **catchment characterisation** framework developed within JVAP has been adopted by Murray-Darling Basin Commission for prioritising saline catchments.
- The **National Windbreaks Program** has provided a predictive capability for farmers to determine the impacts of windbreaks on crop, pasture and animal productivity. It was by far the most comprehensive study of windbreaks undertaken in the world.
- **Phase farming and alley belts** - Design of new options for managing groundwater in saline catchments while underpinning an expansion of commercial farm forestry. Currently over 10,000 hectares of mallees are planted in Western Australia in alley belt systems integrated with existing agriculture.
- **Design principles for agroforestry** – JVAP has produced four agroforestry design guidelines to assist landholders and extension workers with the principles for agroforestry design, including use of trees for shelter, biodiversity and the placement of trees in the landscape to manage groundwater. These guidelines are used by the Master TreeGrowers program and other advisory networks, and as a text in agroforestry courses at universities and other educational institutions.
- The **Master TreeGrower Program**, funded by JVAP for eight years, has held 63 courses across all states, involving 1240 participants and over 30 participant organisations. The program uses participatory learning to work with landholders to identify farm problems and incorporate farm forestry to solve them. It trains leading farmers who can act as regional knowledge brokers for new entrants to farm forestry.

- **Fodder investment** – early scoping projects funded by JVAP have now been expanded through a collaborative project with funds contributed by Meat and Livestock Australia, Australian Wool Innovation, the Cooperative Research Centre for Plant-based Management of Dryland Salinity and JVAP to explore the use of shrubs for innovative and profitable grazing enterprises.
- The **FloraSearch project** has evaluated 140 Australian native woody perennial species from southeastern Australia for product potential and suitability for commercial development in low to medium rainfall zones. A shortlist of target species is now under more detailed evaluation.
- **Trees, Water and Salt** – Salinity of soil and water and waterlogging are severe problems for Australia. JVAP research has been significant in understanding the relationships between planting designs and locations of trees, hydrology and salinity. This work resulted in guidelines for land managers to plant trees located where they will address salinity and hydrological problems but will also contribute most to farm income.

Table 1. Internal Rate of Return on key JVAP research project clusters (at 5% discount rate; Source: Bauer et al. 2003)

Research project cluster	Total net present value ($M)	NBIR	IRR (%)
Agroforestry and catchment hydrology	4.1	2.4	21
Subtropical and tropical cabinet timbers	10.5	8.4	10.6
Master TreeGrower	17.2	11.0	15
Site and species suitability	70.7	26.2	23.6

