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Integrating Farm Forestry and Biodiversity

A discussion paper
by Dames & Moore NRM/FORTECH

RIRDC/LWRRDC/FWPRDC Joint Venture Agroforestry Program
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Foreword

This report investigates ways of practically integrating biodiversity values into commercial farm forestry developments through examination of:

- legal and policy framework for protecting biodiversity;
- scientific evidence concerning biodiversity in commercial farm forests; and
- evidence from existing farm forests.

There are some indications that laws and policies that promote biodiversity and control the removal of native vegetation can be disincentives to farm forestry. The report identifies some opportunities for farm forestry to contribute to biodiversity, particularly where enhancement of biodiversity is an important priority for plantation establishment and management.

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Executive summary

This discussion paper canvasses the relationship between farm forestry and biodiversity. Its aim is to promote consideration of ways of practically integrating biodiversity concerns into commercial farm forestry developments. It examines the legal and policy framework for protecting biodiversity, available evidence on the scientific relationship between biodiversity and farm forestry, and evidence from existing farm forests. It also provides some suggestions for ways of facilitating greater incorporation of biodiversity principles into commercial farm forestry investments and outlines some possible priorities for research and development.

There is an extensive legal and policy framework for the protection of biodiversity in Australia. This covers international agreements and soft law instruments as well as domestic legislation and policies. The extensive nature of these laws and policies provides controls on practices that could adversely affect biodiversity. On the other hand these laws and policies can also act as disincentives to farm forestry investments by creating uncertainty over harvest rights. An examination of the operation of threatened species and similar legislation to protect species of flora and fauna and their habitats suggest they should not be a major source of uncertainty except possibly in NSW. However, legislation and regulations that control removal of native vegetation can be a significant disincentive as there can be basic conflict between protection and establishment of farm forests. While this can be dealt with to some extent by innovative farm forestry designs, there may be some areas where native vegetation retention prevents farm forestry development. A major source of uncertainty for farm forest investors is local government controls but these tend to be focused on land use rather than the protection or maintenance of biodiversity.

CSIRO reviewed evidence from the scientific literature on the relationship between farm forests and biodiversity as part of this study. This investigation revealed relatively little information on the biodiversity impacts of planted trees compared to agricultural land uses. Most of the literature is concerned with comparisons of biodiversity evident in large scale plantations with native forests. However, some opportunities for farm forests to contribute to biodiversity are identified from the scientific literature.

Positive implications of farm forests for biodiversity are derived from: the ability of plantations to enhance re-establishment of diverse natural vegetation; the maintenance of soil and stream biodiversity; the creation of diverse habitat for native fauna; and off-site benefits through the potential to slow or reverse groundwater encroachment and the general improvement in water quality of wetlands. These positive benefits can be associated with increased agricultural productivity as well as providing direct commercial benefits from timber production.

On the other hand some management practices involved with commercially focussed plantations can have adverse implications on biodiversity. For instance, biodiversity benefits of plantations based on trees with a narrow genetic base planted in single age classes and receiving regular use of herbicides, pesticides, baits and fertiliser are likely to be minimal. However, the relatively limited use of chemicals in plantations compared to agricultural crops represents a positive influence. Potential negative off-site impacts include exotic species (notably *Pinus radiata*) establishing in proximal native vegetation areas or *Eucalyptus* hybridising with other species.

There are direct trade offs between farm forestry with primarily commercial goals and farm forestry aimed at maximising biodiversity impacts. These conflicts can be found in almost all aspects of farm forestry establishment and management eg, the size and shape of tree plantings, species utilised, location of plantings and management practices such as weed and pest control. However, at the same time farm forestry also provides considerable scope for commonality in between commercial and biodiversity goals.

The potential to maximise common benefits between biodiversity and commercial timber plantations is reflected in case studies of farm forestry experience. While some of the case studies suggest that there has been little overlap between biodiversity benefits in the past, there is evidence of an increasing willingness to pursue commercial and biodiversity objectives together. For example, the Maritime Pine project in WA aims to plant *Pinus pinaster* in the lower rainfall areas as a commercial element of large scale landscape redesign. Australian Newsprint Mills appears to have had positive biodiversity affects in plantations around Albury in NSW through maintaining remnant vegetation along watercourses, ridge lines and in other strategic areas as well as through enrichment plantings of native vegetation around the edges of some pine plantations. Similarly, the use of multiple species by State Forests in joint venture plantings in northern NSW illustrates some potential for commercially focused mixed species plantings.

The potential trade-offs between commercial and biodiversity objectives of plantations suggested by the case studies and the literature review imply that explicit recognition of biodiversity as a specific goal of plantation establishment and management is vital if commercial farm forests are to have positive biodiversity implications. Suggested ways of achieving this include:

- development of **innovative approaches to farm forestry design** - eg, through incorporating patchiness in species and age classes, planting of indigenous or habitat species on less productive areas within and around farm forests, use of buffer plantings, use of nurse crops in farm forests, and dispersal of slash rather than burning;
- development of **management practices** with more benign biodiversity effects should be seen as a priority in development of codes of practice for farm forests;
- consideration of the role of farm forests in **property management plans** as part of whole farm systems;
- new **research and development** focussed on the biodiversity impacts of farm forests compared to agricultural land uses including analysis of existing farm forest resources as a source of biodiversity, and a focus on regional level needs for biodiversity conservation;
- more explicit recognition of the **public and private costs and benefits** associated with biodiversity enhancement to assist in determining appropriate levels of public assistance to achieve biodiversity goals;
- incorporating improved biodiversity protection into **catchment management planning and enhanced bioregional planning** so that regional level actions can be factored into farm forests in whole farm plans; and
- improved information flows to landowners and farm forest investors to enable them to better assess the benefits and costs of pursuing biodiversity conservation as part of commercial farm forestry.

It is suggested that large scale expansion of farm forestry will be dependent on private investment but that governments have a role in enabling policies for promoting biodiversity as an explicit goal. This includes sharing the costs of research and development, ensuring dissemination of appropriate information including through the availability of appropriately trained extension officers, promoting the adoption of property management planning, identifying the costs and benefits from biodiversity in farm forests, and the development and application of cost sharing principles for funding of farm forestry investments.

1. Background to discussion paper

This paper assesses the relationships between farm forestry and biodiversity and proposes a framework for action with a view to maximising commonalities between commercial farm forestry developments and maintaining and enhancing biodiversity. It is presented as a basis for discussion of key issues to promote the reconciliation of commercial production and biodiversity goals in farm forests.

Relevant issues are first addressed through an outline of the legal and policy framework relating to biodiversity. This covers the range of influences from international treaties to local government planning regulations (sections 2.1 and 2.2). The paper then sets out key issues arising from a review of scientific literature of the links between farm forest plantings and biodiversity (section 2.3). Some case studies are used to illustrate how biodiversity can be incorporated into commercial farm forests and opportunities for enhancing commonalities between farm forestry and biodiversity are discussed (chapter 3). Finally, potential means of practically reconciling commercial farm forestry and biodiversity are proposed (chapter 4).

Since the late 1960s, Australian communities have asked questions about how land, vegetation and water resources are managed. One issue which the community focussed on was the future for Australia's biological diversity - its plants, animals, microbes and fungi, the genes that they contain and the ecosystems of which they are a part (CSIRO 1996a). In recent years this has been reflected in growing interest in ensuring production systems are consistent with principles of ecologically sustainable development.

In response to these changing community attitudes, governments in Australia introduced policies, legislation and regulations as well as programs to encourage and support biodiversity conservation. In 1992, the Commonwealth Government introduced a comprehensive approach to achieving Ecologically Sustainable Development (ESD) across major economic sectors. The overarching philosophy of the forestry component of the ESD policy is that the benefit to the community from forests can be optimised through forest management policies which protect conservation values and promote ecologically sustainable commercial and non-commercial uses (ESDSC 1992).

The ESD policy emphasises the importance of ecological sustainability but also recognises that for this to be achieved it was necessary for economic activity to be socially and economically sustainable. In other words it recognised that it was necessary to integrate the needs of communities, enterprises and the environment if the long term future of Australia's resource base and way of life is to be sustained.

As part of approaches to ESD, industry sectors developed frameworks for adopting it as part of best management practices. The forest and agricultural industries worked with the Commonwealth and State/Territory governments to develop frameworks for implementing ESD (Commonwealth of Australia 1992). These frameworks identified how to design resource management plans and implement best management practices for ecologically sustainable development.

Since preparation of the ESD strategies, many activities have been implemented by forest and agricultural industries including property management planning, codes of forest practice and integration of on-farm reserve areas to conserve remnant vegetation. Governments now prepare reports on the state of the environment (eg, CSIRO 1996b, NSW EPA 1995, and

SDAC 1996) and publicly listed companies now report to their shareholders and the stock exchange on their environmental management (eg, North 1996; WMC 1995 and WMC 1997).

These approaches to sustainable land management are being built on by the significant increased in expenditures provided under the Natural Heritage Trust (NHT) and the development of new legislation at the Commonwealth level. The NHT will provide over \$1.25 billion while also establishing a capital base of \$300 million to be retained in perpetuity to fund environmental activities. The principles on which the Trust is established include significant improvement and greater integration of biodiversity, land, water and vegetation management on public and private land. It also specifically identifies farm forestry, together with bushcare, as a focus for activities to protect and enhance native vegetation across Australia.

