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Native Forests on Farms

by Mark Parsons, Fortech Pty Ltd

RIRDC/LWRRDC/FWPRDC Joint Venture Agroforestry Program

Supported by the Natural Heritage Trust
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Foreword

About one-quarter of Australia's native forests and woodlands occur on private property. This represents an important resource for both production and conservation, yet such forests are sometimes overlooked during debates on forest uses.

The RIRDC/LWRRDC/FWPRDC Joint Venture Agroforestry Program seeks to promote the development of a dynamic agroforestry sector in Australia. Such a sector has the potential to contribute to the sustainable production of agricultural and forest products, the sustainable management of land, water and biodiversity resources, and the enhancement of agricultural landscapes.

Native forests and woodlands in rural areas form an essential resource for agroforestry development in Australia. Well-managed native forests provide important regional biodiversity and other conservation benefits while also offering farmers income from timber products. For this reason, the Joint Venture Agroforestry Program has a vital interest in promoting research and development on the management and use of privately managed native forests.

This report, the latest addition to RIRDC's diverse range of over 250 research publications, forms part of the Joint Venture Agroforestry Program, which is jointly funded by RIRDC, the Land and Water Resources Research and Development Corporation, and the Forest and Wood Products Research and Development Corporation. Additional funding also comes from the Natural Heritage Trust and the Murray Darling Basin Commission. The JVAP aims to integrate sustainable and productive agroforestry within Australian farming systems.

Peter Core

Managing Director

Rural Industries Research and Development Corporation

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Executive Summary

Native forests on farms are an important component of Australia's native forest sector. They account for around one quarter of the area of productive native forest in Australia. Their contribution to the value of forest production is less clear, but can be as high as half the value of logs produced in some regions.

Despite the significance of private native forest resources in Australia, there is a limited farm forestry culture among landholders. This is a reflection of the history of land development in Australia and is at least partly due to the policies of past governments. There is an increasing focus on private sector resources throughout Australia which reflects increasing pressure on publicly owned forest resources, recognition of the need for sustainable forest management on both public and private land, and an increasing recognition of the commercial opportunities of forest management as part of agricultural businesses.

The Regional Forest Agreement (RFA) process, which aims to establish the basis for long term sustainable forest development across all land tenures, has led to an increased focus on private forest resources in Australia. This is especially the case in Tasmania where significant areas of private forest resources may be required for a comprehensive, adequate and representative forest reserve system.

There has been considerable investigation undertaken on the development of farm forestry and plantations on cleared agricultural land in Australia. Impediments to development of commercial farm forestry, including factors contributing to the lack of a farm forestry culture, are well understood. Analysis of private native forest resources is severely limited by a lack of basic information on the extent and nature of these forest resources. Many of the issues relevant to the development of a farm forestry culture for private native forests are similar to those identified for development of plantations and farm forests on cleared agricultural land.

In strategies designed to develop the sustainable management of native forests on farms, key issues to be addressed include:

- the need for strategic direction and support at a national level;
- removal of legal and regulatory impediments to the sustainable management of private native forests;
- the need for reliable and accessible regional information on the status and potential of private native forests;
- the need for increased landholder skills with respect to silviculture, forest management and marketing forest products;
- the need to assist landholders evaluate the potential for managing native forest resources within the economic context of whole farm planning; and
- the lack of sufficient markets for the full range of non-sawlog products.

Encouraging and facilitating the sustainable management of native forests on farms by the above actions may hasten the development of a farm forestry culture in Australia.

1 Introduction

1.1 GOALS AND OBJECTIVES

Approximately one quarter of all forest and woodland across Australia is on private property (NFI in prep). However, while there has been increased promotion of tree planting on cleared farmland and management of remnant native vegetation for environmental purposes, the sustainable management of native forests on farms for commercial use has received little attention. The Rural Industries Research and Development Corporation initiated a project under the Joint Venture Agroforestry Program to address this issue.

The specific goal of the project is to develop a strategy to encourage and enable landholders to manage their forests to produce commercial products that provide a viable source of farm revenue while also sustaining forest values. Achieving these joint objectives may contribute to the development of a farm forestry culture in rural Australia.

This report is a component of the process of strategy development. A draft was distributed to a range of stakeholders as a discussion paper and the report was substantially amended on the basis of comments received.

1.2 CONTEXT AND CONTENT

The history of agriculture and forestry in Australia has mitigated against the development of a strong farm forestry culture. While successful farmers are skilled in agricultural practices and management, few farmers have the necessary knowledge and skills to sustainably manage their forests and woodlands to produce commercial products. In general, farmers do not regard farm forestry or native forests as integral parts of their farm business.

The commencement of Comprehensive Regional Assessments (CRA) as part of the Regional Forest Agreement (RFA) process has increased the focus on private native forests as sources of sustainable timber supplies and environmental benefits. This is particularly the case in Tasmania, northern New South Wales and Queensland where areas of private forest may be required to meet targets for establishment of a "comprehensive, adequate and representative forest reserve system", as required by the National Forest Policy (Commonwealth of Australia 1992). The RFAs have also focussed attention on the possibility of increasing timber supplies from private land.

This report examines the extent of native forests across Australia and summarises available information on forest types, condition, uses, and values (Section 2). Section 3 assesses available information on the current and potential contribution of native forests on farms to regional economies and farm businesses.

Section 4 examines what is required for sustainable management of native forests on farms. Silvicultural requirements are addressed separately in Annex 1. Section 4 also identifies issues relevant to developing a farm forestry culture based on native forests including ecological, economic, social, and cultural factors and impediments to sustainable native forest management on farms. Gaps in current knowledge are also identified. Finally, some key actions that may be included in a strategy to encourage and enable sustainable management, and consequently help develop a farm forestry culture are recommended.

2 Extent and Types of Private Native Forests

2.1 SOURCES AND DEFINITIONS

Information on the extent, distribution, types, uses, and values of native forests on farms across Australia is scarce and often incongruous. The Resource Assessment Commission's Forest and Timber Inquiry (RAC 1992a, p. 80) reported that "no comprehensive native forest inventory exists for Australia". The RAC undertook a survey (RAC 1992b) in order to obtain a standardised, comprehensive description of the extent and uses of Australia's native forest. The Bureau of Resource Sciences (BRS) is developing the National Forest Inventory (NFI) to provide a dynamic database for information on Australia's forest resources. A comprehensive NFI report is in preparation. BRS is using NFI data for the inaugural State of the Forests Report for Australia, which is expected to be published in mid-1998. BRS is also developing a report on native forests on private land in Australia. A draft of this report is currently being considered by the NFI steering committee and was provided to the consultants for the purposes of this study.

