Forest Research Strategic Directions

2008 - 2011

Coordinated research and development for sustainable forests and forest-based industries generating economic, environmental and social benefits for Australia

Climate Change

Forest Products

Social Needs

Rural Development

Biodiversity

Biosecurity

Water

Forestry and Forest Products Committee

Prepared by the Research Priorities and Coordination Committee

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Vision

Coordinated research and development for sustainable forests and forest-based industries generating economic, environmental and social benefits for Australia

Australia's forests generate benefits to the nation through:

- mitigation of climate change
- yielding high-quality water
- recreational and tourism values
- sustainable agriculture and rural communities
- biodiversity conservation
- innovative wood and paper products

These benefits are sustained through investment in research and development programs and projects across Australia that draw on the skills and experience of researchers and industry personnel.

The outputs of investments in research and development are knowledge and technology that are used to:

- inform government policy
- underpin sustainable forest management
- improve efficiency and productivity of forest management and wood processing
- indicate potential impacts of environmental and other changes on productivity and profitability of forestry and forest products enterprises

The impact and quality of research and development can be enhanced by coordinated, collaboration and cooperative programs and projects that deliver efficient and effective outcomes for forest managers, forest industries and for research users in government, rural and urban communities and related industrial and service sectors.

The strategy recognises that forest industries will continually evolve in response to market pressures, technical innovation and external drivers such as climate and global security. Forest industries and the forest sector that will be the future beneficiaries of research investment may be very different from current industry.

Background and purpose

Forests are valued in many different ways by the Australian community. They provide raw materials for products that are important to society such as construction timber, furniture and paper products, and important environmental and social services and benefits. Research and development has been fundamental to improved forest management and the development of a productive and profitable forest industry in Australia.

Forest research and development in Australia is conducted by federal and state government agencies, CSIRO, universities and private companies. Public research agencies and units are funded directly from government and through co-investment arrangements which may involve research and development corporations (e.g., Forest and Wood Products Australia, Rural Industries Research and Development Corporation, and Land and Water Australia), Cooperative Research Centres (CRCs) and the Australian Research Council. Private companies in-source and out-source their research requirements and invest directly in stand-alone or collaborative research projects. These new pathways for research funding represent a significant shift in the source of resources for research and the way they are targeted. Broadly, there has been a decline in overall research investment in the forest sector in the last 10 years, with some increased investment by the Federal Government and significantly lower investment by state agencies.

Evaluations of the economic impacts of past investments in research and development in the forest industry have estimated ratios of benefits to costs of around seven to one. In addition to these substantial economic benefits, investment in research and development for the forest industry generates significant social and environmental benefits. For example, plantation establishment and expansion in regional Australia, underpinned by high-quality research, has provided diversification of regional economies, generation of direct and indirect employment and population growth in towns that would have otherwise declined. Environmental benefits of these new forest plantations include increased carbon sequestration, land rehabilitation, habitat restoration, biodiversity conservation and reduced land and stream salinity and improved water quality. Research has demonstrated that small changes to plantation planning and management regimes can significantly enhance biodiversity values and mitigate impacts on water yield and improve water quality.

The Forest Research Priorities and Co-ordination Committee (RPCC) is part of the Primary Industries Ministerial Council structure, reporting to the Forestry and Forest Products Committee (FFPC). It advises the FFPC, which comprises heads of state and federal forest management agencies, on future research directions and provides mechanisms for coordination of forest research activities across government agencies and the private sector.

Many challenges lie ahead for forest managers and the forest industry. Climate change, interactions with limited water resources, meeting expectations for higher forest management standards, and the need to develop new products and processes for wood that can be produced profitably in competitive domestic and global markets, require greater scientific knowledge and increased innovation and provide threats, and

opportunities, for the sector. In consultation with stakeholders from government, industry and the community, the RPCC has therefore determined strategic directions for forest research and development in Australia for the period 2008 to 2011

The goal of this document is to provide a clear statement of research needs to inform future research investment decisions in all areas of the sector. Research and development investments aligned with these strategic directions will deliver economic, social and environmental benefits for Australia. Research directions and priority research areas are defined for five research and development themes.

Research and development themes

- Mitigation of and adaptation to climate change in Australia
- Water quality and yield
- Forests for multiple objectives
- Health and biosecurity of Australia's forests
- Product development and use

Cross-theme interactions

These five themes are not independent and cannot be addressed in isolation. For example, climate change influences water resource management, fire management, biodiversity conservation, biosecurity and forest health as well as the use of forest products. Consequently, research strategies to address water resource management, biodiversity conservation, biosecurity and forest health and forest products take climate change and its impacts into consideration. The research strategies and priorities of this plan reflect interactions between the research themes.

Capacity building and technology transfer

Achievement of our vision through the successful implementation of the five research themes requires investment to build research capacity and to develop processes to ensure that the benefits of research are effectively transferred to communities, policy makers and the forest industry. For some research themes, priority needs encompass capacity building and knowledge and technology transfer strategies and initiatives.

Coordination, cooperation and collaboration

Efficient achievement of research objectives will require continued strengthening of collaboration, cooperation and coordination among research providers across

disciplines, regions and organisations to overcome fragmentation and duplication and to improve research delivery performance.

Recognition of regional differences

It is critically important to recognise the range of different opportunities, constraints and environmental conditions as well as different levels and stages of development in forest management and forest industries in the diverse regions of Australia, (including temperate, tropical, sub-tropical, low-rainfall and high-rainfall regions) and therefore the different research needs and resources in these areas.

1 Mitigation of and adaptation to climate change in Australia

Forests and climate change

There is strong scientific evidence that the rise in average temperatures since the mid-20th century is due to increases in atmospheric greenhouse gas concentrations associated with human activities, and that past and future increases in greenhouse gas emissions will result in further increased average global temperatures, shifts in rainfall patterns and other changes to the global climate system[1].

As Australia's gross domestic product and population increase, demand for energy-intensive goods and services also rises. Given Australia's continuing reliance on fossil fuels, growth in demand will lead to increased greenhouse gas emissions.