The *Environment Protection and Biodiversity Conservation Bill 1998* introduced by the Government identified loss of biodiversity as one of the greatest environmental challenges facing Australia. This bill, which lapsed following the prorogation of Parliament on 31 August 1998, aimed to rationalise Commonwealth involvement in environmental issues including promotion of biodiversity and protection of endangered species and ecological communities.

In addition, the Commonwealth's recognition of the importance of integrating economic and ecological sustainability in land management systems is recognised in the Productivity Commission's Ecologically Sustainable Land Management Inquiry (IC 1997). This inquiry has conducted a comprehensive review into ecologically sustainable land management. A draft report was released in September 1997 and following public hearings on this report, the final report is awaiting tabling in the Parliament.

With the increasing use of cleared farm land to produce forest and wood products - either as plantations or farm forests - there is a need to develop a better understanding of farm forestry and biodiversity conservation. In addition, the spread of the landcare movement and increased public funding aimed at reducing environmental degradation provided through the Natural Heritage Trust has seen an increasing emphasis on the links between commercial production and environmental protection including biodiversity. Whatever the goals of individual landowners, there is a growing interest in identifying management practices that integrate commercial production of trees on farms with environmental protection including biodiversity conservation.

2. Farm forestry and biodiversity conservation - the existing situation

2.1 The legal and policy framework

Australia has a comprehensive legal and policy framework in place to protect biodiversity as part of wider approaches to ESD. This has been developed in response to growing community concern over environmental protection as well as international environmental initiatives. The level of response has been comprehensive, from the Commonwealth government reflecting domestic and international issues, across State governments concerned with land management, down to local government actions related to land use planning and development.

International instruments and initiatives

It is appropriate to commence a review of issues relevant to the integration of biodiversity conservation and farm forestry by reference to international developments because they have, in many respects, an enormous influence on legal and policy initiatives at all levels of government in Australia, but especially at Commonwealth and state levels.

The Commonwealth Government has entered into a number of legally binding international instruments relevant to farm forestry and biodiversity conservation including:

- **Convention on Biological Diversity (1992)** - This convention agreed upon at the Rio de Janeiro, United Nations Conference on Environment and Development, is a legally binding document. The principle objectives of the convention is the conservation of biological diversity and, sustainable use of its components and a fair and equitable sharing of the benefits arising out of the use of genetic resources including by appropriate access to genetic resources. Biological diversity is defined to mean the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems.
- **CITES (1973)** - The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty which was ratified by Australia in 1976. It is one of the most widely accepted treaties in the world with more than 125 signatories. It is directed at trade and is based on the view that the preservation of endangered species will be enhanced if there are controls on international markets. The Convention has application to forestry operations because trees can be included in the appendices of species. To date the convention has had particular significance regarding timber species taken from tropical rainforests. Production of this timber in sustainable farm forestry operations would be consistent with the CITES Treaty and could attract a premium in world markets because of market supply restrictions resulting from the CITES Treaty.
- **Framework Convention on Climate Change (1992)** - This convention relates to forests in their capacity to be stores of greenhouse gasses. Under the convention, there are obligations to promote the sustainable management and conservation of sinks and stores of greenhouse gasses. Forests - whether natural areas, plantations or farm forests - are specifically identified as desirable carbon stores (Article 4(1)(d)).
- **Convention to Combat Desertification (1994)** - this convention targets countries experiencing serious drought and/or desertification, particularly in Africa, but includes Australia. This convention is expected to come into force in 1998. It promotes an integrated approach to control desertification. It looks at the physical, biological and

socio-economic aspects of the processes of desertification and drought. Forests and farm forestry are identified as specific land uses which help prevent desertification processes and thus are of importance under this convention.

- **Ramsar Convention (1971)** - the Convention on Wetlands of International Importance Especially as Waterfowl Habitat requires parties to promote the conservation of listed wetlands and the 'wise use' of wetlands within their territory. The convention is unlikely to have application to farm forestry operations except where they are likely to significantly alter the hydrology of catchments which include Ramsar wetlands. This may be an issue in parts of the Murray-Darling Basin, for example.

Although these international agreements are described as being legally binding, under general principles of international law the agreements themselves cannot bind citizens of the states which are signatories to the agreements. Rather the state, once it has signed and ratified the treaty or convention, has an obligation to then implement the terms of that convention within its own jurisdiction by way of its own domestic legislation.

Examples of Commonwealth and state laws which relate to these international agreements include the:

- Environment Protection (Impact of Proposals) Act (Commonwealth, 1974);
- Endangered Species Protection Act (Commonwealth, 1992);
- Threatened Species Conservation Act (New South Wales, 1995); and the
- Flora and Fauna Guarantee Act (Victoria, 1988).

Soft law instruments

Australia has also ratified "soft law" instruments which, although not legally binding, indicate the policy direction and likely future expectations which will influence the management of natural resources for farm forestry. In addition to the World Charter for Nature ratified in 1982, soft law instruments ratified by Australia include:

- **Agenda 21 (1992)** - this Program of Action for Sustainable Development was one of the agreements which came out of the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro 1992. It, together with the Rio Declaration on Environment and Development, has been of considerable influence on developments both internationally and at national government levels since that time. Agenda 21 is very lengthy but has been particularly adopted by some State and local governments in Australia to help direct planning decisions. It gives guidelines and establishes a framework for the world community to use when making decisions regarding the environment and development. Agenda 21 specifically identifies programs for reforestation and combating desertification which are relevant to farm forestry in Australia.

- **Declaration on Environment and Development (1992)** - like Agenda 21, this statement gives guidelines and establishes a framework for the world community to use when making decisions regarding the environment and development. It particularly provides a framework within which biodiversity conservation and sustainable farm forestry can be integrated into land use planning and resource management in Australia.
- **UNCED Statement on Forest Principles (1992)** - the non legally binding authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests (more commonly known as the United Nations' Statement on Forest Principles) also resulted from the Rio de Janeiro Conference. It aims to relate the subject of forests to the entire range of environment and development issues. The statement makes it clear that forestry issues should be examined in a balanced manner within the overall context of both the environment and development (preamble paragraph (c)).

In addition to the various international instruments described above, there are a number of other international activities which should be noted regarding forestry issues. There had been an attempt to conclude a legally binding agreement on forests at UNCED in 1992. This failed because of deep divisions between developed and developing countries.

It appears that with regard to future directions which might affect farm forestry from the international level there are at least two options and possibly a third. The first option is a separate convention on forests, and the second is a Protocol on Forests to the Convention on Biological Diversity. The third option is an expansion of the principles in various existing international agreements relating to forestry. The United Nations General Assembly, in considering a report by the Commission for Sustainable Development (CSD), in June 1997 has decided that it will allow another 3 years for consideration of the potential for an international convention on forests. To pursue this an Intergovernmental Forests Forum has been formed which is charged with reporting on the need for, and possible elements of, a convention to a meeting of the CSD in the year 2000. Whatever happens, it is likely that international and Commonwealth developments will demand increased integration of biodiversity conservation into primary production and natural resource management activities in Australia.

2.2 Australian legislation and policies

As already mentioned there is a comprehensive set of laws and policies ranging across all levels of government in Australia that form a solid basis for integrating biodiversity and farm forestry. These laws and policies have developed in response to community concerns about resource management and the state of the environment. These community concerns are recognised by the forest industry, forest growers and farmers (GA, NAFI, AFG, and NFF, 1997).

International treaties and conventions ratified by Australia are made effective and legally binding by enactment of legislation in Commonwealth and state jurisdictions. In addition to its role in the development and implementation of international initiatives, the Commonwealth government also has an extensive network of policies and laws related to the maintenance and protection of biodiversity which forms part of a national approach to sustainable forest management. Much of this legislation relates to the conservation and sustainable management of native forests but there is also a considerable body of legislation and policy which relates to plantations and planting of trees on farms. The Commonwealth Government's *Environment Protection and Biodiversity Bill 1998*, introduced into the last Parliament, aimed to rationalise the Commonwealth's involvement in environment issues by

replacing a number of existing Acts and limiting Commonwealth involvement to matters of significant environmental significance.

As State governments have primary responsibility for land management in Australia, they also have a comprehensive network of administrative and legal arrangements related to planning for forest production. While actual approaches vary between the states, arrangements relevant to farm forestry and biodiversity typically include detailed planning legislation, endangered and threatened species protection laws, environmental protection legislation, and direct controls over forestry practices.

Local governments can also have direct influences on farm forestry and biodiversity through the implementation of planning requirements. These can include requirements relating to biodiversity and environmental protection as well as other issues relevant to local governments. Procedures for developing and applying these local controls are set by State environmental and planning legislation.