The RAC's survey and the NFI are the major sources of national information on the nature of private native forests across Australia. NFI data referred to below is obtained from the draft report on native forests on private land and accordingly should be considered preliminary. In addition to this information, RFA processes are providing some good quality regional data on private native forests. Inconsistencies in the data presented below are due to the different definitions and approaches used by the various sources.

RAC Forest and Timber Inquiry (1992)

RAC (1992b) estimated that around 12 million ha of Australia's total forest cover of around 43 million ha, ie around 28%, was on private land (Table 2.1). The inquiry also estimated a net area of 22 million ha was available for timber production, of which around one third (8 million ha) was private forest. These estimates are based on the NFI definition of 'forest' which at the time was:

"woody vegetation, usually with a single stem, having a mature or potentially mature stand height exceeding 5 metres with existing or potential projective foliage cover of overstorey strata about equal to or greater than 30% (NFI 1991, p3)."

The RAC survey covered only Australian Forestry Council (AFC) regions, which are those regions supporting major commercial forest resources. (Refer to the Forest and Timber Inquiry Final Report (RAC 1992a, p.81) for a map of the AFC regions). However, the RAC survey did include around 14 million ha of mixed forest and woodland in the AFC regions of the Northern Territory and Queensland. The area of woodland outside the AFC regions is estimated to total approximately 92 million ha (RAC 1992b).

National Forest Inventory Draft Report on Native Forests on Private Land

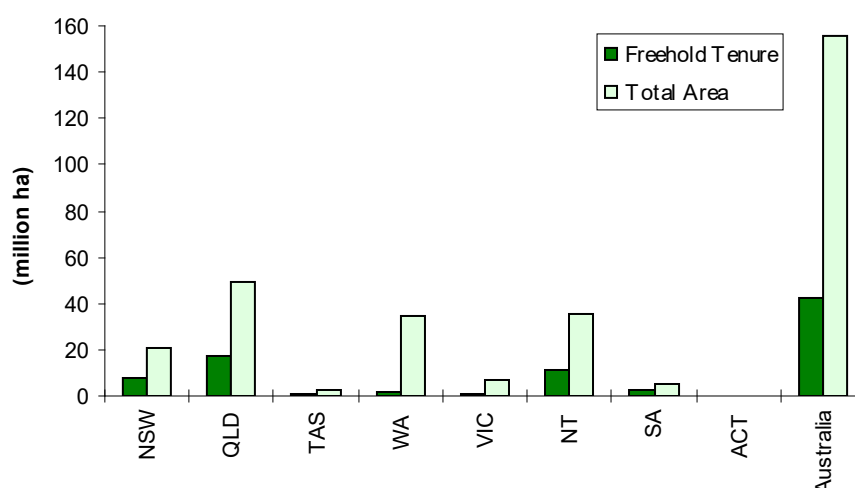
The National Forest Inventory (1995) defined forest as:

"an area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres and with existing or potential crown cover about equal to or greater than 20%" (cited in NFI in prep).

This definition includes all ages of natural and planted forests and all tree and mallee forms of vegetation. The forests included can be categorised as "woodlands" (20-50% crown cover), "open forests" (50-80% crown cover), and "closed forests" (>80% crown cover). "Private native forest" is defined as "native forest on freehold land". Complications arise when comparing some sources of data due to the inclusion or exclusion of leasehold and Aboriginal land.

The NFI draft report on native forests on private land estimated around 42 million ha, (or 27%), of the estimated total of 157 million ha of Australia's forests were on privately owned land (Figure 2.1).

Figure 2.1: Estimated areas of native forest



Source: National Forest Inventory (in prep).

Note: ACT freehold tenure is 600 ha and total area is 12,000 ha

The estimated total area of native forest on farms from the NFI draft report is considerably larger than the RAC (1992b) estimate primarily because the NFI data included trees whose mature heights are 2 metres or more and have a crown cover of 20% or more, compared with 5 metres height and 30% crown cover. Furthermore, the NFI data was not limited, as RAC (1992b) was, to the Australian Forestry Council regions.

It should be noted that there are considerable limitations to these data and, apart from Tasmania, the data for each State should be considered with caution. For example, the NFI data for areas of private native forest in South Australia have not been updated using current vegetation mapping or survey information, and use an incompatible definition of "forest".

Further, areas of private native forest in Queensland include open woodland. Estimated areas of private native forest in Victoria are believed to be more reliable. The estimate for south west Western Australia was derived from an assessment using satellite imagery and ground truthing in 1994, and is considered to be reasonably accurate. The most reliable data on the extent of private native forest is considered to be for the north coast and mid north coast regions of New South Wales and for Tasmania.

2.2 TYPES OF PRIVATE NATIVE FOREST

The variability of climate, soils, and other factors that influence vegetation across the Australian continent give rise to a correspondingly diverse range of private native forest types. The RAC reduced the many types of forest across Australia to fifteen broad forest groups based on major biogeographic forested regions (RAC 1992b, Table 2.1). (For descriptions of the forest groups see RAC 1992a, Vol. 1, p. 82).

Table 2.1: Private native forest and woodland groups in Australia

Forest group	Area ('000 ha)
Tropical rainforest	60
Subtropical rainforest	32
Temperate rainforest	70
Mangrove and swamp forest	164
South western wet eucalypt forest	12
South western dry eucalypt forest	495
South eastern wet eucalypt forest	739
South eastern ash forest	161
South eastern dry forest and woodland	2 698
South eastern coastal eucalypt forest	382
Central coastal eucalypt forest	1 470
North eastern coastal eucalypt forest	657
River red gum forest	100
Native pine forest and woodland	1 081
Northern dry eucalypt forest and woodland	3 220
Total	11 341

Source: RAC (1992a, Vol. 1, p. 83)

Eucalyptus forests dominate private native forest in all States, as shown in Table 2.2, except in South Australia. Mallee forests, many of which are also dominated by eucalypts, predominate in South Australia.