The 2007 APEC Leaders' Declaration on Climate Change, Energy Security and Clean Development specified that 'an equitable and effective post-2012 international climate change arrangement' must address the key role that sustainable forest management and land use practices play in the carbon cycle. Forests will play an important role in climate change and greenhouse gas emissions in the future, both locally and globally.

The post-2012 arrangements for addressing global greenhouse gas emissions are under negotiation. The new Federal Government and all state governments are committed to the introduction of an emissions trading scheme as part of an effective framework for addressing the impacts of climate change. A national emissions trading scheme is expected to commence no later than 2010 with the detailed design finalised by the end of 2008. In February 2008 the Australian Government announced a review of climate change policies with the aim of assessing whether existing programs are complementary to an emissions trading scheme. A key initiative of the Australian Government is to ensure that 20 per cent of Australia's electricity supply is sourced from renewable energy by 2020.

Climate change is a pervasive issue requiring inter-agency and inter-industry collaboration and co-ordination to identify and solve problems. Many of the impacts of climate change and the adaptation mechanisms to address these impacts are poorly understood. For Australian forests and the forest industry, in particular, the knowledge base on impacts and adaptation requirements for climate change is poor. Australian ecosystems may be particularly vulnerable. For example, a quarter of Australia's eucalypt species occur over a range of annual mean temperature of less than 1°C, and half of all native species occur over temperature ranges of that vary by less than 3°C. With temperature changes over the next century predicted to exceed that range, the

[1] IPCC 2007. 'Summary for Policymakers'. In: Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.).*Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* Cambridge University Press, Cambridge, United Kingdom and New York, USA.

most suitable growing conditions for half of Australia's eucalypt species could potentially be outside the geographic range that they occupy today.

Continued public and private sector support for scientific research is essential. Furthermore, Australia is party to international conventions that require continued support and investment in scientific research to support global solutions. International collaboration in research benefits Australia as well as the world.

Sustainably-managed forests can play an important role in mitigating the impact of climate change by:

- sequestering carbon in new forests (plantations, agroforestry, reforestation)
- reducing further forest loss and associated greenhouse gas emissions
- changing management practices in existing forests (for example through fertilisation, changing rotation lengths or harvesting intensities, managing fire or other disturbances or increasing the store of carbon in wood products)
- providing biomass for energy generation in appropriately managed forest systems and reducing emissions for fossil fuels

Provided appropriate management standards are applied to provide for biodiversity conservation, forest productivity and maintenance of carbon stocks, burning biomass from sustainably-managed forest is a carbon-neutral form of energy generation. Forest biomass energy sources include harvest and sawmill residues, purposely grown fuelwood, waste wood and paper products. Forest biomass can be combined with other biomass materials into pellets or briquettes.

Risks to forest carbon stocks through wildfire, pests and diseases (that may be increased by climate change) need to be assessed and managed. An important role for research providers is to ensure that quality scientific knowledge and information are available to policy makers, communities and industry in a usable form. Complex linkages between information, society, industry and public policy suggest the need for effective scientific engagement and communication with all sectors and stakeholder groups.

Forest research can therefore reduce the environmental, social and economic impacts of climate change through contributions to climate change mitigation and adaptation strategies.

Mitigating climate change

Past research has contributed to our understanding of the role of plantations, forests and woodlands in sequestering carbon. This knowledge has been used to develop carbon accounting tools and systems that are essential for measuring the magnitude of carbon sequestration. Accurate carbon accounting at a regional or sub-regional scale requires further research especially for non-traditional forest species (e.g. revegetation with mixed native species).

Outcome 1.1

Policy makers, communities and industry are aware of and understand the positive impacts of forest management on the

carbon cycle, and the role of forests in ameliorating the impacts of climate change

Key strategies

1.1.1 Produce research outputs that better inform policy makers, communities and industry of the significant potential contribution that forests and forest products make to the amelioration of climate change through carbon sequestration and through the production of renewable energy sources from sustainable managed plantations and forests.

1.1.2 Develop research to demonstrate that climate change provides an opportunity for better integration of forestry into Australian landscapes and society in a range of environments

1.1.3 Strengthen linkages between tree growers and the forest products sector in the context of the carbon cycle and emissions management.

Priority research

- Continue to investigate the potential for climate change mitigation through reforestation and changes to forest management, considering limitations of productivity, competition for land and, especially, competition for water.

Outcome 1.2

The forest industry is adequately prepared for a carbon trading environment at local and national levels

Key strategies

1.2.1 Continue research and development into carbon accounting systems to provide industry with the knowledge and tools suitable for use at scales appropriate for effective and efficient carbon trading.

1.2.2 Build capacity in socio-economic analysis for assessment of the efficiency and effectiveness of policy, including market-based instruments, in mitigating the impacts of climate change.

1.2.3 Provide accurate scientific data and information to support efficient and effective implementation of market-based instruments such as carbon penalties or emissions trading, that increase the relative costs of using emission-intensive technologies and encourage uptake of alternative technologies such as biomass energy generation. Financial incentives, performance and emissions standards and information programs can also be used to encourage the use of energy-efficient and low-emission technologies.

Priority research

- Further develop carbon accounting tools (models and systems) suitable for use at a regional scale that provide forest managers with the knowledge to engage in carbon trading, supported by refinements to models of forest growth that underpin these tools
- Understand the changing risks of pests and diseases, cyclone, drought and fire so that the appropriate level of risk can be factored into forest management and carbon accounting systems

Outcome 1.3

Biomass energy production systems enhance energy security and reduce carbon emissions

Key strategies

1.3.1 Support development of biomass energy technologies in line with introduction of carbon emission trading in 2011-12.

1.3.2 Investigate social and biodiversity social impacts of biomass energy generation. These impacts may be different for communities near the source of production and from those at more distant locations. For example, issues such as local air quality and road traffic congestion need to be included among the costs and benefits of biomass energy, together with employment creation and reliable power supply.