2.2.1 Legislation

The following summary of existing legislation and policies shows that forestry activities are highly regulated in Australia across all levels of government and biological diversity is likely to remain a key element in the regulatory framework for forests. There are a number of common forms of legislation and policies which affect the integration of farm forestry and biodiversity conservation in Australia. These include:

- **Conservation of threatened species** - at both Commonwealth and state levels, there are laws which seek to conserve biodiversity and require biodiversity conservation to be considered when planning land use and resource management activities. Examples include the *Endangered Species Protection Act (Commonwealth, 1992)*, the *Threatened Species Conservation Act (Tas, 1995)*; *Flora and Fauna Guarantee Act (Vic, 1988)*, the *Nature Conservation Act (Qld, 1992)*, *Wildlife Conservation Act (WA, 1950)*, the *Threatened Species Conservation Act (NSW, 1995)* and the *National Parks and Wildlife Act (NSW, 1974)*. The implications of this type of legislation are discussed in Section 2.2.3.
- **Management of native vegetation** - at state and local government levels there are laws which seek to manage remnant stands of native vegetation. Examples include the *Native Vegetation Act (SA, 1991)*, and the *Native Vegetation Conservation Act (NSW, 1997)*. These Acts and regulations specifically exempt planted trees.
- **Land use planning and development approvals** - at state and local government levels there are laws which seek to control the way land and other resources are developed and used by individuals to safeguard the interests of the wider community. Examples include the *Development Act (SA, 1993)*, the *Land Use Planning and Approvals Act (Tas, 1993)*; the *Environmental Planning and Assessment Act (NSW, 1979)* and the *Local Government (Planning and Environment) Act (Qld, 1990)*. These laws typically regulate changes to land use. For example, the *Development Act (SA, 1993)* defines ‘commercial forestry’ as the use of land for planting, maintaining and growing trees for commercial production of timber or other forest products from plantation or native forests. Any activity which constitutes development requires an approval from either the local council or the Development Assessment Commission who must assess the proposal by

reference to the applicable development plan. Thus the extent to which consideration of biodiversity conservation can be had when assessing development proposals depends very much upon the provisions in the relevant development plan. All plans contain specific provisions regarding the clearance or removal of native vegetation. Where a development or project is assessed by the Minister as being one of major environmental, social or economic importance, the Development Act's Environmental Assessment Provisions come into operation.

- **Catchment management and landcare** - at state and local government levels there are laws to ensure that land and vegetation resources are used and managed in such a way that the quantity and quality of surface water is sustained. Examples include the *Catchment and Land Protection Act* (Vic, 1992), the *Conservation and Land Management Act* (WA, 1984), the *Catchment Management Act* (NSW, 1989), and the *Soil Conservation and Landcare Act* (SA, 1989). These laws generally encourage sustainable land uses such as well designed and managed farm forestry. They frequently use catchment plans or strategies as a mechanism for planned land use and there are normally opportunities to integrate farm forestry and biodiversity conservation within these plans and strategies.
- **Regulation of forestry activities** - the States adopted laws to regulate the harvesting and management of forests and forest industries after Federation. Examples include the *Local Government (Forest Resources) Act* (SA, 1944), the *Forestry Act* (Qld, 1959), the *Forests Act* (Vic, 1958), the *Forestry Act* (Tas, 1920), and the *Forestry Act* (NSW, 1916). These laws generally created government institutions to regulate forestry in native forests and plantations. Later, legislation was used to impose forest practices codes which regulate forest management, harvesting and site maintenance for native forests and plantations. At the same time, the Commonwealth used its constitutional powers to control the export of certain forest products as a mechanism for ensuring biodiversity conservation in forests. For example the *Export Control (Unprocessed Wood) Regulations* (Commonwealth, 1986) and the *Export Control (Hardwood Wood Chips) Regulations* (Commonwealth, 1996) both created under the *Export Act* (Commonwealth, 1983). However, these controls are now being removed for plantation grown wood subject to the implementation of codes of practice.
- Similarly, as private investors became more important in forest industries some governments established agreements by law under the relevant forestry acts to secure enterprise rights for these investors. For example the *Forests (Wood Pulp Agreement) Act* (Vic, 1936), the *Forests (Bowater-Scott Agreement) Act* (Vic, 1986) and the *Florentine Valley Paper Industry Act* (Tas, 1936). These examples make it clear that , some governments have been willing to provide security for forestry investments in the form of specific legislation.
- **Environmental protection** - the Commonwealth and state governments have enacted laws to protect the environment from pollution and degradation by misuse or mismanagement. For example the *Environmental Protection (Impact of Proposals) Act* (Commonwealth, 1974), the *Environment Protection Act* (WA, 1986), the *Environmental Planning and Assessment Act* (NSW, 1979) and the *Environmental Management and Pollution Control Act* (Tas, 1994). These laws set out regulatory frameworks - typically overseen by an Environment Protection Authority - which seek to prevent damage to the

environment from industrial, development or resource management activities. In some states there are specific regulations relating to management of forestry operations which are relevant to farm forestry and biodiversity conservation.

- **Plantations and farm forests:** New South Wales has enacted the *Timber Plantations (Harvest Guarantee) Act 1995*. This legislation provides a process whereby landholders who have established plantations or farm forests can have these accredited and thereby exempt them from the provisions of other state legislation that may prevent the crop from being harvested. Accreditation is conditional on compliance with a code of practice.
- Tasmania's *Forest Practices Act 1985* provides a system whereby forest and plantation owners can apply for their estates to be declared Private Timber Reserves. Forests and plantations with this status are exempt from planning regulations. This provides a substantial degree of protection for the right to harvest the crop.
- Victoria's planning provisions permit timber production in rural zones and require that timber production be conducted in accordance with a code of practice. Timber production is defined to include plantation establishment, management, and harvesting. Planning permits are therefore not generally required to harvest a plantation. Farm forestry, as defined in the regulations, is specifically exempt from planning provisions and from application of the code of practice.

2.2.2 Proposed Commonwealth Legislation

As already mentioned, prior to prorogation of the Parliament on 31 August 1998 for a federal election, the Commonwealth Government had introduced the *Environment Protection and Biodiversity Conservation Bill 1998* which made significant changes to existing Commonwealth environment legislation. While the Bill lapsed with the prorogation of Parliament, the proposed changes are expected to be taken up by the new Parliament. The Bill replaces 5 existing Commonwealth Acts - the *Environment Protection (Impact of Proposals) Act 1975*, the *Endangered Species Protection Act 1992*, the *National Parks and Wildlife Conservation Act 1975*, the *Whale Protection Act 1980* and the *World Heritage Properties Conservation Act 1983*.

The Bill more explicitly defined the Commonwealth's responsibilities with regard to environment and biodiversity conservation as relating to actions that are likely to have a significant impact on matters of national environmental significance. As such a primary aim of the Bill was to reduce overlap in environmental responsibilities between the Commonwealth and State and Territory Governments. These approaches in the Bill were based on an agreement given in principle endorsement by the Council of Australian Governments (COAG) in 1997.

With regard to biodiversity and farm forestry, key aspects of the proposed legislation included:

- provision for voluntary conservation agreements with landholders for biodiversity conservation;
- provision for the protection of endangered or threatened species and ecological communities, and the specification of six categories consistent with the International Union for the Conservation of Nature categories;
- provision to prepare bioregional plans within a Commonwealth area and to cooperate with States and Territories in preparation of bioregional plans;
- allowance for the Commonwealth to accredit and rely upon State assessment and approval processes for actions impacting upon matters of national environmental significance; and
- provision for increased recognition of the importance of identification and monitoring of components of biodiversity.

2.2.3 Policies

In addition to the above legal framework, governments have developed a comprehensive set of policies for ensuring environmental protection (in which biodiversity is a driving force) relevant to the forest sector, including farm forestry. Particular policies relevant to biodiversity and plantations include:

- **National Forest Policy Statement** - the NFPS, which has been signed by all states, spells out the roles of each level of government and private landowners in forest management and provides a framework for governments to take action to implement ecologically sustainable management of forestry in Australia.
- **National Strategy for the Conservation of Australia's Biological Diversity** - this was prepared by ANZECC in consultation with a range of bodies including the Australian Forestry Council. It takes into account the provisions of the Convention on Biological Diversity. Objective 2-4 deals specifically with forestry and advocates achieving the conservation of biological diversity through the adoption of ecologically sustainable forest management practices. The protocol notes that in terms of forestry issues it will be important to ensure that state and territory management legislation and administrative arrangements take into account the conservation of biological diversity.
- **Plantations 2020 Vision** - the Commonwealth in conjunction with the state governments through the Ministerial Council on Forestry, Fisheries and Aquaculture, and the forest industries has endorsed a national plantations strategy aimed at trebling the area of plantations by 2020.
- **National Principles for Forest Practices Related to Wood Production in Plantations** - these principles were approved by Commonwealth and state

governments in 1995. These include a set of “Principles of Environmental Care” which include protection of flora and fauna in both plantation establishment and management.

- **Intergovernmental Agreement on the Environment (1992)** - policy developments both within the Federal government and state governments have no doubt been influenced by the Intergovernmental Agreement on the Environment reached between the Commonwealth, states and territories and the Australian Local Government Association in May 1992. It sought a more cooperative approach to environmental issues as part of approaches to ESD.
- **Wood and Paper Industry Strategy** - this strategy released in 1995 is consistent with principles established by the 1992 National Forest Policy Statement. It includes Commonwealth commitment of \$53 million to ensure rapid development of Regional Forest Agreements. It also includes \$30 million between 1995/96 and 1999/2000 to implement the Plantation-Farm Forestry Program - an investment aimed at expanding the resource base.

2.2.4 Implications for farm forestry and biodiversity

Farm forest developments are subject to the same legislation and regulations dealing with protection of native flora and fauna as other land uses. To the extent that farm forestry involves the planting of trees on cleared agricultural land, it is generally regarded as having positive implications for biodiversity. However, there are some aspects of farm forestry practices which could be regarded as having potentially adverse impacts on biodiversity (see section 2.3). Any such impacts, particularly for larger scale projects, are likely to be controlled by existing government laws and policies relating to forestry developments. However, there is some likelihood that small scale farm forests could be exempt from such controls as they would not fall within the ambit of local or state government legislation. For example, Victoria's planning provisions exempt farm forestry from the requirements of the code of practices that applies to timber production activities on private land. The rationale for this exemption is that farm forestry is conducted on a small scale and should be considered in the same way as other agricultural practices (which are not regulated by codes of practice) rather than being equated with industrial plantations.