Table 2.2: Proportions of forest types by State and Territory

Forest type	New South Wales	Victoria	Queensland	South Australia	Western Australia	Tasmania	Northern Territory	ACT	Australia
Eucalyptus	96%	77%	60%	19%	61%	97%	90%	100%	74%
Acacia	0.3%	0.4%	13%	0.3%	11%	0.4%	3%	0%	7%
Callitris	1%	0.4%	0.6%	0%	0%	0%	0%	0%	0.5%
Mallee	0.2%	2%	0%	78%	21%	0%	0%	0%	5%
Mangrove	0.1%	0.2%	0.8%	0.6%	0.3%	0%	2%	0%	1%
Other	1%	19% ⁽¹⁾	17% ⁽¹⁾	0.6%	7%	0%	0.4%	0%	8%
Melaleuca	1%	0.3%	3%	0.1%	0%	0%	3%	0%	2%
Rainforest	0.4%	0%	5%	0%	0%	2%	1%	0%	2%
Casuarina	0.1%	0%	0.3%	1%	0%	0.1%	0%	0%	0.2%

Source: National Forest Inventory (in prep).

⁽¹⁾ Not classified in source information - probably predominantly eucalypt.

2.3 REGIONAL DATA ON PRIVATE NATIVE FORESTS

2.3.1 Western Australia

The RAC (1992b) estimate of 507 000 ha of native forest on farms in Western Australia was based on data that did not allow for the full extent of forest clearing. This compares with the estimate of 198 000 ha in the draft National Forest Inventory report. Furthermore, due to clearing of land for agriculture, the private native forest resource in Western Australia is highly fragmented. Of the approximate 7 300 parcels of native forest on farms in the south west of Western Australia, 60% of these are smaller than 10 ha, 31% are from 10-15 ha, and only one is larger than 5 000 ha.

Table 2.3 shows the forest types and dominant species that comprise private native forest in Western Australia. The major forest types are all dominated by eucalypts.

Table 2.3: Private forest types, Western Australia

Forest type (dominant species)	Approximate area ('000ha)
Tuart (<i>Eucalyptus gomphocephala</i>)	4
Jarrah (<i>E. marginata</i> with <i>E. calophylla</i>)	162
Karri (<i>E. diversicolor</i> with <i>E. calophylla</i>)	5
Wandoo (<i>E. wandoo</i>)	27
Total	198

Source: National Forest Inventory (in prep).

2.3.2 Northern Territory

Northern Territory forests have been classified by the NFI into fourteen types. The areas and dominant species of these types on private property are shown in Table 2.4. This includes land owned by Aboriginal communities, some of which is conservation reserves.

Table 2.4: Forests and woodlands in the Northern Territory

Forest type	Area on private land ('000 ha)	Total area of forest type ('000 ha)
Closed (ie. Rain and vine forest)	82.6	102.9
<i>Eucalyptus spp.</i> ; open with grass understorey	5102.9	6041.6
Woodland with grass understorey	6496.9	17506.6
Low woodland	537.0	5928.5
Low woodland with hummock grass understorey	56.8	897.1
Palm woodland	40.8	95.9
<i>Melaleuca spp.</i> woodlands	405.2	1171.4
Open forest ; flood plains	126.3	158.9
<i>Acacia shirleyi</i> . open forest	123.4	2045.2
<i>Acacia spp</i> and <i>Eucalyptus spp.</i> low woodland	165.5	325.8
Mixed species open forest	221.4	453.5
<i>Acacia aneura</i> tall open shrublands	1149.5	4372.8
Total	14508.3	39100.2

Source: National Forest Inventory (in prep).

NB: this table includes woodlands not included in Table 2.1.

2.3.3 South Australia

The NFI draft report presents data on the type and extent of native vegetation in ‘bioregions’ across South Australia. The bioregions with the largest areas of private native forest and woodland are the Eyre/Yorke block, and the Murray Darling Depression, with approximately 1 million ha each. Most of this is likely to be sparse forest and commercially unproductive (Table 2.5).

Table 2.5: Private native forest types in South Australia

Forest type (projected canopy cover)	Proportion of private land (%)
Non-forest (<20%)	27
Sparse forest (20-50%)	47
Dense forest (50-80%)	26
Total	100

Source: National Forest Inventory (in prep)

2.3.4 Queensland

Table 2.6 provides data obtained from the RAC (1992b) which describes forest groups and their areas on private land in Queensland. The NFI has also gathered data on forest types, dominant floristics and structures of native forests on farms in Queensland, based on differing definitions and a different land base.

Table 2.6: Private native forest groups, Queensland

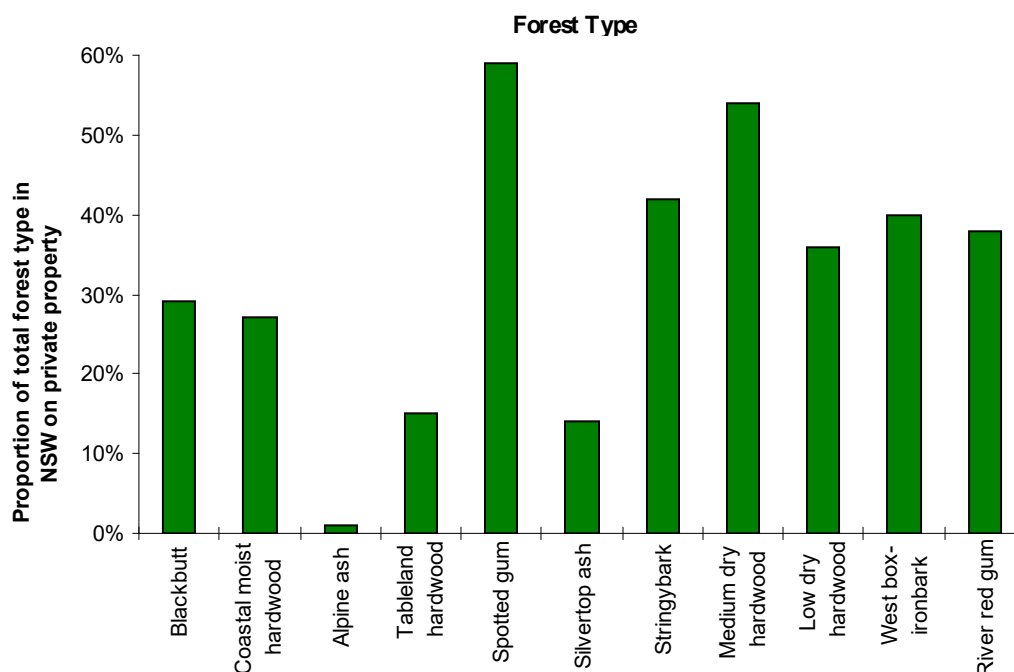
Forest Type	Area ('000 ha)
Subtropical rainforest	32
Central coastal eucalypt forest	434
North eastern coastal eucalypt forest	657
Native pine forest and woodland	210
Northern dry forest and woodland	22
Total	1355

Source: RAC (1992b)

2.3.5 New South Wales

More than half of some eucalypt forest types of New South Wales occur in private native forest. Most notable are the spotted gum and blackbutt types, which are recognised commercial timber species. The proportions of each forest type on private land are shown in Figure 2.2.