NBIR – net benefit investment ratio
IRR – internal rate of return

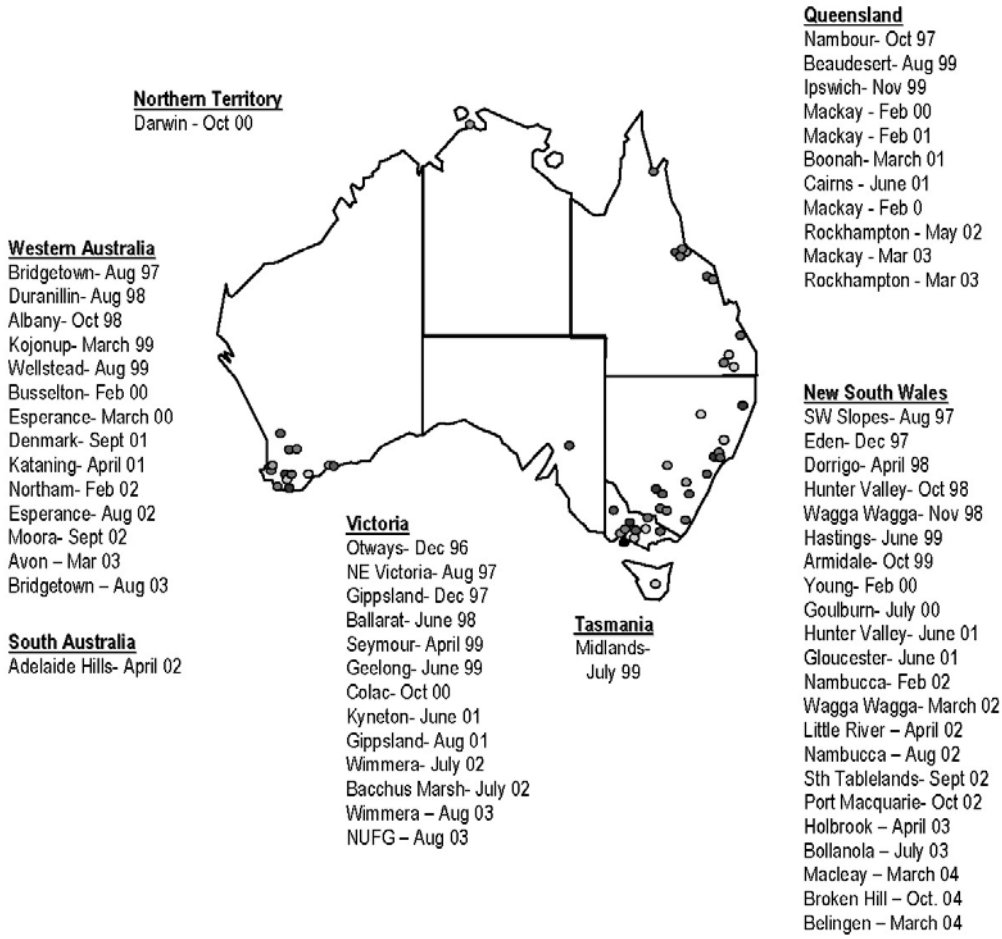


Figure 3. Location of Master TreeGrower course locations from 1996 to 2004.

Source: Reid and Stephen (2006)

5. The Research and Development Program

This 5 year Plan was developed based on a review of R&D priorities and research gaps (Agtrans Research and Farm Tree Systems 2003) and consultation with JVAP partners. This Plan has an increased emphasis on identifying the most prospective products and systems, marketing and supply issues, quantification of ecosystem services and analysis to inform decisions by landholders, managers and investors. It seeks to define regional products and regional investment priorities, and provides a research framework for new product options and agroforestry systems. In projects investigating new product development or agroforestry system design, JVAP will encourage a stronger emphasis on vertical integration or value-chain analysis.

There are three objectives for R&D investment. The objectives are:

1. **Identification and development of new or existing agroforestry products and services –** develop new commercial products and value-add existing products to promote profitable agroforestry industries

2. **Developing product-market linkages** – Analyse markets for product suitability, value and regional development options

3. **Integration** and optimisation of commercial, environmental and social factors:
    a. Design – Develop and improve agroforestry designs to optimise social, economic and environmental factors at the paddock, farm and regional-landscape scale
    b. Environmental services – Demonstrate mechanisms for valuation and trading of environmental services provided by agroforestry (including private native forestry and farm forestry) and their impacts.
    c. Policy and institutional – Investigate new policy and institutional arrangements that stimulate agroforestry investment

To achieve effective research investment and promote a strong research and development capacity the JVAP will pursue the following strategies:

- use of competitive bidding, open tenders and commissioning to provide a balanced portfolio of short and long term projects
- projects selected based on merit and relevance to R&D strategies
- encourage the development of multidisciplinary projects
- promotion of economies of scale
- co-financing of multidisciplinary projects
- encourage links with forest growers and catchment management groups
- partner with government and agribusiness
- engage with key regional stakeholders
- manage knowledge for adoption

Objective One – Products

Objective

Identification and development of new or existing agroforestry products and services – develop new commercial products and value-add existing products to promote profitable agroforestry industries

Background

Agroforestry can provide multiple products and services: energy, wood and fibre, eucalyptus oil and oil products, other extractives, environmental (ecosystem) services and carbon sequestration, and food and fodder. Investment in agroforestry will be encouraged where production, harvesting and processing are demonstrated to be efficient and commercial, and products are targeted to markets. Objective Two will provide feedback on markets and opportunities for value-adding and product improvement. Objective One will address product quality and volume, and required changes in technology or production efficiencies. That is, growers and processors need to plan and manage their resource to achieve a product which matches market needs and meets farm goals. As well, new products and production systems are needed to promote investment in agroforestry in low to medium rainfall zones. Agroforestry can also be integrated into agricultural systems to provide environmental services – to facilitate markets in this area, ecosystem services must be appropriately quantified, valued and monitored.