In SA and WA, some farm forestry plantings have been criticised because they have resulted in the clearing of some individual remnant trees in paddocks. However, these clearances have been approved under existing state legislation designed to protect remnant vegetation with biodiversity significance, and the clearance for farm forestry is relatively small compared to similar clearances for vineyard, crop and horticultural land uses. So long as farm forestry is treated consistently with other land uses, there should be no reason to isolate farm forestry for particular criticism. In fact, it could be argued that many farm forests create more habitat diversity which enhances local biodiversity, compared with other land uses.

The other side of legislative and policy controls is that they can act as disincentives to farm forestry investments. Key disincentives were identified in the Commercial Farm Forestry Strategy (Dames & Moore NRM *et al.*, 1996). There is some evidence that local government controls, in particular, are a cause of uncertainty which discourages farm forestry in Australia eg, the requirement for development planning consent for even small tree plantings in some local government areas can discourage landowners from pursuing investments in trees

(FORTECH 1997). However, where such controls are strongest they relate to land use, not to the protection or maintenance of biodiversity. Again, in general, there is a growing acceptance that farm forestry can have significant environmental benefits, including for biodiversity.

Nevertheless, uncertainty surrounding harvest rights arising from the legislative and policy framework has been identified as an impediment to adoption of farm forestry (Dames & Moore NRM *et al.*, 1995). The key issue related to biodiversity protection which creates uncertainty over farm forest harvest rights is the potential use of threatened species and similar legislation to prevent harvest of planted forests. These laws operate in different ways in different states which present varying implications for farm forestry. Table 2.1 summarises relevant legislation across Australia and the likely implications for farm forestry.

Table 2.1: Endangered species and native vegetation legislation in Australia

Jurisdiction	Legislation	Description/Implications
Commonwealth	Endangered Species Act 1992	Legislative basis for Endangered Species Program, which provides funding for species recovery plans
New South Wales	Threatened Species Conservation Act 1995 National Parks and Wildlife Act 1974; Environmental Planning and Assessment Act 1979	Controls activities that may affect habitats of threatened species Provides for conservation agreements covering private land Basis for planning policies and controls of uses of private land
Queensland	Nature Conservation Act 1992	Protection of habitat on private land through agreements with landholders
Victoria	Planning and Environment Act 1987 Flora and Fauna Guarantee Act 1988	Basis for planning policies and controls of uses of private land Protection of habitats of threatened species
South Australia	Native Vegetation Act 1991	Controls clearing of all native vegetation
Tasmania	Threatened Species Conservation Act 1995	Protection of habitat on private land through agreements with landholders
Western Australia	Wildlife Conservation Act 1950	Protection of habitat on private land through agreements with landholders
ACT	Nature Conservation Act 1980	Enables landholders to be directed to protect native vegetation
Northern Territory	Parks and Wildlife Conservation Act 1993	Protection of habitat through agreements with landholders and declaration of protected areas

While the Acts appear to be similar in intent and approach, the level of real or perceived disincentive stemming from endangered species legislation varies between states. For example, the New South Wales legislation is considered a major disincentive while in other states it is not generally considered a major concern. This difference may be due to how the responsible agencies are applying the legislation in NSW. For example, difficult and time-

consuming application procedures may be applied and there may be no assurance of the outcome. To address this issue, in late 1995 the New South Wales Government introduced legislation that provides a process to guarantee the right to harvest timber from accredited plantations. This legislation was considered by Australian Forest Growers to be fundamentally flawed. While it was amended in 1997 to address one major area of concern, it is not yet clear whether it will be effective or acceptable to forest growers. This legislation should not be confused with "forestry rights" legislation, such as Victoria's *Forestry Rights Act 1996*, which enables legal separation of a tree crop from the land on which it is growing.

Legislation relating to the protection of native vegetation can also have disincentive effects on farm forestry by preventing removal of vegetation as part of plantation establishment. Legislation and regulations that control removal of native vegetation provide a high level of protection for biodiversity and are of current or potential concern to farm forestry investors in several states, especially NSW and South Australia. There are remnants of native vegetation on many sites landholders may plan to use for farm forestry and it may be necessary to remove some remnants to enable establishment. South Australia's *Native Vegetation Act 1991* requires that approval be obtained to clear any native vegetation. This approval process is generally considered by plantation developers to be a major impediment due to the cost and long period required to consider applications and negotiate conditions for clearing. It is likely that similar delays would apply where native vegetation removal was required for farm forestry.

Victoria's planning provisions define the circumstances where approval is required to remove native vegetation. It is likely that these would also cause costs and delays in some circumstances.

There is no statewide system controlling native vegetation removal in Queensland or Western Australia. Individual local governments may apply clearing controls. Tasmania's Private Timber Reserve system provides an effective means for landholders to avoid further regulatory impediments provided that they comply with a code of practices.

The conflict between biodiversity protection and farm forestry establishment is also present where native grasslands are concerned. Native vegetation legislation applies to native grasslands and their presence would prevent replacement with trees.

While there is potential for conflict between biodiversity protection and plantation establishment, innovative designs may help avoid or minimise the removal, disturbance or degradation of remnant vegetation associated with farm forest establishment. However, design may not provide all the answers as there is potential for conflict between farm forests and protected remnant vegetation for instance through colonisation by plantation species.

It has also been argued that Commonwealth government controls requiring licences to be obtained for the export of unprocessed forest products have applied costs and risks which act as disincentives to investment in timber production. For plantations, this issue was addressed under the National Forest Policy Statement which provided that the requirement to obtain export licences would be removed when a code of forest practice which prescribes adequate environmental protection requirements is in place. This has now occurred for Western Australia, Tasmania, Victoria and South Australia.

With these types of changes in recent years it appears that the risk associated with a number of key legislative and policy measures which have been identified as impeding plantation investments have been removed by governments. This includes potential threats to harvest

rights stemming from legislation to protect endangered species. While considerable uncertainty for plantation investments remains with respect to a number of issues, particularly with regard to the variability of local government requirements on plantations, in general it appears that biodiversity related laws and policies do not treat plantations any more severely than other land use activities. This, combined with the removal of export controls from plantation grown material, should assist the certainty with which farm forestry investments can be made.

It is concluded that legislative and policy frameworks to protect biodiversity do not represent unfair disincentives to farm forest plantings, except in New South Wales. It is likely that other more significant disincentives come from local government concerns and from market related factors (Dames & Moore NRM *et al.*, 1996).

2.3 Review of scientific evidence of relationships between farm forests and biodiversity

As part of this study CSIRO conducted a review of scientific literature related to farm forestry and biodiversity (Milestone 2 Report). Understandably, much of the existing literature is based on the biodiversity implications of large scale plantations, and in particular, on comparing these types of plantations with biodiversity in native forests. CSIRO found little evidence of studies comparing the biodiversity value of farm forestry on cleared agricultural land with that of land when it was used for traditional agricultural enterprises. This largely reflects the history of forest plantation and agricultural development in Australia where farm forestry is only a relatively recent and developing approach to commercial timber production. Key conclusions from the CSIRO study were:

- while it is commonly stated that farm forestry can enhance the biodiversity values of agricultural landscapes, the evidence that this is the case is sparse and somewhat equivocal;
- while landholders generally plant trees for purposes other than commercial timber production, they generally see the value of wildlife conservation as a low priority;
- evidence of birds in *Pinus radiata* plantations suggest that biodiversity is likely to be greatest on the edges of such monoculture plantations;
- insect species appear to be well represented in *Pinus radiata* plantations;
- current management practices emphasising the need to control weeds to minimise competition for soil moisture, restrict the opportunity for vegetation diversity along with habitat quality for birds and other flora and fauna species;
- large scale *Pinus radiata* plantations can invade and successfully establish in adjoining native bushlands;
- there is evidence that farm forest hardwood plantations have more microarthropod species beneath them than does open pasture;

- the relative ease with which Eucalyptus species can hybridise may threaten adjoining native forests;
- the limited and diminishing genetic base on which Eucalypt plantations are being based dictates that the direct biodiversity value of hardwood plantations on agricultural land will be extremely limited - less than that of the land where native pasture species form a significant part of the sward, but greater than that of monoclonal crops such as wheat;
- increased habitat for major predators of native fauna such as foxes, feral cats and wild dogs could lead to increased threats of predation to native fauna - however, this may be balanced by the provision of new habitat for native fauna;
- off site benefits of farm forest plantations may include improved stream water quality with enhanced environment for stream biota. While extensive tree plantations have the potential to stem rising groundwater, the extent to which farm forest plantations could reduce groundwater levels and simultaneously provide commercial returns is questionable (Powell, 1996); and
- the use of herbicides, pesticides, baiting, and fertilisers as part of hardwood plantation management do not represent a significant departure from existing agricultural practices.

The major implication of these results from the literature survey is that design and management practices for farm forestry plantings are likely to be important if contribution to biodiversity is desired as a major goal of such plantings. For instance, Mason (1994, p.13) recognises that “plantations, particularly those established on ex-farming land, may have a useful role to play in expanding the habitats available for certain species of native flora and fauna. It is possible that through design, the ecological value of plantations may be enhanced by retention of habitat trees, planting mixed species and development of desirable communities in filter strips and other non-harvestable areas.” Further, the literature survey reflects the relatively limited literature on the biodiversity benefits from non-commercial plantings through environment protection programs such as the One Billion Trees and River Murray Corridor of Green programs. However, it is likely that the more positive implications for biodiversity from such plantings are at some cost in terms of their viability for commercial timber production.