Figure 2.2: Private native forest types in New South Wales



Source: National Forest Inventory (in prep).

NFI data include percentages of different private native forest types by NSW regions. These were calculated from "Forest Resource Inventory of the State" data published in 1972 (Hoschke 1976), the only source that provides data on both public and private native forests for New South Wales. These data are useful for determining in which NSW regions different forest types occur on private land. For example, 61%, 26%, and 13% of the blackbutt forest type on farms in NSW occur in the Northern, Central, and Southern regions, respectively.

Studies by Northern NSW Forestry Services Pty Ltd (1994) and Northern NSW Forestry Services and State Forests of NSW (1996) include assessments of the existing area of net productive private hardwood forest. Together these studies covered an area from the mouth of the Hunter River north to the Queensland border and west to the escarpment. The studies identified a net productive area of 703 430 ha of private native forest in the study areas (Table 2.7).

Table 2.7: Private native forest, NSW mid north and north coast

Broad forest type	Estimated net productive area by site quality class (ha)			Total (ha)
	Low	Medium	High	
Spotted gum dominated	73810	101695	5740	181245
Blackbutt dominated	44470	55145	12570	112185
Dry mixed hardwood	95495	80800	2260	178555
Moist mixed hardwood	2860	106905	34010	143775
New England mix	54535	26135	7000	87670
Total	271170	370680	61580	703430

Source: Modified from Northern NSW Forestry Services (1994) and Northern NSW Forestry Services and SFNSW (1996).

Grant (1989) provided a list of the more common commercial timber species found in private native forest in New South Wales (Table 2.8).

Table 2.8: Common commercial timber species in NSW

Forest type and location	Species
Hardwood forests of the north coast: The coastal strip between the Hawkesbury River and the Queensland border extending to the foothills of the tablelands.	Grey ironbark, tallowwood, blackbutt, spotted gum, red mahogany, white mahogany, stringybark, forest red gum, grey box, brush box, turpentine, blue gum, flooded gum, grey gum.
Hardwood forests of the south coast. The coastal strip between the Shoalhaven River and the Victorian border contains valuable and extensive hardwood forests.	Spotted gum, blackbutt, woolly butt, grey box, silvertop ash, stringybark, bangalay, mountain grey gum, Sydney blue gum, turpentine, and grey ironbark.
Hardwood forests of the northern tablelands. From Nundle and Nowendoc to the Queensland border.	New England blackbutt, red stringybark, messmate, ribbon gum, brown barrel, tallowwood, Sydney blue gum.
Hardwood forests of the southern tablelands. From Braidwood to the Victorian border.	East: Brown barrel, stringybark messmate, mountain gum, white ash, manna gum, silvertop ash, woolly gum and mountain grey gum. West: near Batlow and Tumbarumba are alpine ash, messmate, mountain gum and red stringybark.
Ironbark forests of the inland.	Narrow leaved ironbark of the north west and central slopes. Red ironbark and silver leaved ironbark.
River red gum forests. On the banks of the Murray River between Albury and South Australia; on the Murrumbidgee River below Narrandera, and some locations on the Lachlan and Darling Rivers.	River red gum
Cypress pine forests. <i>Callitris columellaris</i> or white cypress pine on the western slopes and plains and in the Riverina; in the wheat belt west to the Darling River. Commercial forests occur in the 400 to 700 mm rainfall zone.	<i>Callitris spp.</i>
Rainforests. High rainfall areas of the coast and eastern slopes of the tablelands; most extensive in the mid north and north coast.	Red cedar, hoop pine, rose wood, white beech, silky oak, teak and cudgerie. Others include coachwood, sassafras, red carrabeen, corkwood, yellow wood, yellow carrabeen, crab apple, pigeonberry ash, booyong, and bollywood

Source: Grant (1989)

2.3.6 Victoria

Table 2.9. describes forest types, and indicates their proportion of the total private forest estate in Victoria. Data were collected from a 1:500 000 database (NFI in prep).

Table 2.9: Private native forest types in Victoria

Forest type	Proportion of total private native forest in Victoria
Eucalypt forest types	
Stringybark/Peppermint	42%
Box/Ironbark	15%
Mallee complex	5%
Silvertop/Banksia	5%
Manna gum	4%
Red gum	3%
Ash type	1%
Snow gum	1%
Other forest types	
Blackwood	1%
Unclassified (mainly eucalypt)	23%

Source: Derived from National Forest Inventory (in prep)

From Table 2.10 it can be seen that 38% and 33% of private native forest in eastern Victoria has a mature stand height from 16 to 28 metres, and from 26 metres to over 40 metres, respectively. Therefore, over 70% of private native forest in eastern Victoria has a mature stand height of at least 16 metres. This indicates significant potential for commercial timber production.