Strategies

- Identify value-adding methods and improved production and harvest efficiencies for existing products, to promote investment in commercial agroforestry ventures
- Identify new products from woody perennials, particularly for broadscale planting in low to medium rainfall zones to address dryland salinity and manage landscape hydrology
- Demonstrate improved whole-system production efficiencies for new and existing agroforestry industries (including establishment costs, silviculture, genetics, processing and harvesting)
- Evaluate tree-based extractives for product potential, extraction efficiency and quality
- Examine the scope to utilise agroforestry by- and co-products for bioenergy
- Define the nature, quantity and impacts of environmental services provided by agroforestry (including private native forestry and farm forestry), particularly in the context of regional natural resource management targets.

Performance Indicators

- Two new commercial species or products identified for agroforestry development in low to medium rainfall zones
- Availability of production protocols for value-added products
- Improved harvester design for harvesting short-stemmed and multi-stemmed woody perennial species
- Cineole, lignin and other tree-based chemicals evaluated for extraction efficiency for industrial applications, and results communicated to industry
- Quantified assessment of the environmental services provided by agroforestry on-farm and for key regions, for use by land managers and regional groups

Objective Two - Product-market linkages

Objective

Product-market linkages –Analyse markets for product suitability, value and regional development options.

Background

Agroforestry industry development requires a value-chain approach – understanding consumer and processor needs, finding markets and uses, finding value-adding opportunities, marketing, responding to market feedback and planning for quantity and continuity of supply. This includes defining product groups; identification of niche and commodity products; analysis of regional supply; and coordination, where appropriate, with supply and marketing of existing and future industrial scale plantation products in some regions. Research is needed to evaluate current products with respect to existing and potential markets, and marketing methods. Greater emphasis is needed on forward planning by growers, investors and processors. Markets for co-products (to diversify or increase income sources), and issues of conversion technology and supply are also relevant.

Strategies

- On a regional basis, project existing and potential volume and continuity of supply from agroforestry tree products, and predict planting and marketing needs. Assess the interaction with industrial plantation supply and marketing
- Identify gaps in information available on the market opportunities for products from identified species
- Define species-product-market linkages, including where NRM benefits are implied
- Investigate market potential for value-adding of existing and new products from farm forestry and agroforestry, to improve commercial returns
- Assess the interaction, competition and potential cooperation or flow on effects between prospective new low rainfall agroforestry industries and existing traditional agricultural and forest industries in a common market place

Performance Indicators

- Evidence of improved planning for volume and continuity of supply from defined agroforestry tree products, and resultant marketing needs
- Evaluations available for regional industry potential for selected new agroforestry products and systems in low to medium rainfall zones, including scope for commercialisation and regional infrastructure development
- Study on trading mechanisms suitable for small-scale tree growers to provide environmental services

Objective Three –Integration and optimisation of commercial, environmental and social factors

Objective

- Design – Develop and improve agroforestry designs to optimise social, economic and environmental factors at the paddock, farm and regional-landscape scale
- Environmental services – Demonstrate mechanisms for valuation and trading of environmental services provided by agroforestry (including private native forestry and farm forestry) and their impacts.
- Policy and institutional – Investigate new policy and institutional arrangements that stimulate agroforestry investment

Background

There is a need to demonstrate how agroforestry systems meet farm management requirements, assist regional and catchment objectives, and promote commercial agroforestry industries. Analysis must show the design constraints and commercial feasibility of different agroforestry systems, and identify regions and land systems where they are most viable and likely to be adopted. Regional economics, scale of production for commodity streams and integration with environmental services (with or without markets) are also important.

A key public benefit of agroforestry is the provision of environmental (ecosystem) services, including maintenance or improvement of landscape visual amenity, biodiversity and water quality, prevention of soil, wind and water erosion, and reduction or prevention of dryland salinity. Rewarding landholders for providing ecosystem services would help make agroforestry a more attractive option.

Quantification of the impact of agroforestry on ecosystem services will facilitate testing of markets for ecosystem services, and modelling of catchment-scale issues such as the effect of scaling up agroforestry on catchment water supply and salinity.

The ‘design’ research needs to address landholder, investor or catchment manager decision making processes, particularly with regard to management practices and trade-offs to ensure the system is commercially, socially and ecologically viable. Research can also address policy and institutional requirements to promote investment in agroforestry, and the impact of policy and trade on industry

development. Development of new institutional arrangements for investment must address risk, legal, financial and organisational aspects.