2.3.1 Opportunities for enhancing biodiversity impacts of commercial farm forestry

There are practical management and economic opportunities for managing farm forestry systems in ways compatible with biodiversity conservation objectives. In addition, there is scientific evidence that farm forestry designs which specifically encourage biodiversity conservation can result in reduced agricultural management costs and increased production (Bicknell, 1992; Bird *et al.*, 1992; Bird *et al.*, 1994; Lefroy, 1991). While there is also some evidence that farm forestry can lead to reduced disease and pest risks (Nick Reid UNE, pers. comm.) there is also some evidence that transferring areas from traditional agricultural activities to plantation forestry may increase the presence of vertebrate pests (Catling and Burt, 1995).

Some of the key opportunities available are illustrated by the following examples:

- **Some plantations enhance re-establishment of diverse natural vegetation** - commercial plantings of Queensland Maple (*Flindersia brayleyana*) and Red Cedar

(*Toona ciliata*) were found to support complex understorey flora with more than 350 species found in some plantations. Most plants grew from bird dispersed seeds so the use of tropical plantations by birds and other wildlife is important. Hoop Pine (*Araucaria cunninghamii*) plantations were also found to support indigenous colonising species. In some cases the colonisation of plantations is faster than natural succession on degraded land (Keenan and Daly, 1996).

- **Tree plantations on farms can maintain soil biodiversity** - there is more microbial and microarthropod activity in the soil under trees and farm forestry plantings than in soil on cleared or unplanted land. For example, soil beneath trees near Armidale, NSW supported more than 115 mg CO₂/kg soil/day compared with less than 62 mg CO₂/kg soil/day in soil on cleared areas. Similarly, areas beneath trees supported more than 14,500 collembola per m² and almost 40,000 acari per m² of soil compared with less than 3,500 collembola per m² and almost 26,000 acari per m² of soil in cleared areas (Chris Gentle, UNE, pers. comm.).
- **Trees planted on farms can maintain stream biodiversity** - trees and other agroforestry plantings along the riparian zone and in recharge areas have the potential to control rising saline groundwater and consequently to control land and stream salinisation (eg, Schofield *et al.*, 1991; Stirzaker *et al.*, 1996). In so doing, they contribute to the maintenance of stream biodiversity by preventing the rise of stream salinity levels as well as contributing to the capture of nutrients and bacterial pollutants in runoff from the catchment (eg, Brechwaldt, 1983; Hobbs *et al.*, 1993).
- **Farm forestry can provide an income from farm land managed for habitat** - it is possible to design farm forestry plantings along riparian zones, around dams and saline sites, in shelter and wildlife corridors, or in wide spaced agroforestry systems which integrate periodic harvest of selected and specially managed trees with the provision of habitat. The Royal Australian Ornithological Union (RAOU) identified the loss of temperate woodland as a significant habitat issue (RAOU, 1996) while at the same time researchers have identified the advantages of woodland shelter for some livestock enterprises (eg, Bird *et al.*, 1992).
- **Plantations offer diverse habitat** - because of their perennial nature and more complex form, plantations of trees provide more diverse habitats - both above and below the ground - than other agricultural land uses such as annual crops and pastures. For example, from studies in north-eastern Victoria, Suckling *et al.*, (1976) found that for birds, 50 percent of the 71 species (including two exotic species) occurring in mature eucalypt forests were observed in *Pinus radiata* plantations. While the extent to which these plantations provide high value habitat will depend on what the birds were utilising the forests for, it is likely that their presence would be greater than if the land was under agricultural uses;
- ♦ In the case of mammals, those absent from *Pinus radiata* plantations compared to native Eucalypt forests were mainly arboreal including those totally dependant upon eucalypts for food and shelter (eg, Koala). Having already lost the cover of native vegetation, and with it the tree dependent fauna, the planting of trees on farms for commercial or environmental service reasons would enhance the habitat for native

fauna on these areas and so contribute to biodiversity.

- ◆ As an example, over the life cycle of the *Pinus radiata* plantation most insect orders (Diptera, Hemiptera, Lepidoptera) were represented similarly to mature Eucalyptus forests, but representatives of the parasitic wasp group (Hymenoptera) were less well represented. This led Suckling *et al.*, (1976) to suggest the risk of instability of insect populations in *Pinus radiata* plantations was greater although they provide a caution stating that “the ecological status of many insects that were trapped in pine and eucalypt plantings is still largely unresolved”.
- ◆ In the case of native forests, it is the higher fertility areas within the native forests that carry a disproportionate number of native species, eg, for arboreal animals 63% were found in the most fertile 9% of a dry sclerophyll forest in the Eden area (Braithwaite, 1984). Ironically it is the native vegetation of these more fertile areas (because of their agricultural potential) that are less well represented in conserved areas (eg, Braithwaite *et al.*, 1993). Subject to the Eucalyptus species selected for planting, the enhanced fertility of agricultural areas suggests plantations on such areas would provide attractive foraging opportunities.
- **Agroforestry increases diversity of productive plants** - the use of agroforestry shrubs and trees for shelter, forage and land management, especially in the semi-arid zone where timber production is less economic, increases the diversity of productive plants and increases the niches available for indigenous animals above and below the soil. It also increases the opportunities for recolonisation by indigenous plants.
- **Biodiversity in farm forestry can contribute to farm productivity** - there is increasing evidence of the financial benefits of ecological functions performed by biodiversity in farm forestry as well as other environmental services such as shelter and shade. For example, Siracid wasps in the New England Tablelands, which feed and breed on Acacia windbreaks planted around paddocks, have been shown to reduce the populations of scarab larvae in pastures (Nick Reid, UNE, pers. comm.). These scarab larvae, if allowed to mature, defoliate Eucalyptus trees during their adult stage.
- **Mixed plantations can produce high quality sawlogs** - there are a number of strategies which can be used to produce high quality sawlogs. Some of these include the use of understorey and nurse crop species to ensure that commercially important species grow with the required height, straightness and diameter to optimise the production of timber from the area planted. Short-lived trees such as *Acacia dealbata* can assist growth of commercially important species such as *Pinus radiata*, *Eucalyptus maculata*, *Acacia melanoxylon* or *Eucalyptus nitens*.

2.3.2 Threats to biodiversity from farm forest plantings

The conclusions from the literature review also identify a number of potential threats to biodiversity conservation which need to be addressed through appropriate management practices if the potential economic opportunities for managing farm forestry systems are to be

realised in a way which is compatible with biodiversity conservation objectives. The major biodiversity concerns relating to farm forestry plantations include:

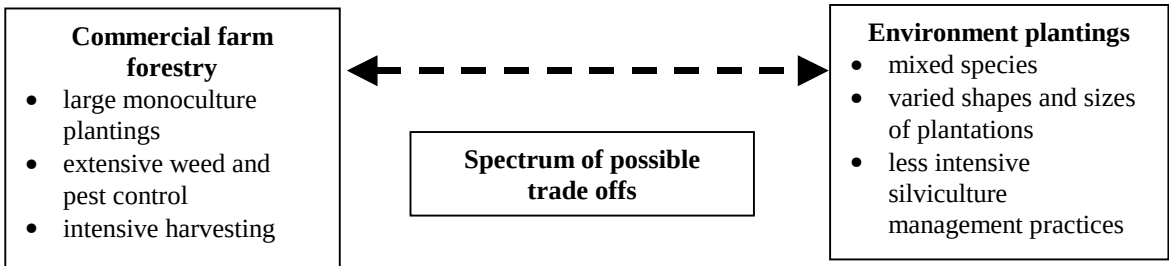
- **Plantations may harbour vertebrate pests** - as well as providing habitat for native fauna, trees on farms can provide cover for vertebrate pests such as foxes, cats, rabbits and hares. It has been suggested that transferring areas from traditional agricultural activities to plantation forestry may increase the presence of vertebrate pests for the following reasons (Catling and Burt, 1995):
 - cover provided by a timber plantation makes predators less conspicuous ('out of sight out of mind');
 - cover may increase the difficulty of mounting an efficient control program;
 - cover provides a more natural habitat range for many vertebrate pests; and
 - predation by foxes, feral cats and dogs could be commercially beneficial to plantations by controlling rabbits and hares which ring bark and chew growth points of young trees during the early establishment phase.
- **Some current management practices may have an adverse effect** - practices that are commonly used for plantations include use of herbicides to minimise weed competition, fertiliser application to promote growth rates and single age class monoculture plantings providing single canopy species but no supporting understorey. Such practices are little different from standard agricultural management practices but farm forests offer some other biodiversity benefits that agriculture does not. It is anticipated that the use of chemicals for forestry application will continue to remain under scrutiny to ensure that impacts upon the environment are minimised and a thorough assessment process is undertaken prior to registration as already occurs.

Harvesting practices can also have an important influence on the maintenance of biodiversity. The practices for minimising impacts both on and off-site associated with forest harvesting are well known. They include the use of rubber tyred rather than tracked machines and the use of grapples to minimise soil disturbance from snagging. Where farm forests are concerned there may be need to develop different approaches to reflect the lower volumes of trees that are likely to be removed as well maintaining suitable habitats that farm forests may supply. Mixing species and ages of plantations may be the most relevant ways of facilitating this.