Table 2.10: Private native forest types, eastern Victoria

Structural forest type	Estimated areas of private native forest (ha)	Proportion of total private native forest
Closed forest (ie, rainforest)	340	0.1%
Mature stand height > 40m; open forest	28 560	4.6%
Mature stand height 26-40m; open forest	179 280	28.8%
Mature stand height 16-28m; open forest	235 060	37.7%
Mature stand height 5-15m; open forest	9 990	1.6%
Woodland	83 220	13.3%
Unclassified and other forest types	23 530	14.0%
Total forest on farms	568 610	100.0%

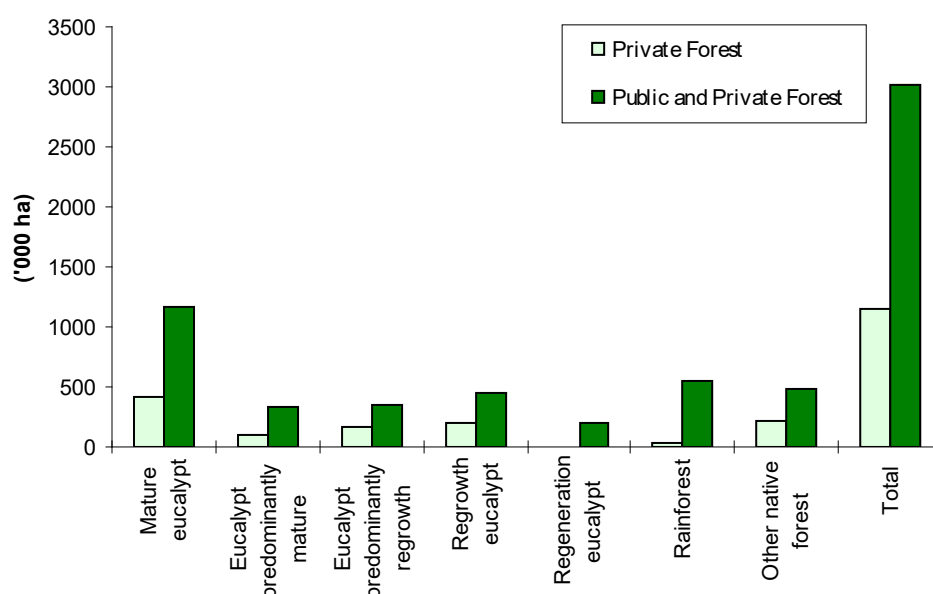
Source: Modified from National Forest Inventory (in prep); derived from 1:100 000 database

2.3.7 Tasmania

The RAC (1992) and NFI (in prep) estimated private native forest resources available for timber production in Tasmania of 0.8 million ha and 0.6 million ha respectively. In 1994, the Forestry Commission of Tasmania estimated that Tasmania had 945 700 ha of private native forest, of which 450 000 ha was available for timber production (Forestry Commission Tasmania 1994). Estimates of private native forest resources in the Tasmanian Regional Forest Assessment (Public Land Use Commission 1996) showed that private native forest accounted for around 1.146 million ha of a total native forest resource of 3.024 million, or close to 40% of native forest resources in Tasmania (Figure 2.3).

More detailed and accurate information should be available from studies conducted as part of the Tasmanian RFA. However, this information has not yet been published.

Figure 2.3: Private native forest area in Tasmania



Source: Public Land Use Commission (1996)

An estimated 75% of Tasmania's private native forests are classified as "dry eucalypt" forests. The most common commercial species of these forests are described in Table 2.11.

Table 2.11: Common commercial species of Tasmanian private dry eucalypt forest

Eucalypt type	Main Species
Ash	<i>E. obliqua</i> ; <i>E. delegatensis</i> ; and <i>E. sieberi</i> .
Gum	<i>E. globulus</i> ; <i>E. viminalis</i> ; <i>E. dalrympleana</i> ; <i>E. rubida</i> ; <i>E. ovata</i> ; and <i>E. pauciflora</i> .
Peppermint	<i>E. amygdalina</i> ; <i>E. pulchella</i> ; <i>E. tenuiramis</i> ; and <i>E. rodwayi</i> .

2.4 VALUES AND USES

The values and benefits accruing from the existence and use of private native forests vary widely. They include commercial values from timber harvesting, other forest products such as oils, seeds, fuel, honey, and pharmaceuticals, and shelter for livestock.

Values may be classified as "intrinsic" or "utilitarian". Intrinsic values are those that are seen as being good or desirable in themselves, while utilitarian values are seen as means to some other end or purpose, such as the uses people make of the forest. Figure 2.4 (which is illustrative rather than exhaustive) shows the RAC (1992a) categorisation of these values. The major commercial uses of native forest on farms are timber harvesting, beekeeping, grazing livestock, recreation, and tourism. *Eucalyptus* forest covers about 60% of the private forest in Australia and represents the major timber production resource (RAC 1992a).

Private forests also provide environmental benefits including conservation of soil, water, flora and fauna. While to date these have been very poorly documented, the potential importance of private land to contribute to conservation values is illustrated in the Tasmanian RFA where it has been demonstrated that areas of private land will be required for the establishment of a comprehensive, adequate and representative reserve system. The RFA has clearly demonstrated that private forests have biodiversity and flora and fauna values. Similarly, studies in Queensland indicate that two-thirds of Queensland's rare and threatened flora, and 180 rare and threatened fauna species, occur in private native forest (NFI in prep).

Figure 2.4: Values and uses of native forest

Values	
Utilitarian	Intrinsic
Commercial tradeable goods	Aesthetic
- wood and non-wood products	Heritage
Services for commercial enterprises	Spiritual
- tourism, water	Biocentric
Site for recreation	Wilderness
Protection of natural systems	Lifestyle
- soil, water, flora, fauna, atmosphere	
Uses	
Utilitarian	Intrinsic
Wood	Environmental quality
Non-wood products	Biological diversity
Grazing	
Minerals	
Tourism	
Recreation	
Water	