Strategies

- Design, develop and trial systems for new agroforestry products for low to medium rainfall zones that meet farm management needs, promote viable agroforestry industries, and improve natural resource management
- Coordinate a regional assessment and prioritisation of catchments suitable for significant expansion in agroforestry to address regional economic, social and environmental targets. Include consideration of regional fit for different products, competitiveness and economics.
- For key regions, build on existing work to demonstrate how to scale-up current understanding of tree-water interactions to predicting agroforestry impacts on water yields and groundwater levels at landscape scale
- Demonstrate mechanisms for valuation and trading of environmental services provided by agroforestry (including private native forestry and farm forestry) and their impacts.
- Examine methods of measuring the sustainability of native forests actively managed for timber production on private land
- Determine policy options to assist new agroforestry industry start up processes, including how agroforestry will interact with existing industries
- Evaluate new institutional arrangements for investment in agroforestry, incorporating risk sharing, legal, financial and organisational aspects (for targeting agroforestry in high-need NRM regions)

Performance Indicators

- The extent to which analysis of agroforestry regional prospects is used to inform government policy, and prioritise JVAP investment
- Increase in number of regional NRM strategies which incorporate farm forestry in catchment plans and investment strategies
- Demonstrated improvements in agroforestry design to achieve commercial and NRM targets at the paddock, farm, and regional-catchment scale
- Guidelines for landholders to demonstrate the effect of management decisions on agroforestry outcomes and whole-of-farm commercial viability (based on quantified financial and ecosystem service data)
- Best management practices for actively managed private native forests in eastern Australia delivered in workshops in 4 key regions
- Analysis of potential institutional investment arrangements for agroforestry used by government and other investors

6. Communication, Knowledge and Adoption

JVAP will manage R&D outputs and outcomes through:

- communication (dissemination and promotion of research outputs, targeted to key influencers and intermediaries),
- knowledge management (analysing user needs, synthesis of research outcomes, and ensuring the knowledge base is accessible), and
- adoption – adoption will depend on uptake of the advice given by agroforestry extension advisors and intermediaries. Direct facilitation of adoption by landholders is not a role of JVAP. However some aspects of adoption will be engaged via regional and policy links and field-based courses such as the Master TreeGrowers program.

JVAP identifies the following broad categories in its target audience: industry, growers, community groups such as Landcare, catchment committees, private forestry development committees, agribusiness advisors, researchers and policy makers. To implement the objective of effectively communicating the outcomes of JVAP funded research the Program will address information needs and improve information flow and understanding of agroforestry. The aim is to build capacity to make investment decisions about agroforestry within farming, catchment and regional networks, and via policy and research.

Activities will be to:

- Continue publication of JVAP research results and access via the RIRDC web site.
- Evaluate information needs of farm forestry advisors, regional NRM bodies and others.
- Improve accessibility and useability of agroforestry information. Research outcomes will be provided to advisors, intermediaries and decision-makers. Information can also be used to inform potential buyers of products, and provide advice on marketing.
    - Synthesise and package research products. The past ten years has seen significant advances in technical understanding of silviculture (tree crop management), tree water use, impacts on natural resource management and agricultural productivity, and sustainability of agroforestry. JVAP and other research will be synthesised for relevant topics and regions, to address recognised needs.
    - Improve useability of the RIRDC agroforestry web site (e.g. via topic pages and searches) and links to other relevant web sites
    - Link with and provide material to networks such as regional NRM bodies and farm forestry and rural advisors, including private development

committees, Greening Australia, Australian Forest Growers and government departments

- Improve delivery of research outcomes within JVAP projects, and via training and field-based courses such as Master TreeGrowers
- Provide community educational material about the environmental and commercial outcomes of agroforestry. For example, articulate the potential of agroforestry, give proven demonstration outcomes, and provide advice on commercial options, especially for low to medium rainfall zones.
- Promote awareness of JVAP as a R&D provider, and of its portfolio of research, through presentations at conferences, policy forums and links with RDC, advisor and farmer networks
- Attend practitioner and policy review forums, to identify R&D needs
- Use research outcomes and the above syntheses to identify gaps for further research.