2.3.3 Implications for farm forestry and biodiversity

The evidence of potentially positive and negative relationships between biodiversity and farm forests reflects the reality of some conflict between commercial timber production and planting of trees on farms for environmental reasons (including biodiversity). This in turn suggests there is a spectrum (Figure 2.1) over which trade offs between these goal can occur. For instance, the major problems identified above largely reflect the nature of plantings and management practices associated with larger scale plantings.

Figure 2.1: Trade offs between commercially focussed farm forestry focussed and biodiversity goals



At the other end of the spectrum are those plantings, driven by both public and private expenditure, aimed at environmental protection eg, plantings made with Natural Heritage Trust funding. These plantings are much more likely to contain mixed species and be managed less intensively. They are therefore likely to have significantly greater impact on enhancing and protecting biodiversity. However, they are generally not oriented to commercial wood production.

The major question arising out of this is whether commercially based farm forestry can bridge the gap between these different ends of the spectrum. The scope for doing this and some potential options for pursuing this goal are outlined in the following chapters.

3. Opportunities for practical integration of farm forestry and biodiversity

3.1 Existing attitudes and approaches

Farm forestry investments in Australia are driven by both commercial and environmental considerations. Key organisations investing in trees on farms for commercial purposes are: plantation prospectus companies focussing mainly on blue gum plantations for woodchip exports; joint venture programs with forest industry companies and state forest agencies eg, Oji Paper and Primary Industries South Australia, Hansol and the Department of Conservation and Land Management in Western Australia; the NSW State Forests Hardwood Plantation Joint Venture program, and some private landowners. In addition, a number of forest industry companies have large scale plantation programs on private land and a number of companies are actively considering the implementation of joint venture programs with private landholders. These include both hardwood and softwood plantations for pulplog and sawlog production.

Planting of trees on farms for purposes other than commercial wood production is being driven by landholders as well as by the range of government programs aimed at addressing environmental degradation issues. Such environmental plantings are usually driven by catchment, soil and water quality considerations, and while biodiversity can be actively considered in the plantings it is usually secondary to these other environmental concerns.

There is a diversity of views regarding farm forestry and its potential contribution to biodiversity. As part of this study discussions were held with a range of those involved in planting trees on farms. In general, while those involved in commercial operations considered that planting of trees on cleared agricultural land has more positive implications for biodiversity than agricultural uses, the need for commercial returns also meant that management practices necessitated some limitations to these effects. In this regard most commercial tree growers emphasised the need to treat plantations as just another agricultural crop, particularly in terms of legal and policy requirements. As the number of commercially oriented plantings of trees on farms increases there is also evidence that commercial tree growers are becoming more flexible in their requirements for issues such as size and layout of plantings which is likely to enhance biodiversity effects. The division between commercially and non-commercially driven plantings is illustrated in Western Australia (see box below). Western Australia is the leading region for development of commercial plantings of trees on farms with over 80,000 ha planted to blue gums in the last decade.

It is the non-commercial plantings that have tended to adopt designs and management practices that emphasise biodiversity. The Community Rainforest Reforestation Program (CRRP) in tropical Queensland provides an example of such an approach to farm forestry where biodiversity has been an important component of plantation development.

Biodiversity and farm forestry in Western Australia

Three consistent themes dominate farm forestry in Western Australia. These are:

- farm forestry as a viable commercial alternative to existing land uses;
- farm forestry as a mechanism for dealing with land degradation issues; and
- farm forestry as a mechanism for dealing with biodiversity issues.

In most situations, it is recognised that farm forestry for any one of these reasons could potentially deliver additional benefits to other objectives. To date, where shared objectives have occurred, these were between commercial production and land conservation, or between land conservation and biodiversity conservation. There has been relatively little consideration of potential overlap between commercial production and biodiversity conservation.

For example, the South West Regional Planning Committee has a primary interest in commercial forestry on agricultural land. Biodiversity is not taken into account in the planning process and most plantations are subject to usual commercial practices of spraying and weed control. However, there are some indications that alternative strategies are being investigated for pest management which may be more compatible with biodiversity protection. There is also some recognition that potential biodiversity benefits from farm forestry can help to increase community interest and involvement in farm forestry.

On the other hand the South Coast Regional Initiative Planning Team has a primary interest in the landcare benefits of farm forestry, with direct commercial value and biodiversity value viewed as by-products. These initiatives tend to be less commercially driven with significant reliance on government support through schemes such as the National Vegetation Initiative.

The new Maritime Pine (*Pinus pinaster*) program which aims to promote planting of trees for both commercial and environmental benefits in the lower rainfall regions (400-600 mm per year) of WA does attempt to address all three objectives simultaneously. The program aims to assist landscape reconstruction through incorporation of tree planting as part of property management planning. It incorporates planting of *Pinus pinaster* as a commercial crop with other species primarily for environmental and nature conservation benefits. At least 10% of all trees planted on farms as part of the program are for environmental/nature conservation benefits. The program provides for CALM to establish the plantations while farmers receive a share of income from the farm forests.

Biodiversity and Farm Forestry in Tropical Queensland

The Community Rainforest Reforestation Program aims to develop a timber resource based on plantations of native rainforest species on previously cleared private property. This program emphasises planting of high value cabinet timber species and is driven primarily by government funding. While there are likely to be significant biodiversity benefits from trees planted under this scheme, they are less likely to provide long term economic returns similar to more commercially oriented plantings.

Additional projects, such as the Wet Tropics Tree Planting Scheme specifically address biodiversity objectives. Projects under this scheme concentrate on mixed species plantings along watercourses or in other areas of recognised biodiversity potential. However, there is little consideration of direct economic benefit as a primary objective of this scheme, although there may be the potential to include harvestable timber products in such strategies.

3.2 Potential for enhancing biodiversity impacts of commercial plantings

Despite evidence of different capabilities to encapsulate biodiversity in farm forestry between commercially versus environmentally focussed plantings, there is scope to ensure that biodiversity impacts of the former are maximised. However, if farm forests are to be treated on an equivalent basis to agriculture it is important that this be achieved in cooperation with landowners and not imposed. As already mentioned, there is an extensive network of legal and policy instruments relevant to control of large scale plantations on farm land but this is less applicable to smaller scale farmers. If the potential commercial and other environmental benefits of farm forestry are to be realised, it is important that actions which attempt to maximise biodiversity effects of farm forest plantings be implemented in conjunction with landowners. Otherwise, such attempts run the risk of creating a disincentive to development of farm forestry in Australia.

If it is accepted that commercial farm forest developments will not be driven by biodiversity, the key question becomes to what extent can commercial farm forestry make a positive contribution to biodiversity in addition to other environmental benefits. From the available scientific evidence it would appear that this could be best achieved by:

- more **innovative design** of farm forestry plantings to maximise the edge effects and links with any remnant vegetation eg, careful planting of trees in a farm forestry system can reduce the isolation of existing remnant vegetation, or can create new habitat area. Use of buffers around remnant vegetation or along the edges of riparian vegetation and corridors can also add to biodiversity impacts of plantations. Strategic planting of native vegetation species around their pine plantations by Australian Newsprint Mills illustrates the type of innovative approaches that could be applied to enhance biodiversity without adversely affecting commercial objectives (see box below);

- careful use of chemicals for weed control and consideration of means of achieving biological control where effects on non-target native species are a concern - these could be specified in **codes of practice**; and
- incorporation of biodiversity into **property management planning** with farm forests becoming an integral part of the farming system, including maximising links with native forests and other remnant vegetation on farms.

Practical integration of biodiversity and commercial farm forestry

Australian Newsprint Mills (ANM)

ANM has attempted to preserve biodiversity, as part of its pest management strategy in its plantations around Albury in NSW, by maintaining remnant vegetation and through strategic plantings around the edges of some pine blocks. The company commissioned Charles Sturt University to conduct biodiversity surveys at two of its plantation sites - Ferndale (1992) and Ettamogah (1994-ongoing). Surveys in the Ferndale property - 1862 ha with areas planted to *Pinus radiata* in 1990 and 1991 - recorded 14 native species of mammals, 52 bird species, 9 reptiles and 7 frogs. Surveys in the Ettamogah property - plantations planted in 1989, 1992, 1993 and 1994 - recorded 17 species of mammals, 144 bird species, 11 reptiles and 10 frogs.

It was concluded that strategic location of enrichment plantings of mixed indigenous species and retention of native vegetation along watercourses, ridge lines and in other strategic areas can significantly increase biodiversity in plantation forests.

Joint Venture Plantation - Lower Kangaroo Creek - Northern NSW

The literature review conducted by CSIRO suggested that incorporation of multiple species into farm forest plantings could provide significant biodiversity benefits, but this has traditionally been seen as contrary to commercial plantation objectives. This emphasis reflects existing practice that focuses on single species plantations which is related to ensuring minimum volumes required for commercial production. Single species plantations have also been regarded as the most efficient in terms of establishment and management costs.

However, a recent planting under the NSW State Forests joint venture plantation program in Northern NSW, illustrates willingness to adopt increasingly flexible approaches in establishment and management of commercial plantations. In this case, in response to environmental concerns from the landowner, a 20 hectare block planted at lower Kangaroo Creek by State Forests used a mix of species consisting of 12 ha of *Eucalyptus grandis* planted along a river section of the block and 7 ha of *Eucalyptus cloeziana* on the remaining section. While not related to biodiversity, State Forests was also willing to modify its usual establishment practices with regard to the use of chemicals. While this is only a relatively minor example, it illustrates the potential for changing traditional approaches to plantation establishment for farm forests, within commercial constraints of the program.