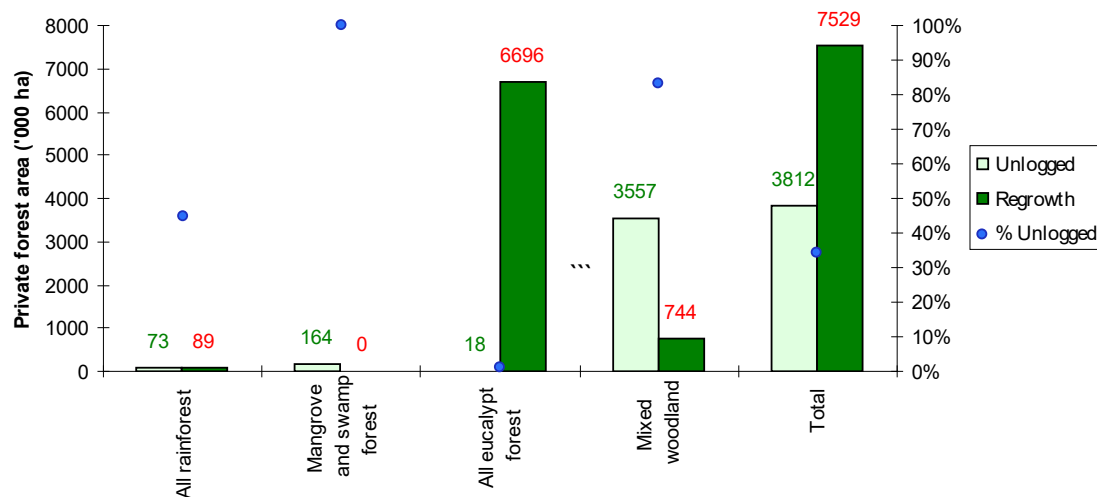
2.5 CONDITION

The condition of private native forest is affected by a number of related factors, which may be characterised as extrinsic or intrinsic. Extrinsic factors are those superimposed by past and present human disturbance, and spasmodic or catastrophic events, such as wildfire, floods and cyclones. Intrinsic factors include soil type, topography, aspect, and climate.

Human based extrinsic factors affecting the condition of native forests can be further divided into Aboriginal use, especially their use of fire regimes across the continent, and European colonisation of the continent and their role in changed fire regimes, livestock grazing, timber harvesting, and silvicultural treatments in native forests. The intensity and frequency of fires, logging, livestock grazing, and silvicultural treatments, and other disturbances affect the forest condition. The condition of a forest may be determined by assessing the impact of these intrinsic and extrinsic factors on structure, floristics, and the ecological processes operating within.

Reliable detailed information at national, state, and regional levels on the condition of private native forest is not available. However, there is substantial information on logging history, which can be a significant extrinsic factor in forest condition. Table 2.5 shows the extent of unlogged and regrowth forest on private land in Australia, as determined by RAC (1992a). An important point to note is that over 99% of eucalypt forests on private land in the Australian Forestry Council regions was considered to have been logged and was classified as regrowth forest.

Figure 2.5: Condition of private native forest and woodland



Source: RAC (1992a)

Detailed studies on the condition of private native forests have been undertaken for the mid north and north coast regions of New South Wales. These are described below. Similar information has been collected for private forests in Tasmania as part of the RFA process.

New South Wales Mid North Coast and North Coast

The studies by Northern NSW Forestry Services Pty Ltd (1994) and Northern NSW Forestry Services and State Forests of NSW (1996) included assessments of the condition of net productive private hardwood forests being managed, or potentially manageable, on the north coast and mid north coast of NSW. Table 2.7 indicates the net productive private native forest in those areas.

Over 90% of the productive or potentially productive native forest on private land on the mid north and north coast of New South Wales qualified as being low to medium site quality, with less than 10% qualifying as high site quality. A description of "site quality", in a timber production sense reflects intrinsic site quality factors such as soils, parent rock, topography and climate, as well as extrinsic factors, affected largely by human induced disturbances such as fire, timber harvesting and grazing.

2.6 CONCLUSIONS

Approximately 11 million ha of Australia's 43 million ha of native forest estate is privately owned. On the basis of this figure alone, a thorough knowledge and understanding of this forest estate is warranted. However, information on the extent, distribution, types, uses, and values of native forests on farms across Australia is scarce and often incongruous. Reliable detailed information at national, state, and regional levels on the condition of native forest on farms is not available, although the National Forest Inventory and comprehensive regional assessments being undertaken as part of RFA process are working towards providing this information.

Private native forests can be used as a source of timber products, such as sawlogs or pulplogs, and non-timber products. Conservation of soil, water, flora and fauna in native forest on private property has been very poorly documented. Other uses of private native forests may place value on indigenous heritage, recreation, tourism, education, and water catchment. There is another perspective that places value on the maintenance of private native forests as areas undisturbed by humans and their activities.

Any strategy to promote productive farm forestry through sustainable management of native forests on farms must be pursued in conjunction with improved information on private native forests. The RFA process will help develop the information base and ensure that private native forests are considered an integral part of economic, social and environmental assessments.

3 Economic Contribution of Native Forests

3.1 SOURCES OF DATA

This Section assesses regions in Australia for which there is credible data on the economic contribution, or potential contribution, of private native forests. As was the case with information on the extent and condition of private native forests, economic data are also very scarce. The RFA process is addressing this through information being collected as part of economic and social assessments. However, to date information from this process is only available for Tasmania.

The data available for most States and regions on the volume of timber products harvested from private land may be unreliable. However, it gives some indication of the economic importance of private native forests. It is difficult to assess the significance of income which accrues to landholders from the products harvested.

3.2 CURRENT CONTRIBUTION

3.2.1 Tasmania

Legislation in Tasmania provides for private native forest to be an active part of the sustainable timber resource. In 1995-96 the production of timber products, primarily sawlogs and pulplogs, from both private and crown forests provided approximately \$700 million (or 7%) of Gross State Product (Tasmania - Commonwealth Joint Steering Committee 1997). Taking indirect benefits into account, it is estimated that the contribution of the forest industries in Tasmania was around 17% of Gross State Product.

Private forest provides around one-third of total log removals in Tasmania. In 1994/95 Tasmania produced around 5 million m³ of logs of which 32% was from private forests. Over the previous 5 years the contribution of private forest to sawlog removals remained around 20% of total removals. Over the same period the proportion of total removals obtained from private land increased so that private land accounted for almost half of total pulplog removal in 1994/95. An estimated 500 000 m³ of firewood is also harvested annually from private native forests (Forestry Commission Tasmania 1994).

In financial terms, removals of logs from private forests in 1994/95 accounted for 47% of gross mill door value in Tasmania (Table 3.1). Reflecting relative share in volumes, private land accounted for smaller proportions of veneer logs (4%), category 1/3 sawlogs (32%) and special species sawlogs (31%) than for pulplog (50%) and other eucalypt sawlogs (53%).