7. Investment risks and their management

The principal risks associated with investment in agroforestry R&D relate to:

- Complex biophysical issues relating to tree and shrub performance and the impact of trees on the landscape
- Non-transferability of results due to the large regional differences in agroforestry systems
- Product substitution or competition from other agricultural enterprises
- Poor or limited uptake of research results
- Failure to demonstrate commerciality
- Change in government policy and market factors that affect the viability of R&D investments. e.g. The policy and market environment relating to carbon, biofuels and environmental services will affect the scope for development in this area, notwithstanding the generally positive movements in the policy environment. However, the growing demand for services and non-wood products has greatly expanded the scope for farm forestry operations outside traditional forestry areas and this is expected to continue.

The complexity and public benefits of agroforestry require recognition by government and private investors that investment must be maintained over a long time period, to build and refine commercial systems and species.

The JVAP can maximise its impact by concentrating on R&D that has a national focus and that provides the knowledge base to increase the confidence of investors in agroforestry. The program can also address some of the above risks by ensuring that, where relevant, research outcomes are built into advice on design principles and guidelines for agroforestry systems, and there is effective dissemination of research results to policy, farmer and agroforestry advisor networks, and catchment management groups**.**

Monitoring and evaluation

The Joint Venture recognises the need for continuing monitoring and evaluation of the Program's performance. RIRDC has processes in place to monitor progress in funded projects, to publish and promote research outcomes, and use external consultants to evaluate the Program's performance and effectiveness. JVAP will also analyse research needs and project outcomes on an annual basis, to assess the continued relevance of R&D strategies.

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Appendices

Appendix 1. Driving forces for Agroforestry

Agroforestry can be defined broadly as the management of trees and shrubs integrated with agricultural systems for multiple products and benefits.

Agroforestry integrates trees or woody perennials, grown for fruits, nuts, seeds, plant extracts, timber, fodder or natural resource management, with grazing, cropping or other farm enterprises. Farm forestry is one type of agroforestry, where trees are managed in stands or woodlots for traditional wood products, but integrated into the whole-farm plan and farm business.

Driving forces for agroforestry development in Australia include:

- Private benefits from agroforestry (income for landholders from wood and non-wood products, increased farm productivity, increased land value and reduced damage to infrastructure from, for example, salinity or wind and water erosion)
- Public benefits (e.g. need for commercial solutions to address dryland salinity, water quality, biodiversity and carbon sequestration)
- Regional NRM and industry development issues (e.g. National Action Plan for Salinity and Water Quality (NAP) and Natural Heritage Trust 2 (NHT), refer Appendix 2)
- Emerging carbon sequestration markets and interest in evaluating markets for ecosystem services market incentives, including quantifying the environmental impact of agroforestry
- Recognition of cross-sectoral role of agroforestry (providing environmental services on-farm and at the landscape-scale, through well designed and managed agroforestry, appropriately placed in the landscape.)
- Reducing Australia's trade deficit in wood products and supporting the processing industry (through an expanded area of plantations and farm forestry; refer Appendix 2)

Many farmers have long recognised the value of trees as part of the agricultural system. For example, trees offer wood products for commercial sale, shade for livestock, protection of crops from the wind, and habitat for the predators of insect pests, as well as a more aesthetically pleasing environment in which to live. In many regions of Australia, farmers are now planting trees as a short rotation (pulp) or long-rotation (timber) crop, to diversify their income. Others have traditionally managed their remnant native forest for conservation and production, with periodic harvest of fence posts, poles and sawlogs.

Also, woody trees and shrubs such as tagasaste, kurrajong and old man saltbush can be integrated into farm management to offer supplementary fodder plus shade and soil protection. Integration of trees and woody shrubs can improve overall farm sustainability, and resilience in dry seasons and drought.

In Australia over the last two centuries, trees have been cleared over large areas to facilitate agriculture. The widespread clearing of trees and other native vegetation in Australia has had significant consequences, such as:

- Increased soil, water and wind erosion
- The loss of productive land to salinity and other types of soil degradation
- Loss of water quality (such as that caused by rising salinity levels and siltation)
- Loss of biodiversity (both on-site and off-site, such as downstream wetlands and wildlife corridors to upper catchments)
- Damage to public infrastructure such as roads and buildings.