Priority research

- Develop economically and socially feasible, and ecologically appropriate, biomass energy production systems and integrated timber and biomass production systems for different forest production conditions for a range of energy consumers.
- Research to mitigate potential impacts of increased biomass utilisation on biodiversity, forest productivity and other forest values.

Adapting forest management to climate change

Scientific research provides critical knowledge to underpin adaptation of forest and land management systems to minimise the impact of climate change in natural and planted forests.

A research agenda that informs government, community and industry stakeholders of how climate change may alter land management decisions will encompass a broad range of issues including:

- climate change impacts on water supply and demand, and trade-offs between the market economy, the water economy and the carbon economy market
- climate change impacts on fire regimes (frequency and intensity of bushfires) and fire and land management strategies
- climate change impacts on forest productivity associated with increased CO_2, and with the effects of altered climate patterns on the frequency and severity of extreme events such as storms and floods
- climate change impacts on biodiversity and the need to manage landscapes for greater resilience to cope with increased average temperatures and changed water and fire regimes
- climate change impacts on changes to the likelihood and severity of biosecurity threats from existing and new pests including insects, pathogens and weeds

Outcome 1.4

Forest and water resource managers can predict and manage the impact of climate change on water yields from forested catchments.

Key strategies

1.4.1 Focus research efforts in forested catchments that supply water to Australia's major population centres to assess the impacts of changed rainfall patterns and increased temperatures on future water supplies.

1.4.2 Develop tools to predict, monitor and measure climate change impacts on fire regimes in water supply catchments and their potential impacts onwater yield and quality.

1.4.3 Assess the impact of predicted changes in climate on water resources for timber plantations and other land uses in selected regions.

Priority research

- Develop calibrated and tested process-based models and other landscape-level analytical tools to explore likely changes in water use by important forest types (including plantations) in key regions of Australia under different climate change scenarios, different types of management strategies and different fire regimes.
- Analyse the interaction of alternative forest management options, including timber harvesting and the use of prescribed fire, and impacts of climate change on water yield and quality

Outcome 1.5

Fire management systems are adapted to changed climate conditions

Key strategies

1.5.1 Evaluate possible economic, environmental and social impacts of altered fire regimes associated with changed climatic conditions, rising temperatures and changing rainfall patterns.

Priority research

- Conduct a detailed study of the elements that determine fire risk and how they are projected to change under future climate scenarios
- Analyse climate change scenarios to assess the extent to which climate change alters the risk of bushfires in different regions of Australia.
- Determine appropriate management options to reduce bushfire risks to forests, plantations, biodiversity and the community under changed climatic conditions.

Outcome 1.6

Landscapes are designed and managed for resilience

Key strategies

1.6.1 Understand the vulnerability of forest species and ecosystems to climate change, for example, those with relatively narrow spatial distributions within areas characterised by relatively uniform climatic conditions. Develop management strategies for vulnerable native and plantation species and ecosystems.

1.6.2 Assess the impact of more frequent or prolonged drought on establishment, survival and growth of trees planted for commercial or environmental purposes in both traditional and dryland regions.

1.6.3 Evaluate consequences of the effects on biodiversity of disturbances induced by climate change, such as changed fire regimes, prolonged drought and increased prevalence of pests and diseases.

Priority research

- Studies of vulnerability of native and plantation forest ecosystems to climate change and factors limiting species distributions (such as extreme climatic events or other correlated factors such as the incidence of fire), to identify species or ecological communities at greatest risk.
- Identify possible management options to minimise the adverse effects of climatic changes including "assisted migration" of species to new habitats that may become suitable under changed climatic conditions
- Identify areas where plantations with currently marginal water supply have been established and with the aid of climate models analyse the impact of future climate scenarios on plantation productivity and water availability in these regions
- Determine the impact of management responses, such as thinning and fertility management, on stand survival
- Evaluate alternative species that may be suitable for plantations in areas now or soon to become available for planting, as climate change begins to take effect.

2 *Quality and yield of Australia's water resources*

Forests and water resources

Water security is a major policy and socio-economic issue in Australia that is heightened by recurring drought and uncertainty about water availability in the future due to population growth in urban areas, rapid land-use change, and the potential impacts of climate change. Forests and forest management have been an important focus of political and public attention in the debate about allocation and pricing of Australia's water resources. Attention has focused on:

- the impact of plantation establishment on water flows and competition with other land uses
- the impact of fire and timber harvesting in forested catchments on water quality and quantity
- the sustainability of plantations in lower rainfall areas and in a drying climate

Less attention has been focused on the role of native forests and plantations in improving water quality and mitigating problems such as salinity. An holistic approach to land use and water allocation in which forestry is recognised as an integral component of the landscape is the most effective and efficient strategy, rather than focussing on individual components and issues.

Recent government initiatives to reform water allocation arrangements and increase environmental flows in regulated river systems have highlighted the potential for conflict between the benefits of plantations in salinity control, biodiversity protection and carbon sequestration and their role in reducing stream-flow and groundwater recharge.

Rainfall is an important factor in the selection of suitable locations for plantation establishment. While native forests are a dry-land land use and are not dependent on extractive water use, plantation forests are viewed as competitors for water resources in regions particularly where some agricultural crops depend on irrigation from groundwater. For example, in South Australia legislation requires planted forests to have a water licence where depth to groundwater is less than six metres.

The forestry sector must act with urgency in response to activities of the National Water Initiative (NWI) and other policy processes related to the management of Australia's water resources. Within the context of the NWI, development of plantation forestry is regarded as a significant land-use change. The impact of proposed new plantations and expansion of existing plantations must be addressed in regional water plans in terms of the impacts of water interceptions on surface-water and groundwater availabilities. This requires an understanding of the total water cycle and an assessment of economic and environmental costs and benefits associated with the changed land use.