Table 3.1: Gross mill door values of logs, Tasmania, 1994/5

Source	Veneer Logs	Category 1/3 Sawlogs	Other Eucalypt Sawlogs	Special Species Sawlogs	Pulplogs	Total
Public	\$2 021 000	\$14 846 000	\$6 227 000	\$1 138 000	\$64 531 000	\$88 763 000
Private	\$87 000	\$6 963 000	\$6 933 000	\$510 000	\$63 749 000	\$78 242 000
Total	\$2 109 000	\$21 809 000	\$13 159 000	\$1 648 000	\$128 280 000	\$167 005 000

Source: Tasmania - Commonwealth Joint Steering Committee (1997)

3.2.2 New South Wales

Table 3.2 summarises timber yields in recent years from private native forest in New South Wales. These volumes are based on sawmill returns supplied to State Forests of New South Wales, and thus represent a conservative estimate of the true values as not all wood arriving at the mills would necessarily have been recorded. Dyason (pers. comm. 1997) estimated that actual removals may be underestimated by as much as 50%. About three quarters of sawmills on the north coast of New South Wales obtain timber from private native forests (O'Neill pers. comm. 1997).

The most significant contribution from private native forest in New South Wales has been hardwood sawlogs, which, in recent years, have yielded on average about 370 000 m³/year. This represents an average of about 28% of the total yearly sawlog yield from all tenures in New South Wales in recent years.

Table 3.2: Timber yields ('000m³) from private native forest, NSW

Product	95/96	94/95	93/94	92/93	91/92	90/91	89/90	88/89	87/88	82/83
Hardwood sawlog	225.4 (19%)	242.0 (18%)	329.4 (22%)	372.2 (26%)	328.4 (31%)	373.3 (32%)	375.4 (30%)	327.3 (28%)	345.8 (29%)	360.8 (33%)
Cypress pine sawlogs	12.8 (12%)	6.5 (6%)	8.8 (8%)	6.9 (7%)	9.6 (10%)	13.6 (14%)	15.1 (14%)	14.3 (13%)	15.3 (15%)	21.5 (22%)
Hardwood veneer log	1.2 (6%)	0.6 (3%)	0.2 (1%)	5.4 (26%)	3.7 (21%)	0.1 (0.5%)	nd	nd	0.3 (1%)	nd
Brushwood	nd	nd	nd	nd	1.5 (47%)	1.1 (50%)	0.8 (27%)	2.3 (58%)	2.5 (57%)	3.3 (16%)
Poles, piles, girders	8.4 (25%)	5.2 (11%)	7.7 (16%)	8.3 (20%)	17.6 (33%)	15.7 (23%)	16.7 (24%)	10.2 (20%)	13.5 (24%)	19.1 (30%)
Mining timbers	5.1 (42%)	4.7 (45%)	1.3 (23%)	10.0 (50%)	14.0 (54%)	15.7 (52%)	26.8 (53%)	19.1 (42%)	22.0 (44%)	48.8 (42%)
Chipwood (tonnes)	22.4 (3%)	60.1 (7%)	45.2 (6%)	52.8 (7%)	81.4 (10%)	108.8 (12%)	77.1 (9%)	85.5 (11%)	75.1 (10%)	172.6 (22%)
Sleepers	0.7 (10%)	0.5 (7%)	5.7 (38%)	19.8 (60%)	21.0 (37%)	26.0 (38%)	30.4 (40%)	65.2 (53%)	47.8 (44%)	50.1 (50%)
Miscellaneous products	nd	nd	nd	0.4 (29%)	1.6 (32%)	12.7 (72%)	15.2 (71%)	17.1 (55%)	16.3 (48%)	5.5 (25%)

Notes:

The data are in thousands of cubic metres gross volume except for chipwood which is in tonnes.

The numbers in brackets are the percentage of the total yield.

Source: State Forests of New South Wales annual report data assembled by FORTECH.

nd = no data available or no harvesting.

Table 3.3 summarises the average annual contribution of the major private native forest timber products to the total yield from all forest tenures in New South Wales.

Table 3.3: Timber harvested from private native forests, NSW

Product	Average proportion of total yield, 1987/8 to 1995/6	Major supply regions (State Forests of NSW Regions)
Hardwood sawlog	28%	Northern and Central
Cypress pine	11%	Western
Hardwood veneer log	8%	Northern
Poles, piles, girders	23%	Northern and Central
Mining	45%	Southern, Central, Western, Softwoods
Chipwood	10%	Southern
Sleepers	38%	Western, Central, and Northern

Source: State Forests of New South Wales annual report data collated by FORTECH.

3.2.3 Queensland

The Queensland state forest management agency collects information from licensed sawmillers on sawlogs taken from private native forest. Taylor (pers. comm. 1998) reported that sawlog yields of about 200 000 m³/year from private native forest in Queensland has exceeded yields from public native forest. Yields have steadily decreased to the present yield from a peak of about 600 000 m³/year in 1950.

It is likely that the private forest sector in Queensland supplies large volumes of timber for sleepers and mining timbers to users in central Queensland. However, no data on this are readily available.

3.2.4 Other States

In Western Australia, private native forests yield about 100 000 m³/year, which is generally considered to be below the productive potential of these forests (NFI in prep).

The state forest management agency in Victoria does not collect information on timber production from private native forest and no data are available.

South Australia's private native forest resources have been deemed to be so restricted in extent that state legislation, the *Native Vegetation Act* 1991, requires that consent be obtained to remove any native vegetation. This requirement effectively prevents harvesting from private native forests (refer Section 4.4.2).

3.3 SUSTAINABLE YIELDS

Estimating national or regional yields of wood from private native forest is much more difficult than for public forests due to the diversity of management intentions associated with private ownership. For instance the Tasmanian RFA process has estimated private wood yields on a sampling basis with discounts for non-harvestable areas. The discounts are based on environmental factors and owner intent. For example, the Statewide weighted

average used in Tasmania was that owners wished to retain 40% of their forest resources outside declared private timber reserves. Estimates for the RFA show current standing volume of private native forest of 7.3 million m³ of sawlogs and 46.6 million m³ of chipwood.

A sustainable yield of sawlogs and veneer logs of 200 000 to 220 000 m³/year was determined for private forests in Tasmania if suitable forest was partially logged to favour sawlog retention (Private Forestry Council 1989). This compares with the annual sawlog harvest from 1988 to 1992 of about 260 000 m³.

Table 3.4 summarises the estimated long term potential sustainable timber yield for Australia developed. The estimates were generated during this study by assuming values for net productive areas and productivity for each of the major forest groups identified by RAC (1992b). The estimate serves merely to provide a guide to the magnitude of potential yields. The actual current harvestable volume depends on forest condition.