In parts of the continent (most marked in the Murray-Darling Basin and the West Australian wheatbelt), the removal of trees has had a profound effect on the hydrological balance: watertables have risen, bringing salt held in the soil profile to the surface. The National Land and Water Resources Audit (2001) estimated that there are currently 7 million hectares of land affected by dryland salinity, with an estimated 20 million hectares by 2020. Dryland salinity is currently estimated to affect 2.5 million hectares of farmland; a total of 12 million hectares is estimated to be at risk (National Land and Water Resources Audit 2001). Dryland salinity diminishes the nation's capacity of the land to grow food and other products, and is estimated to cause $130 million p.a. in lost production, largely in the low to medium rainfall, sheep-wheat zones of Australia. Increased adoption of well-planned farm forestry has the potential to reduce the impact of dryland salinity. Deep-rooted perennials can utilise soil water to a greater depth than annual plants, thereby drying the soil profile, lowering the water table and drawing salt lower down in the soil profile. By reducing recharge to the water table the quality of surface water runoff can also be improved (for example, less salt, turbidity and sedimentation).

Agroforestry is regarded as an important management tool to rehabilitate existing saline lands and prevent further dryland salinity. To stimulate broadscale planting of trees, particularly in the low to medium rainfall zones, commercial or at least semi-commercial solutions must be demonstrated.

Appendix 2. Where agroforestry sits in the policy framework

Farm forestry and natural resource management are recognised in a range of national policy documents and government initiatives:

- Plantations for Australia 2020 Vision
- Farm Forestry National Action Statement
- National Research Priorities
- Rural Research Priorities
- National Land and Water Resources Audit
- National Action Plan for Salinity and Water Quality (NAP)
- Natural Heritage Trust (NHT2).
- Environmental Industry Action Agenda
- Renewable Energy Action Agenda

The Plantations for Australia 2020 Vision framework, announced in 1997, recognises the need to promote plantation forestry in Australia. The goal is to treble the effective area of plantation estate between 1996 and 2020, to address the projected shortfall in national timber supply and reduce the reliance on imports and native forest timbers. About 60% of Australian lands are managed privately; plantations and farm forestry on cleared agricultural land will be vital to achieve this vision.

Informing a range of policies is the National Land and Water Resourced Audit (2001, and current revision) as discussed above. Two key national issues are dryland salinity, and regional natural resource planning and management.

In October 2001, the Australian and state governments signed a bilateral agreement for implementation of the National Action Plan for Salinity and Water Quality (NAP). In December 2002 a bilateral agreement was signed for implementation of the National Heritage Trust (NHT) funds. The aim of these agreements is to facilitate integrated delivery of Natural Resource Management priority issues, including salinity and water quality. Investments under NAP and NHT are made via single regional plans. There are 57 regions identified (Natural Resource Management Ministerial Council 2005). For each region, an Integrated Natural Resource Management Plan is developed by local communities supported by Government and science. The plans include an investment strategy based on clear targets for management and monitoring of natural resource issues. To June 2004, 25 regions have had NRM plans accredited by governments. The investment for these approvals focus on regional on-ground activities (72%), resource condition and resource assessment, planning and capacity building. Agroforestry is a tool for addressing a range of natural resource issues, but has different relevance and recognition within regional plans.

In December 2002, four national research priorities and their priority goals were announced by the Prime Minister. Two of these are relevant to agroforestry and the

goals of JVAP – An environmentally sustainable Australia, and Frontier technologies for building and transforming Australian industries.

These priorities include strategies such as sustainable water management practices; reducing the environmental impacts of resource-based industries; overcoming soil loss, salinity and acidity; reducing emissions in energy generation; frontier technologies exploiting niche markets; and new products and services through biotechnology and genomics; and other cutting-edge science and advanced materials. The recent priorities for the RDCs align with the national research priorities. Achieving NRM goals and finding new products and energy from woody perennials support these goals.

The Renewable Energy Action Agenda (2000), developed by industry with support by government, has the objective of providing a framework to underpin growth of a commercially viable and international competitive Australian renewable energy sector. Biomass is one of a range of renewable energy sources addressed. The main driver is reduced greenhouse gas emissions, while creating commercial business opportunities. The Government's Mandatory Renewable Energy Target commenced on 1 April 2001 to facilitate the use of tradeable renewable energy certificates..

Waste material from agricultural and forestry industries and dedicated energy crops have the capacity to supply a significant proportion of Australia's renewable liquid fuels and electricity markets. Regulation and legislation governing use of forest and plantation wood waste and dedicated tree energy crops is under review, and offers a potential future source of renewable energy in regional and remote areas of Australia.