National objectives, such as the Plantations 2020 Vision to treble Australia's plantation area or increased planted forests for climate mitigation, may be constrained by availability of suitable land, with water availability (annual rainfall, evaporation, seasonality and soil storage capacity) a critical component of land suitability. Locating plantations in parts of the areas where water is more available, and development of management strategies to more efficiently use water to enhance growth, may be necessary for long-term sustainability.

The sustainable management of native forests under drying conditions will require development and implementation of different techniques to those used under previous rainfall conditions.

There are opportunities for research to contribute to decision-making on water management by all levels of government, as well as by private land users. Negative perceptions of communities and authorities towards the impact of plantations on water availability and other services can be addressed through well-informed awareness and education programs, underpinned by research. Scientific and socio-economic research contributes key knowledge inputs to the development of water management policy, including water allocation and pricing. Research can also contribute to efficient implementation and operation of policy measures and requirements. For example, the National Water Commission has expressed concern at the quality and extent of science underpinning water plans, and limited understanding of the relationship between water and the environment. The Commission concluded that 'continued effort is required both to improve the available science and to ensure that the best information is used in water planning'[2].

Forest and other research organisations need to focus increasingly on regionally based environmental management and policy implementation. The eWater CRC is an important vehicle for integrating water research especially in relation to management of catchment hydrology.

Outcome 2.1

A balanced and equitable basis for allocating water that does not unfairly impede growth of the forestry sector and recognises the economic and environmental benefits that forests provide

Key strategies

2.1.1 Provide the knowledge base for water allocation mechanisms that account for the total environmental and economic impacts of plantation forests within a catchment or region relative to the environmental and economic impacts of other land uses including those dependent on irrigation. This can be achieved through collaboration among all stakeholders supported by, multi-disciplinary research

[2] National Water Commission 2007. *National Water Initiative. First Biennial Assessment of Progress of Implementation*. Commonwealth of Australia, Canberra, August, p. 7.

2.1.2 Strengthen capacity in modelling and related areas, especially for scaling up plot-based data and information to catchment and regional scales to estimate water use by different land uses.

Priority research

- Develop full water-balance accounts to evaluate the impact of forests and other land uses on the quantity and quality of water resources, in the context of other environmental factors including biodiversity, salinity and carbon sequestration as well as economic and social outcomes of changes, This requires accounting for interactions between climate change, hydro-geological processes, local and regional water interception and social and economic processes

Outcome 2.2

Native and planted forests are managed in a sustainable manner using information based on knowledge of limitations within a changing climate.

Key strategies

2.2.1 Develop improved knowledge of growth performance of plantation species' growth performance to optimise productivity per unit area and optimisewater-use efficiency.

2.2.2 Develop improved understanding of native forest water use under current and future climate conditions and different types of management regimes.

Priority research

- Species selection for environments with variable rainfall which have suitable wood properties for industrial use and which generate competitive returns
- Develop plantation design and management systems that maximise water availability and optimise water-use efficiency. Focus on water-use efficiency under a range of environments with particular emphasis on management systems for drier environments.
- Research on native forest water use at tree, site and catchment scales.

3 *Policies and processes to strengthen the capacity of forests to deliver multiple objectives*

Forests for multiple objectives

Forests can be managed in ways that deliver commercial, environmental and social benefits to society. However, often the demands of one stakeholder group are met at the expense of the demands of one or more other groups. Demonstrating the sustainable nature of forest management is a major challenge for forest managers. This requires development of technical knowledge to underpin sustainable forest management, and communication programs to effectively deliver this information to stakeholders.

Critical to reaching shared views on the future use of forests is the public policy process. The policy environment for forest management in Australia is highly fragmented, with different agencies responsible for different aspects of forest policy at state and federal levels. Suitable mechanisms to co-ordinate many aspects of policy development and implementation are absent. Research cannot solve this issue, but it can assist in identifying appropriate policy and institutional arrangements for efficient and effective coordination of forest management to satisfy the competing demands of forest users. It can support policy development processes by providing consistent, reliable and coordinated technical information.

Sustainable forest management can deliver multiple benefits including:

- water yield and quality (addressed in Theme 2)
- biodiversity conservation
- resilient ecosystems and landscapes capable of adapting to change
- recreational and amenity services
- social benefits
- wood and fibre production (addressed in Theme 5)
- carbon sequestration (addressed in Theme 1)
- diversification, increased productivity and sustainability of agricultural production systems

Competing uses can be segregated or integrated at appropriate spatial scales, depending on local circumstances and needs. These decisions can be complicated by land tenure arrangements (public or private ownership) and/or the land management regime (national park, state forest, private forest). Technical knowledge and information can be used to develop and strengthen tools and techniques for quantifying the multiple benefits of forests for consumers, communities and governments including:

- product life cycle analysis
- regional-level assessment of social and economic impacts of forestry
- measurement of environmental externalities, unpriced values and assets, and inter-generational equity (spatial and temporal externalities)

- community engagement
- connecting consumer choices to forest management practices (certification, sustainable forest management)
- integration of biodiversity conservation objectives and constraints with wood supply objectives and scheduling

The information and data produced with the aid of tools like these can be used in development of policy mechanisms that encourage desired environmental management behaviour by producers and consumers.

Outcome 3.1

Better-informed policy decisions to-meet the multiple demands on forests

Key strategies

3.1.1 Determine future demand for goods and services from Australia's native and planted forests, including where and how they can be effectively and efficiently provided and what supply risks are likely to occur.

3.1.2 Develop monitoring and reporting mechanisms for forests to demonstrate the outcomes of active forest management

Priority research

- Investigate opportunities for expansion of Australia's plantation estate based on analysis of economic, environmental and social research inputs.
- Research to support a more comprehensive approach to risk management for forests, identifying key risks to the different forest resources and development of suitable treatments to effectively manage those risks
- Efficient tools for monitoring the different values and uses of forests.
- Evaluate socio-economic impacts of alternative land management systems involving forest plantations.