As outlined in the box above the potential for such actions is illustrated in practices already being adopted by commercial plantation growers. Some specific suggestions for practical integration of biodiversity with commercial farm forestry are outlined in chapter 4.

4. Reconciling commercial farm forestry and biodiversity

Any attempts to deliver enhanced biodiversity as part of the expansion of commercial farm forestry in Australia must recognise the potential conflicts between these two objectives. At the same time, however, it is important to recognise that increased farm forestry plantings provide an opportunity to enhance our farming landscape as well as provide commercial benefits. Not all farm forestry plantings may add significantly to biodiversity compared to traditional agricultural practices. However, there is enough evidence to suggest there is scope to expand areas of overlap between commercial and biodiversity goals. Some of the key elements in achieving this goal are outlined in the following sub sections. Common themes which run through these suggestions include:

- the important role of research and development in identifying innovative solutions;
- the role governments can have in providing enabling policies based on sharing of costs and returns, particularly by linking initiatives across suggested actions; and
- the importance of explicit recognition of biodiversity enhancement as a goal of farm forestry development.

4.1 Innovative design of farm forestry plantings

Changing designs of farm forest layouts within farm landscapes offers considerable scope for enhancing biodiversity impacts without adversely affecting commercial timber production. A basic principle of farm forestry design to improve biodiversity impacts is the promotion of patchiness by mixing species and planting at time intervals which provide a mix of age classes in close proximity (Abel *et al.*, 1997). The use of buffers around the margins of existing remnant vegetation and provision of corridors will also assist with off-site adverse impacts from plantations as well as providing more diverse habitats for native fauna and flora around the edges of plantations.

The following provide some specific possibilities for practically integrating biodiversity into farm forests building on the principles above:

- **mixing species in farm forests based on varying site quality** - this would involve integrating indigenous and habitat plantings into property management plans for farm forests so that commercial species are planted and managed on sites of high quality and biodiversity plantings are located on sensitive or low productivity sites. For example, riparian zone waterlogged areas (often discharge areas), shallow soils or rocky areas (often recharge areas), degraded or very steep areas can all be planted to suitable indigenous or habitat species;
- **development and investigation of alternative silvicultural regimes utilising habitat species** - an option for regions where thinnings have minimal net economic returns could be to use indigenous or habitat species as nurse crops and then either felling them or killing them and leaving them standing. This would provide valuable habitat and has

been trialed successfully in South Australia for Blackwood and *Eucalyptus globulus* production using *Acacia mearnsii* and *Acacia saligna* nurse crops of which half are killed and left standing at 4 years and the remaining at 8 years. The dead trees provide habitat for a range of insects which in turn feed bandicoots and birds. Another option in this regard is the use of indigenous species, particularly shade tolerant grasses to provide habitat for birds, small vertebrates and insects; and

- **alternative slash disposal techniques** - greater dispersal of slash rather than burning could be expected to assist insectivorous and fungi eating marsupials such as Bettongs and Bandicoots. Most codes of practice recognise the benefits of such activities.

Abel *et al.*, 1997 set out the key principles for designing farm forest plantings for joint timber production and nature conservation benefits. Key design factors relating to plantations include:

- incorporate structural layers into farm forest plantings including understorey shrubs, taller middle-story shrubs or small trees, and an upper canopy of taller trees;
- mix species within a plantation area in varying patches to provide a greater range of habitats which can be occupied by more species;
- maintain links between planted areas by using corridors/buffers and by linking existing vegetation - however, it should be noted that if exotic species such as *Pinus radiata* were the primary plantations species, there may be some adverse affects through linking plantations and remnant vegetation. It should also be noted that corridors can also provide pathways for negative affects such as disease and feral animals;
- use patches of compact areas rather than thin areas;
- plant trees across time intervals to allow harvesting to be spread over time.

While these practices can provide a general guide to increasing commonality between farm forests and biodiversity protection, it needs to be emphasised that establishment and management prescriptions for maximising the biodiversity effects can be highly regional and site specific. What may be appropriate for one region may not necessarily apply to others. There is a need to further refine these types of general statements at the bioregional level to reflect such differences.

These practices can be integrated into commercially focussed farm forest plantings. While there may be some effect on the economic viability of wood production or the costs of establishment, other effects on agricultural productivity and the value of environmental benefits can offset these (DAMES & MOORE NRM *et al.*, 1996). For instance, changing the shape of plantations would not be expected to greatly increase the costs of establishment or harvesting, the key economic issue being that the size of plantations is sufficient for viable establishment and harvesting operations. Examples already referred to suggest that use of corridors to create links with native vegetation may be increasingly adopted as part of sustainable forest management practices. In addition, there appears to be a greater willingness

by investors to consider mixed species and the environmental effects of farm forests in planning commercial plantations.

The range of farm forestry establishment practices suggest a gradation exists between commercially oriented tree plantings and those which may be primarily for the purposes of environment protection. With increasing emphasis on environmental factors this includes:

- traditional block plantation approaches emphasising single species primarily for wood production;
- block or alley plantings incorporating age diversity;
- block or alley plantings with age and species diversity; and
- block or alley buffer plantations with age and species diversity to protect remnants and areas with higher levels of biodiversity.

The economic viability of these alternatives needs to be assessed within the context of whole farm operations together with the needs and preferences of the landholder. For instance, it may not be appropriate to put large areas under block plantings due to the loss of agricultural production and associated cash flow which may result. Similarly, increased agricultural production or a stronger emphasis on environmental benefits may justify a lower return from wood. The viability of different farm forest plantings needs to be assessed in the context of a whole farm plan. This is discussed in section 4.3.

4.2 Codes of practice

Codes of practice are increasingly seen as a vital means of ensuring that both native forests and plantations are managed in accordance with ESD principles. Existing plantation codes of practice have been examined by CSIRO as part of a Commonwealth policy to remove export controls on plantation grown material subject to there being adequate codes of practice in place. These codes need to cover all land tenures. The protection of biodiversity is an important underlying component of most codes of practice. This is also reflected in the criteria against which codes are being assessed by CSIRO. These criteria include factors relating to native vegetation removal and associated flora and fauna issues, water quality issues, soil conservation and conservation of cultural and heritage values. As already discussed controls on the export of plantation grown wood have been lifted in Victoria, Western Australia, Tasmania and South Australia on the basis of existing codes of practice.

The focus on codes of practice in achieving ESD with respect to plantations provides an opportunity for forest growers, the plantation industry and farmers to develop approaches to management which maximise biodiversity values consistent with commercial goals by building these into the development of codes of practice. Whether this is done by means of voluntary codes or legally enforceable arrangements is beyond the scope of this paper. What needs to be recognised is that arrangements to promote enhancement of biodiversity in plantations can be addressed through codes, these should be seen as a process of continuous improvement and that organisations of plantation growers (eg, through AFG) could commit to actively considering biodiversity issues in such codes.

Elements which plantation codes of practice are likely to need to address in terms of biodiversity include:

- recognition of biodiversity values in plantation management plans;
- use and management of indigenous species in headlands, buffers, filter strips, the riparian zone and areas within plantations which have a low timber productivity or are unsuited to plantation species;
- management of plantations to protect biodiversity values with specific mention of practices for use of herbicides, pesticides, fertilisers, fire and harvesting equipment (soil compaction);
- design and management of plantations to protect rare and endangered plant and animal species which may occur on the site;
- protection of water yield in catchments used for water supply or environmental flows;
- selection of species and provenances to preserve indigenous genetic diversity where this can be consistent with commercial objectives;
- wherever possible integrate natural habitats for predators and pathogens of plantation pests and diseases into headlands, buffers, filter strips, the riparian zone and areas within plantations which have a low timber productivity or are unsuited to plantation species; and
- integrate corridors for wildlife and genetic exchange between remnant vegetation communities and wildlife habitats (such as wetlands) into design and management of plantations and environmental service plantings.

There are a number of advantages in adoption of codes of practice as a mechanism for creating linkages between trees on farms and biodiversity conservation. These include:

- demonstrated compliance - by being proactive, forest growers, industry and farmers demonstrate compliance with existing biodiversity policies, regulations and rules to the wider community;
- reduced risk - by being proactive, stakeholders have a stronger position in the debate about tradeoffs between commercial production and biodiversity conservation in land use;
- self-regulation - by being proactive, forest growers, industry and farmers are more likely to remain self regulated than if, in the absence of a voluntary code, the community demands direct intervention by governments;
- market for environmental services - voluntary certification of trees planted on farms for environmental services increases the opportunities for establishing a true market for environmental services delivered by forest growers and farmers;

- quantify environmental service values - increasing demand for quantification of environmental service values will improve the likelihood of cost sharing mechanisms being introduced to complement investment by forest growers and farmers; and
- clear investment framework - certification schemes provide a clear framework within which investors can make decisions about how, when and where they invest in farm forestry.

Another developing area in respect of achieving biodiversity conservation in the context of ESD is the pursuit of certification and labelling for sustainable forest management practices and products. This is actively being pursued for both plantations and native forests in Australia. Approaches based on Montreal Process criteria and indicators for sustainable forest management are currently being developed in Australia by the Montreal Process Implementation Group (MIG). The FWPRDC has also undertaken an assessment of the applicability of the Montreal Process criteria and indicators to forest plantations in Australia (FWPRDC 1996b).