A carbon market has been formed internationally and in New South Wales; other Australian states are considering enabling similar arrangements. Such trading could provide private benefits to landholders, emitters of greenhouse gases (such as power companies) and brokers. It may also provide public benefits by reducing the national contribution to the enhanced greenhouse effect.

Appendix 3. Key issues for Agroforestry

The following summary is drawn largely from Agtrans Research and Farm Tree Systems (2003) review of research priorities.

Markets, products and investment

Farm forestry is most developed in regions of relatively high rainfall that are close to timber markets or wood processing facilities. Here, the significant expansion in plantations and farm forestry has been largely through investment by government, private companies and individual landholders in short rotation tree crops. Some institutional investors have also invested in longer term environmental plantings to provide an ethical investment component to their portfolio. There is also some government investment in long rotation plantations.

Agroforestry is less well advanced and less easily driven by wood fibre production in the sheep-wheat belts and pastoral zones, which generally are further from markets and processing facilities, and have lower rainfall.

In these circumstances a mix of public and private investment may be needed to encourage agroforestry in these areas. Mechanisms to achieve more investment by private companies and institutional investors are not yet clear.

Australian agroforestry is geographically dispersed, and for off-farm products, the challenge is to coordinate and provide continuity of supply to markets. Research is needed to define common product groups across agroforestry regions, find mechanisms to coordinate supply, find markets and uses, and develop market recognition for agroforestry-grown products that give market advantage (e.g. certify for environmental sustainability; establish an agroforestry label). In some cases this can be achieved by analysis and synthesis of existing research information and improved delivery to users.

Landowners need to manage and value-add their tree crop over time to meet market specifications for products. Farmers need greater awareness of market prices and specifications, value-adding and marketing of tree crops and products.

Integration and improvement of agroforestry designs *- to show the economic, environmental and social management trade-offs*

There is a need to demonstrate the regional applicability of agroforestry designs and species options, evaluate the economics, and increase public understanding of commercial options. There is a lack of clear economic information as to when and where agroforestry is commercially viable, or at least when it is at break-even point so that investment can be considered for other on-farm and off-farm natural resource and sustainability benefits.

Analysis of agroforestry designs must include demonstration of the environmental, commercial and social benefits and costs of the designs. In lower rainfall regions, more information is needed on how to optimise the commercial benefits for farmers.

Regional issues to consider are the effect of agroforestry on regional biodiversity, catchment water balances and competition between agroforestry and other land uses. The management recommendations must aim for improvements on-farm and at the landscape scale for conservation purposes, and/or improvements in best practice for the agroforestry industry.

Policy environment and infrastructure

A number of current issues impact on policy, and the potential for agroforestry research, development and adoption. The main ones are:

- concern over water use by plantations, particularly where water catchments are fully or over-allocated
- uncertainty as to the scale of impact that plantations can have on dryland salinity
- lack of information to support market-based instruments for trading ecosystem services
- uncertain policy and markets for biomass and renewable energy
- lack of clear market incentives for certified sustainable forest products
- private growers lack confidence that pricing mechanisms are transparent and that log markets are subject to fair competition with government suppliers
- the fragmentation of responsibilities across spheres of government and between agencies creates policy confusion, as do inconsistencies and irregularities in local government land-use planning
- taxation treatment of long term agroforestry investments
- reduction of funds available for forestry research
- devolution of natural resource planning and research to regional communities via catchment management authorities
- limited regional planning to coordinate growers and investors, large and small, to consider investment and development of regional infrastructure

Knowledge transfer and capacity for adoption of agroforestry by farmers, rural advisors, regional groups and community

The past ten years has achieved significant advances in technical understanding of silviculture (tree crop management), tree water use, conservation value on-farm, and sustainability of agroforestry. This research has addressed many practical questions of science and technology. However the public still have a very limited understanding of the potential of agroforestry.

The challenge is to increase understanding of the role of agroforestry by catchment managers, agribusiness advisors and landholders, and increase their capacity to support or adopt agroforestry. Traditional state government extension, previously linked with forestry and agricultural research, has been significantly reduced, and there is an increasing disconnect between research and delivery to landholders (lack of supporting

knowledge systems). Extension is now often delivered through groups such as Private Forestry Development Committees, Greening Australia and agribusiness advisors. There is an opportunity to provide catchment planners with clearer information as to when farm forestry and agroforestry can meet their catchment management targets. Regional delivery of agroforestry research results is needed, and will require some re-packaging of research results to be locally relevant.