Outcome 3.2

The contribution of active forest management to biodiversity conservation at different scales is understood by communities, governments and industry

Key strategies

3.2.1 Develop knowledge and information about landscape-scale effects of particular land-use options and management strategies to inform public debate about forest use. Values to be considered should include wood production, biodiversity, visual amenity, catchment management, water yield and quality and other values and services.

3.2.2 Develop and implement improved methods for monitoring and quantifying the impacts of timber production and other management practices on forest biodiversity.

3.2.3 Develop and demonstrate more effective management and mitigation of negative impacts of timber production.

3.2.4 Assess the response to disturbance and recovery by native plants and fauna

Priority research

- Conduct multi-disciplinary analyses of strategies, and develop decision support tools, to integrate or segregate production and conservation at different scales and in different forest types.
- Research into improved monitoring and reporting for forest biodiversity and habitat surrogates.
- Long-term, operational-scale, ecological and management experiments to determine the effects of repeated cycles of forest management activities, and time to recovery, for sensitive species of plants and animals.

Outcome 3.3
Forest management is physically, economically and environmentally integrated into agricultural production systems

Key strategies

3.1.1 Assess the economics of integrated farming systems where trees are grown in association with agricultural crops and grazing systems for short-term and long-term forest product options

3.1.2 Develop catchment-scale and farm-scale models of integrated agroforestry systems

Priority research

- Investigate systems to integrate short-rotation and long-rotation tree species grown in association with cropping and grazing production systems for increased economic, environmental and social benefits
- Research on plantation designs, configuration and placement in the landscape to maximise biodiversity outcomes in rural landscapes

4 *Protecting the health and biosecurity of Australia's forests*

Forest health and biosecurity

Protection of Australia's forests from pests and diseases is of critical importance to the long-term sustainability of the trees and the industry. A pest or disease incursion may inflict significant economic and environmental losses on commercial and public forests and cause serious hardship for forest-based communities and companies. The National Industry Biosecurity Plan (IBP) for the plantation industry, launched in 2007, provides a framework for managing the industry's priority biosecurity issues. The plan identifies priority plant pests or pest groups of relevance to plantation forestry and provides a framework for developing response strategies and contingency plans for implementation in the event of an outbreak.

The likelihood and impact of biosecurity risks from new and existing pests and diseases in a changing climate are expected to increase. The need for appropriate institutional arrangements and mitigation and management mechanisms, underpinned by reliable scientific knowledge and information, is critical to effective implementation of prevention and response strategies.

There are many national, state and inter-governmental organisations with a role to play in plant biosecurity, including forest biosecurity. These include:

- Primary Industries Standing Committee
  - Primary Industries Health Committee
  - Plant Health Committee
  - Research Working Group 7 (Forest Health – contributes to Plant Health Committee)
- Federal Government agencies
  - Department of Agriculture, Fisheries and Forestry
    - Office of the Chief Plant Protection Officer
    - Australian Quarantine and Inspection Service
  - Biosecurity Australia
- Plant Health Australia
- State Forest agencies

It is critical that forestry is recognised and represented in integrated biosecurity plans and strategies in all jurisdictions. This is a stated purpose for the Australian Biosecurity System for Primary Production and the Environment (AusBIOSEC), but there is little evidence at this time that forestry issues are on the agenda for consideration. There needs to be a shift from parochial thinking and action towards a coordinated national approach.

Research organisations and groups providing biosecurity and forest health research include CSIRO Forest Biosciences, the Australian Biosecurity Cooperative Research Centre, the Cooperative Research Centre for Forestry, Forest and Wood Products Australia, forest agencies in the states and Research Working Group 7. The first step towards national coordination of forest health and biosecurity is to ensure that these participating organisations are aware of and understand their respective roles and responsibilities. The risk of complacency is real and it is important that the industry is vigilant and well informed.

Forest health and biosecurity expertise in Australia is declining, especially in the areas of detection and diagnostics. There is an urgent need to develop capacity in universities for students to specialise in forest health and biosecurity management. The CRC for Forestry and other federal and state research organisations are working with universities to address this emerging capability gap.

With increasing volumes of timber traded, the likelihood of pest incursions in Australia occurring is also increasing. Strengthening border and pre-border security checks and provision of comprehensive diagnostic tools will be important components of Australia's biosecurity defence strategy.

Outcome 4.1

Australia's natural and planted forests are included in national and state biosecurity plans jointly supported and implemented in a proactive and integrated manner by governments and industry

Key strategies

4.1.1 Develop a national biosecurity plan for native forests to complement the existing plantation industry plan. The transfer of management responsibility for native forest from production forestry to conservation and environment agencies, places an onus on those agencies to address forest biosecurity. These agencies must contribute to the national biosecurity framework and to development of a better understanding of threatening processes and their potential impacts and the development of contingency plans.

4.1.2 Forest biosecurity issues that can impact on non-traditional forest industries are identified and better understood.

4.1.3 Ensure that forestry is addressed in state biosecurity plans and all forest management agencies are engaged and investing in coordinated research and development and contingency planning to address biosecurity threats.

4.1.4 Evaluate models for national engagement of agencies to support forest health and biosecurity research such as the Industry Pest Management Group (IPMG) and Sub-Tropical Forest Health Alliance (SFHA)

Priority research areas

- Analysis of the potential impacts of pests and disease threats on non-commercial values (biodiversity, recreation, water and other values) in forests.
- Investigation of appropriate policy and management arrangements across jurisdictions and forest ownerships to effectively respond to biosecurity risks.

Outcome 4.2

Forest managers are equipped with biologically, economically and environmentally effective tools for managing pest and disease threats within Australia.

Key strategies

4.2.1 Effective control strategies are developed for the large number of pests and pathogens that threaten forests. New control strategies may be needed to replace existing strategies made redundant by environmental or economic factors.

4.2.2 Use scientific research to assist in identification of threats and in risk assessment and management for plantation and natural forests . As genetic diversity in planted forests declines the risk profile changes. Climate change and international trade patterns also change the likelihood of pest and disease incursions.