The major conclusions in respect of farm forestry plantations and biodiversity from this study were:

- with regard to plantation expansion the Montreal indicators for conservation of biodiversity are all relevant to vegetation intended for removal in relation to its total occurrence;
- for established farm plantations the indicators are not relevant but there could be an assessment of the proportional area included in schemes like Land for Wildlife. This would indicate landowner interest in enhancing the value of plantations as wildlife habitat; and
- the availability of operating prescriptions and guidance whether through a code of practice or through expert support is the most appropriate means of ensuring the conservation of soil and water resources.

The development of frameworks for implementing and monitoring such indicators as a basis for continuous improvement as well as for certification of sustainable forest management practices could greatly assist the demonstration of appropriate levels of biodiversity conservation in respect of farm forest plantations.

4.3 Increasing landholder interest

Demonstrating the potential for joint commercial and environmental benefits from farm forestry is vital to increasing landholder interest and adoption of farm forestry practices. Increasing information flows to landholders and investors is an important means of building interest. The development of property management planning including associated budgets and ensuring that farm extension advisers understand the potential roles of farm forests can be important components of increasing this information flow.

4.3.1 Property management planning

Increasing adoption of property management planning by landholders provides a framework for considering plantation development as an integral element in farm production and

conservation of the farm environment. In particular, it offers the opportunity to assist in maximising the contribution of farm forests to biodiversity by focussing on location and design of the plantings in relation to remnant vegetation and other relevant factors.

Key issues in developing such a plan would be:

- clarifying the relative importance of the different roles forest plantations can have on the farm - the greater the importance on environmental factors the less potential conflict with commercial wood production;
- identifying different characteristics of the farm where plantings of various species and types of vegetation may be made;
- linking plantings and existing remnant vegetation where it exists as well as to existing agricultural enterprises; and
- preparation of a budget for tree plantings including consideration of net returns - such an analysis will allow clear identification of the relative costs and benefits of farm forestry.

As well as innovative farm forestry designs to promote links between farm forests and other land resources important for biodiversity protection, innovative approaches to environmental protection can assist in meeting this goal. For instance, allowing for covenanting of land for conservation purposes, or enhancing and protecting native vegetation on the fringes of farm forestry plots may assist achieve the joint goals of commercial timber production and enhanced biodiversity production.

The recognition of native forests on farms in property management plans and their active management for timber production has high potential for direct biodiversity benefits. In addition, the linking of planted farm forests with native forests and other remnant vegetation could provide even greater biodiversity benefits. However, the potential of native forests on farms often receives relatively little attention compared to that for planting of trees on cleared land. With respect to biodiversity, however, the management of private native forests is much more likely to come under the direct influence of legal and policy frameworks relating to native forests. This includes native vegetation controls and codes of forest management practice where they are in place for private land. For these reasons, native forests have not been a focus of this study.

4.3.2 Extension services

The provision of extension services is important to the adoption and spread of property management planning as well as building an understanding of the potential benefits of farm forestry. Ensuring that extension officers have a good understanding of the potential role of trees and farm forests is likely to be an important factor in achieving integrated farm forestry developments. Similarly, greater recognition of regional biodiversity needs through enhanced bioregional planning, would also help landowners integrate considerations of biodiversity into their farm forests. This could be facilitated by incorporating farm forestry and biodiversity into catchment management plans.

4.4 Research into biodiversity impacts of farm forests

The literature review conducted by CSIRO as background to this discussion paper illustrated a lack of knowledge of the biodiversity impacts of farm forests compared to agricultural land uses. This clearly highlighted a need for more research comparing the biodiversity value of planted farm forests compared to existing agricultural practices. Two workshops involving biodiversity researchers undertaken in conjunction with this study also highlighted the need for additional research before any definitive conclusion on the relationship between farm forestry and biodiversity can be drawn. These workshops also suggested that care needs to be taken in the development of prescriptions for maximising the biodiversity impacts of farm forests because desirable actions may vary with many factors such as regional or site specific endangered or threatened species, and local ecological characteristics. Identified priorities for research and development included:

- further development of designs for farm forests that maximise biodiversity impacts and quantification of trade offs between commercial and biodiversity goals for farm forests;
- identification of factors for different bioregions that may be relevant to establishment and management practices for maximising the biodiversity effects of farm forests;
- utilisation of existing farm forests to identify biodiversity effects.

4.5 Identification of cost sharing principles for farm forests

As already outlined, experience of farm forest plantings to date indicates that the inclusion of environment and nature conservation goals in farm forests is often dependent on public funding contributions. The consideration of biodiversity protection as part of farm forests, particularly if it comes at some cost to commercial considerations, raises the issue of public and private benefits from farm forest plantings. Recognition and more precise specification of the public and private benefits and costs from farm forests will assist in incorporating them into whole farm plans. Similarly, identification of the public and private benefits would assist in directing public funding for promoting the integration of biodiversity objectives into farm forests. The provision of funding would be likely to significantly increase the extent of environmentally focussed plantings. As a guide to the types of benefits and costs which would be associated with different types farm forests Table 4.1 provides an outline of costs and benefits associated with the range of approaches to farm forests.

4.6 The role of governments

There are potential roles for governments in all of the initiatives outlined above. However, if investment in farm forestry is to be expanded beyond relatively small scales, private investment must become a driving force in farm forestry. Thus it is suggested that government policy should be directed at enabling investors to identify the benefits from practical integration of biodiversity goals into farm forest plantings. More regulatory approaches are only likely to act as disincentives to farm forestry.

Enabling policies within the key needs identified above could include:

- sharing of the costs for research and development required to implement more innovative farm forestry designs;

- assisting the development of multi skilled extension officers who have sound understanding of the role of trees and farm forests in farm landscapes;
- promoting the adoption of property management planning and providing frameworks which promote the inclusion of biodiversity conservation into property management plans;
- improved bioregional planning to identify priorities for biodiversity conservation;
- identification of the public and private benefits from farm forests, particularly benefits from promoting biodiversity; and
- development and application of cost sharing principles for the provision of funding for farm forestry investments.

Table 4.1: Cost sharing matrix of farm forests

METHOD (Design)	PRIVATE		PUBLIC	
	Costs	Benefits	Costs	Benefits
Traditional plantation (block monoculture)	• Foregone agricultural production • Basic site preparation and plant propagation • Vulnerable production base	• Plantation returns per rotation • Cost savings at harvesting and marketing from economies of scale	• Boom/bust nature of local forestry industry • Low and vulnerable regional biodiversity • Contraction of the local agricultural support industry	• Specialised regional plantation skills • Diversification of regional production base
Block or alley plantation with age diversity	• Foregone agricultural production • Annual site preparation and plant propagation based on the constraints and requirements of block/alley design • Varying annual maintenance	• Annual plantation returns • Beneficial on-site externalities (eg, shade & shelter)	• Contraction of the local agricultural support industry	• Diversification of regional production base • Stable regional forestry industry due to annual harvests
Block or alley plantation with age & species diversity	• Foregone agricultural production • Annual site preparation and plant propagation based on the constraints and requirements of block/alley design • Varying annual maintenance	• Annual plantation returns • Diverse production base • Beneficial on-site externalities (eg, shade & shelter)	• Contraction of the local agricultural support industry	• Diversification of regional production base • Maintained levels of regional biodiversity • Stable regional forestry industry due to annual harvests
Block &/or alley buffer plantations with age & species diversity to protect remnants and biodiverse areas (eg, riparian zones)	• Foregone agricultural production • Complex site identification, preparation and plant propagation based on the constraints and requirements of block/alley design • Varying annual maintenance	• Annual plantation returns • Diverse production base • Beneficial on-site externalities (eg, shade & shelter, maximum support for pest predators)	• Contraction of the local agricultural support industry	• Diversification of regional production base • International biodiversity requirements fulfilled • High and protected levels of regional biodiversity • Stable regional forestry industry due to annual harvests

4.7 Conclusions

The aim of this paper is to stimulate consideration of actions that can be taken to enhance the practical integration of farm forestry and biodiversity. It was originally intended that the conclusions would provide a set of guidelines that could be adopted by practitioners to improve the biodiversity effects of commercial farm forests. However, the scientific literature review suggested that there was little evidence on which to base such specific actions. Furthermore, biodiversity researchers have suggested that such guidelines need to be at least bioregion specific. The literature also suggested that there are considerable trade offs between commercial and biodiversity goals of farm forests. However, case studies outlined in this chapter suggested that there is also considerable potential for maximising the commonality between commercial farm forestry and biodiversity.

In light of these conclusions, this chapter has attempted to highlight those factors which are considered important to reconciling the potential conflicts between commercial farm forestry and biodiversity. Many of these factors will require additional research to identify clear directions. However, investments in farm forestry should not be delayed while more definitive actions are identified. The actions identified in this chapter have thus aimed to provide a framework which enables landholders and investors to take account of the commonality between commercial and biodiversity effects of farm forests in light of their own goals and circumstances. At the same time priorities for research which provides practical outcomes of use to farm forest investors and landholders have been outlined.

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This report investigates ways of practically integrating biodiversity values into commercial farm forestry developments through examination of:

- legal and policy framework for protecting biodiversity;
- scientific evidence concerning biodiversity in commercial farm forests; and
- evidence from existing farm forests.

There are some indications that laws and policies that promote biodiversity and control the removal of native vegetation can be disincentives to farm forestry. The report identifies some opportunities for farm forestry to contribute to biodiversity, particularly where enhancement of biodiversity is an important priority for plantation establishment and management.

The report complements the publications in the RIRDC/LWRRDC/FWPRDC Joint Venture Agroforestry Program, which aims to foster the integration of sustainable and productive agroforestry within Australian farming systems.

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Integrating Farm Forestry and Biodiversity

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