4.2.3 Build capacity in critical areas of detection and diagnosis of pests and diseases in relation to biosecurity

4.2.4 Explore interactions between silviculture, disease management, wood production and wood quality

Priority research

- Research into risk management and development of predictive models to help forest managers and owners improve preparation and mitigation strategies. This research should embrace assessment of costs and benefits of different strategies.
- Improved methods for surveillance and early detection of exotic and established or indigenous forest pests and pathogens, including spatial analysis and environmental data to target resources, sentinel/hazard site surveillance and trapping technologies
- Continue development of remote sensing technology coupled with ground survey, to provide methods to support health surveillance programs across native forests and plantations
- Research on the life cycle, impacts and responses to priority pests and diseases in forest and wood products

5 Forest product development and use

Forests provide the raw material for one of Australia's largest manufacturing sectors with a turnover of $15 billion per year and employment of over 80,000 people. Forest plantations now supply over 70% of domestic needs while native forests provide specialised resources that cannot be produced in plantations. Advances in processing technology have provided engineered wood products with the potential to compete with traditional sawn structural products and to challenge steel in some industrial market sectors. There are emerging opportunities for development of new products such as bioplastics, natural chemicals, bioenergy and pharmaceuticals and wood-based biocomposite products, as well as bioplastics and resins that are renewably produced and more easily recycled and degraded at the end of the product life.

Changing climatic conditions are likely to alter seasonal tree growth patterns and hence influence wood development, wood properties and the performance of timber. For example, untreated timber products that previously provided useful service life will increasingly require protection with wood preservatives to provide the same service life. However, while wood preservation may extend the useful life of less durable timber and timber products, the environmental impact of wood preservative systems is coming under increasing scrutiny.

Most of the resources from the rapidly expanding hardwood plantation sector are destined for the export chip market with minimal value-adding in Australia. The properties and quality of wood from these plantations are less than ideal for value-adding, being planted and managed primarily as pulpwood resources. With the exception of Tasmania, there has been minimal silvicultural management of the majority of this timber resource for solid timber products. The combination of these characteristics in first-rotation plantations means that the wood they produce may not be suitable for intensive value-adding. Forecast growth in global demand for hardwood timber and timber products may justify silvicultural interventions in second-rotation tree crops with the prospect of higher returns.

There is need for the development of new uses for wood as a raw material, and a more active engagement in the biomass energy field. New approaches to using wood will make a significant contribution to mitigation of climate change, especially if a carbon trading scheme is introduced. However, the carbon storage capacity of wood products is not recognised by international arrangements such as the Kyoto Protocol. Wood can substitute for non-renewable materials in areas such as packaging, fuel, chemicals and construction. Despite this, the environmental advantages of wood are not fully recognised in policies, standards and codes or by consumers.

Within Australia there is a distinct divide between the north tropical/sub-tropical forest industry and the south temperate forest industry. This difference is reflected in different priority needs.

These developments have occurred during a period when the funding for strategic research by State government forestry agencies has diminished. There is a need to develop new approaches to fund pre-competitive forest products research.

Significant issues facing Australia's wood processing sector include:

- reduced availability of native hardwood resource due to increased areas of forests reserved for biodiversity protection, recreation and catchment protection
- increasing competition from alternative materials such as steel, concrete, aluminium, plastic and composite products which demonstrate greater consistency and predictable performance; these materials are making inroads into traditional timber markets such as house framing and packaging
- environmental pressures on building regulations, energy production, plantation development and greenhouse gas reduction are creating both opportunities and threats for the forest products industry
- increased supplies of fast-grown small-diameter wood
- rationalisation of the processing sector and increasing average scale of operations
- increasing supplies of certified plantation-grown wood
- imposition of trade restrictions on export of roundwood to encourage increased investment in wood processing in Russia, Indonesia and Malaysia
- advances in processing technology have provided engineered wood products with the potential to compete with traditional sawn structural products and to challenge steel in some industrial market segments
- increasing costs of fossil fuels and the search for lower greenhouse gas emission fuels and power-generating technologies
- lack of an innovation culture in the wood processing sector
- emergence of a carbon trading scheme in Australia
- increasing costs of waste disposal to landfill and opportunities to recover, re-use and recycle wood

Outcome 5.1

Timber resources are of sufficient quantity and quality for profitable value-adding within Australia.

Key strategies

5.1.1 Declining availability of natural forest hardwood timber resources is increasing pressure to add value to available resources within Australia. The best available technology should be used to optimise production from these resources.

5.1.2 Improve recovery rates and utilisation of wood from waste streams to maximise the use of the available resource. Negative perceptions associated with re-use and recycling wood can be addressed through education programs.

Priority research

- Quantify the wood utilisation characteristics of the younger plantation resource, which has very different properties to mature native-forest wood.
- Investigate the relationships between genetics, site conditions and silvicultural management, and wood production and quality with the objective of maximising the capacity to add value to the resource.

Outcome 5.2

The opportunity to add value to Australia's wood fibre resource is enhanced by access to harvesting and processing techniques and technologies.

Key strategies

5.2.1 Increase the proportion of forest products research investment going to projects with longer-term, higher-value and more widespread benefits for the Australian forest sector.

Priority research areas

- Investigate opportunities to add value to timber from both plantations and natural forests, particularly for smaller regrowth logs
- Develop replacements for increasingly unacceptable preservative systems, adhesives and coatings (e.g., metal components, emissions of volatile organic compounds)
- Support development of modified or novel products and/or processes that are more suited to the known properties of the near-term and medium-term future resource, including development of non-pulp products capable of being produced from hardwood plantations, providing a financial incentive for longer rotations and higher plantation management costs (e.g. thinning, pruning)
- Develop new timber composite products with higher added value
- Develop improved, intelligent, efficient harvesting and processing technologies for the current resource, to reduce transport and processing costs and improve recovery and product value, including reduced energy consumption in harvesting, transport, sawing, drying, machining and protection systems.

Outcome 5.3

Value-adding to wood resources in Australia is optimised in social, economic and environmental terms

Key strategies

5.3.1 To move the product focus further along the value chain and maximise opportunities for adding value in Australia. To achieve this, a number of constraints have to be overcome, by investment in efficient wood processing infrastructure; community acceptance of large-scale processing locally and nationally, compliance with strict environmental codes and standards in line with product demand, and overcoming competition from low-cost wood processing in developing countries. This will critically define where Australia's competitive advantage lies in wood processing.

Priority research

- Development of integrated approaches to value-added processing, utilisation and end- use for Australian forest products.
- Whole-of-life comparisons between wood and substitute materials and systems, including durability models leading to the development of design-based solutions to minimise the environmental impacts of various construction systems

- Research to support market mechanisms that better connect growers and processors and provide for widespread participation in forest product markets, including for small-scale growers and for environmental services.

Outcome 5.4

Australia's timber industry strengthens its position in the construction market by aligning itself with future opportunities determined by climate, economic, political and social change.

Key strategies

5.4.1 Develop better information on the green credentials of timber construction in terms of greenhouse gas footprint of wood products relative to other construction materials

Priority research

- Investigate the potential benefits of timber relative to non-wood building materials, in relation to embedded energy, greenhouse gas emissions and other aspects of environment, community health and sustainability
- Develop and adopt multi-disciplinary approaches to sustainable housing, embracing skills in the areas of architecture, energy consumption, renewable natural resources, resistance to natural disasters, and recycling capacity

Table 1. Indication of current status and responsible funding body or agency for each research priority

Mitigation of and adaptation to climate change in Australia		
Priority Research	Status Currently Active (Y/N)	**Broad Funding Responsibility**
Potential for mitigation through reforestation, considering limitations of productivity, competition for land and, especially competition for water.	**Y**	State Land Management agencies State Forestry Agencies Commonwealth Dept Climate Change Plantation Industry
Further develop carbon accounting tools suitable for use at a regional scale that provide forest managers with the knowledge to engage in carbon trading, supported by refinements to models of forest growth that underpin these tools.	**Y**	State Forestry Agencies Commonwealth Dept Climate Change Sequestration Industry
Understand the changed risks of disease, cyclone, drought and fire so that the appropriate level of risk can be factored into forest management and carbon accounting systems.	**N**	FWPA, LWA, CSIRO Forestry, Bushfire CRCs State Forestry Agencies Commonwealth Dept Climate Change Forest Industry
Develop economically and socially feasible, and ecologically appropriate, biomass energy production systems and integrated timber/biomass systems for different forest production conditions for a range of energy consumers.	**N**	FWPA Forestry, Bushfire, eWater CRCs State Forestry Agencies Commonwealth Dept Climate Change Forest Industry
Research to mitigate potential impacts of increased biomass utilisation on biodiversity, forest productivity and other forest values.	**Y**	FWPA Commonwealth Dept Climate Change State agencies, energy generators
Explore likely changes in water use by important forest types (including plantations) in key regions of Australia under different climate change scenarios.	**Y**	Forestry, Bushfire, eWater CRCs State Land Management agencies Commonwealth Dept of Climate Change, BOM, CSIRO FWPA, Forest Industry

Mitigation of and adaptation to climate change in Australia (cont.)		
Priority Research	Status Currently Active (Y/N)	Broad Responsibility
Analyse alternative forest management options including the use of prescribed fire to minimise adverse impacts of climate change on water yield and quality.	**N**	Fire Management Agencies Water and Catchment Authorities Forestry, Bushfire, eWater CRC State NRM agencies Dept Climate Change, BOM Forest Industry
Study of the elements that determine fire risk and how they are projected to change under future climate scenarios.	**N**	Bushfire CRC, CSIRO, BOM State fire management agencies State Forestry agencies Commonwealth ?? Plantation industry
Analyse climate change scenarios to assess the extent to which climate change alters the risk of bushfires in different regions of Australia.	**N**	Bushfire CRC, CSIRO, BOM State fire agencies State Forestry agencies Forest Industry
Determine appropriate management options to reduce bushfire risks to forests, plantations and the community under changed climatic conditions.	**N**	Bushfire CRC, CSIRO, BOM State fire management agencies State Forestry agencies Forest Industry
Identify species or ecological communities under risk from a shift in suitable climatological niches.	**Y**	State Environment/Conservation agencies Commonwealth Dept Environment Forest Industry
Analyse factors limiting species distributions such as extreme climatic events or other correlated factors such as the incidence of fire.	**N**	State Environment/Conservation agencies Commonwealth Dept Environment
Identify possible management options to minimise the adverse effects of climatic changes including “assisted migration” of species to new habitats that are becoming suitable under changed climatic conditions	**N**	State Environment/Conservation agencies Commonwealth Dept Environment
Identify areas where plantations with currently marginal water supply have been established and with the aid of climate models analyse the impact of future climate scenarios on plantation productivity and water availability in these	**Y**	FWPA, LWA State Forestry Agencies Commonwealth BOM, CSIRO

regions.		Forest Industry
Determine the impact of management responses, such as thinning and fertility management on stand survival.	**Y**	FWPA Forestry CRC State Forestry Agencies Plantation Industry
Evaluate alternative species that may be suitable for plantations in areas now or soon to become available for planting, as climate change begins to take effect.	**Y**	FWPA Forestry CRC State Forestry Agencies Forest Industry

Water Quality and Yield		
Priority Research	Status Currently Active (Y/N)	Broad Responsibility
Develop full water balance accounts to evaluate the impact of forests and other land uses, on quantity and quality of water resources in the context of other environmental factors including biodiversity, salinity and carbon sequestration as well as economic and social outcomes of changes	**Y**	eWater CRC State Water agencies State Forestry agencies Commonwealth BOM, CSIRO Forest Industry
Species selection for environments with variable rainfall which have suitable wood properties for industrial use and which generate competitive returns	**Y**	FWPA Forestry, Future Farm Industries CRCs State Forestry Agencies Forest Industry
Develop plantation design and management systems that maximise water availability and optimise water use efficiency. Focus on water use efficiency under a range of environments with particular on management systems for drier environments.	**Y**	Forestry, Future Farm Industries CRCs FWPA, Forest Industry
Research on native forest water use at tree, site and catchment scales.	**Y**	Forest management agencies, LWA

Forest for Multiple Objectives		
Priority Research	Status Currently Active (Y/N)	Broad Responsibility
Investigate opportunities for expansion of Australia's plantation estate.	**Y**	FWPA State Forestry agencies Commonwealth DAFF Forest Industry
Research to support a more comprehensive approach to risk management for forests, identifying key risks to the different forest resources and development of suitable treatments to effectively manage those risks.	**N**	State Forestry agencies Commonwealth DAFF Forest Industry
Evaluate socio-economic impacts of alternative land uses including various production systems involving forest plantations.	**Y**	FWPA, RIRDC Forestry CRC State Forestry agencies Forest Industry
Conduct multi-disciplinary analyses of strategies, including the development of decision support tools, to integrate or segregate production and conservation at different scales and in different forest types.	**N**	Forestry CRC State NRM/conservation agencies State Forestry agencies Commonwealth DAFF, Environment Forest Industry
Develop and implement improved methods for monitoring biodiversity and habitat surrogates	**Y**	State Forestry and Conservation agencies
Long-term, operational-scale, ecological and management experiments to determine the effects of repeated cycles of forest management activities, and time to recovery, for sensitive species of plants and animals.	**Y**	State Forestry agencies
Short rotation and long rotation tree species grown in association with cropping and grazing production systems for increased economic, environmental and social benefits.	**Y**	R&D Corporations (RIRDC, LWA) Forestry, FFI CRCs Forest Industry
Research on plantation designs, configuration and placement in the landscape to maximise biodiversity outcomes in rural landscapes	**Y**	RIRDC, LWA, Forestry, FFI CRCs Forest industry

Health and Biosecurity of Australia's Forests		
Priority Research	Status Currently Active (Y/N)	Broad Responsibility
Analysis of the potential impacts of pests and disease threats on non-commercial values (biodiversity, recreation, water and other values) in forests.	**N**	State land management agencies Commonwealth DAFF
Investigation of appropriate policy and management arrangements across jurisdictions and forest ownerships to effectively respond to biosecurity risks.	**N**	Commonwealth DAFF, Biosecurity agencies
Research into risk management and development of predictive models to help forest managers and owners improve preparation and mitigation strategies. This research should embrace assessment of costs and benefits of different strategies.	**N**	Forestry, Plant Biosecurity CRCs State land management agencies State Forestry agencies Commonwealth DAFF Forest Industry
Improved methods for surveillance and early detection of exotic and established or indigenous forest pests and pathogens, including spatial analysis and environmental data analysis to target resources, sentinel/hazard site surveillance and trapping technologies.	**Y**	FWPA State land management agencies State Forestry agencies Commonwealth DAFF Forest Industry
Continue development of remote sensing technology coupled with ground survey, to provide methods to support health surveillance programs across native forests and plantations	**Y**	Forestry, Plant Biosecurity CRCs State land management agencies State Forestry agencies Commonwealth DAFF Forest Industry
Research on the life cycle, impacts and responses to priority pests and diseases in forest and wood products	**Y**	Forestry, Plant Biosecurity CRCs State land management agencies State Forestry agencies Commonwealth DAFF Forest Industry

Product development and use		
Priority Research	Status Currently Active (Y/N)	Broad Responsibility
Quantify the wood and utilisation characteristics of the younger plantation resource, which has very different properties to the mature native forest wood.	**Y**	FWPA State Forestry agencies CSIRO Forest Industry
Investigate the relationships between genetics, site conditions and silvicultural management and wood production and quality with the objective of maximising the capacity to add value to the resource.	**N**	FWPA CRC Forestry State Forestry agencies CSIRO Forest Industry
Investigate opportunities to add value to timber from both plantations and natural forests particularly for smaller regrowth logs.	**Y**	FWPA CRC Forestry State Forestry agencies CSIRO Forest Industry
Develop replacements for increasingly unacceptable preservative systems, adhesives and coatings (e.g., metal components, VOC emissions).	**Y**	FWPA Commonwealth Forest Industry
Modified or novel products and/or processes that are more suited to the known properties of the near and medium term future resource, including development of non-pulp products capable of being produced from hardwood plantations, providing a financial incentive for longer rotations and higher plantation management costs (e.g. thinning, pruning).	**Y** **(just commencing)**	FWPA CRC Forestry State Forestry agencies CSIRO Forest Industry
Develop new timber composite products -higher value adding.	**Y**	FWPA State Forestry agencies CSIRO Forest Industry

Product development and use (cont.)		
Priority Research	Status Currently Active (Y/N)	Broad Responsibility
Develop improved, intelligent, efficient harvesting and processing technologies for the current resource, to reduce costs and improve recovery and product value including reduced energy consumption (e.g. sawing, drying, machining, protection systems).	**Y**	FWPA CSIRO Forest Industry
Development of integrated approaches to value-added processing, utilisation and end- use for Australian forest products.	**Y**	FWPA CSIRO Forest Industry
Research to support market mechanisms that better connect growers and processors and provide for widespread participation in forest product markets, including for small-scale growers and for environmental services.	**N**	RIRDC. FWPA Forest industry
Whole of life comparisons between wood and substitute materials and systems, including durability models leading to the development of design-based solutions to minimise the environmental impacts of various construction systems.	**N**	FWPA State Forestry agencies CSIRO Forest Industry
Investigate and promote the benefits of timber relative to non-wood building materials, including its energy, greenhouse, environmental and community development advantages.	**N**	FWPA State Forestry agencies CSIRO Forest Industry
Develop and adopt multi-disciplinary approaches to sustainable housing embracing skills in the areas of architecture, energy consumption, renewable natural resources, resistance to natural disaster and recycling.	**N**	FWPA State Forestry agencies CSIRO Forest Industry