Table 3.4: Estimated potential sustainable wood yields

Forest group	Gross private forest area ('000 ha)*	Assumed net productive proportion**	Assumed productivity (m ³ /ha/yr)**	Estimated sustainable yield ('000m ³ /yr)
Tropical rainforest	60	50%	1	30
Subtropical rainforest	32	50%	1	16
Temperate rainforest	70	50%	1	35
South western wet eucalypt forest	12	50%	6	36
South western dry eucalypt forest	495	75%	2	742
South eastern wet eucalypt forest	739	50%	6	2217
South eastern ash forest	161	50%	6	483
South eastern dry forest & woodland	2698	75%	2	4047
South eastern coastal eucalypt forest	382	75%	2	573
Central coastal eucalypt forest	1470	75%	2	2205
North eastern coastal eucalypt forest	657	75%	2	1012
River red gum forest	100	75%	1	75
Native pine forest and woodland	1081	75%	0.2	162
Northern dry eucalypt forest and	3220	75%	0.1	241
Total	11177			11874

* Source: RAC (1992b)

** Source: FORTECH estimate.

The calculation of sustainable yield is only of academic interest if these yields are not matched by demand. As suggested above, there appears to be sufficient demand in Tasmania. In New South Wales and Queensland, there are inadequate and/or inappropriate demands for timber from private native forests. The historic record of production in most states does not reflect either the resources' silvicultural potential or its capacity to address Australia's trade imbalance in forest products, which arises principally from consumption of paper products.

3.4 CONCLUSIONS

The production of wood from private native forest in areas of Tasmania, New South Wales, Queensland, and Western Australia significantly contributes to local, regional, and state economies and employment. Production levels and other information from native forest on farms is poorly documented. While there is little available data on the current or potential contribution of native forest on farms to farm revenue, it is likely to be significant. There is known to be substantial trade in forest products between landholders and sawmillers, firewood merchants, sleeper cutters and other processors. Payment would often be in the form of products such as sawn timber for farm use and/or in other forms difficult to trace.

Based on available data, it is concluded that the contribution of native forest products from private native forest to farm revenue, local, regional, and national economies, and employment is below potential contribution. However, it appeared that the sawlog and veneer log yield from private native forests in Tasmania during 1988 to 1992 exceeded the sustainable yield. Apart from Tasmania, there is little documented information on sustainable yields from private native forest. This lack of sustainable yield development is related to a lack of demand for the range of forest products from private native forests in most states.

In the absence of documented information, an estimate of the potential national production of timber products from private native forests was developed using assumed values for net productive area and growth rates for each major forest type. This estimate indicates that the potential production is some 12 million m³/year. To put this in perspective, the total national harvest of forest products was estimated to be around 19.5 million m³/year in 1994/5 (ABARE 1996).

4 Requirements for Sustainable Management

4.1 KEY ISSUES

In the context of developing a farm forestry culture based on native forests on farms, ecologically sustainable development has as its basis the need to optimise the benefits accruing to landholders from commercialisation of native forest products and uses, in accord with ecological and social constraints. Key issues in this regard include:

- understanding the ecological processes in native forests and therefore developing appropriate management practices;
- an understanding of the economics of private forests within a property management planning context, including an understanding of the competitiveness of farm forestry compared with other farm businesses and influences on farmer intent with respect to forest use;
- the legislative and regulatory framework within which landholders with native forests must operate; and
- social and cultural influences on landowner attitudes and intent.

This Section examines key issues under each of these factors and identifies impediments, skills and gaps in knowledge relevant to development of a farm forestry culture based on native forests. Many of these issues are similar to those relating to plantations on cleared land.

4.2 ECOLOGICAL INTEGRITY

Silvicultural management of native forest on farms will directly influence the extent to which they are sustainably managed and commercially productive. The ecological characteristics of native forests, including the biological characteristics of individual tree species, should determine the selection and timing of silvicultural activities. Key areas of activity that affect ecological integrity include:

- silvicultural systems and growth of the forest;
- assessing growing stock condition and productivity;
- manipulation of growing stock;
- harvesting and regeneration methods;
- tending and thinning;
- pest and disease control; and
- fire management.

Annex 1 outlines of key issues in relation to each of these activities.

4.3 ECONOMIC VIABILITY

To ascertain whether farm forestry is economically viable, the growth rate, type, area, and condition of the forest must be assessed and the quantity of products determined. Market

signals influence silvicultural and other management practices. Silvicultural practices may be affected where there is strong demand and high prices for a particular forest product or low demand for other products. For example, good prices for poles and veneer from early mature trees may influence tree marking under a selection regime, with the rotation cycle being decreased. Conversely, low demand for low quality timber may mean that it is uneconomic to thin young regrowth forests. This constrains growth of more valuable products.

Future markets are very difficult to determine and accordingly, as a general rule, it is desirable to retain flexibility with a view to providing for a number of products. Like any good investment strategy, a diverse portfolio decreases the risk.

Fluctuating markets and prices of other commodities influence native forest management decisions, especially by those farmers whose forest is not a primary source of income. For example, during a period of a protracted fall in beef prices accompanied with a period of rising hardwood timber prices, a beef cattle grazier might decide to log a forest stand earlier than planned, or log more of the stand than planned. This is a pragmatic business decision, even though it may lead to shorter and unsustainable cutting cycles and depletion of future timber yields.

Dyason (pers. comm. 1997) is developing an ecological production model for farm forestry, which uses a silviculture based native forest recovery phase with culling of poor quality trees and chipwood based programs to eventually enable increased productivity from native forest. Deterioration of the genetic diversity would require re-stocking with high quality genetically improved stock. Such an eco-production model could be incorporated into existing property management planning processes currently active in a number of regions.

Studies into the private native forests of the mid north (Northern NSW Forestry Services Pty Ltd and State Forests NSW 1996) and north coast of New South Wales (Northern NSW Forestry Services Pty Ltd 1994) have determined that farmers' forest management practices are largely demand-driven and based on the precept that these forests were an alternative revenue for graziers. Very few landholders had properties, or forest on properties, solely for timber production purposes. The study area has a long history of logging of private forests with a pattern of early exploitation followed by selective logging driven by demand for prime sawlogs, which constitute only a small portion of the wood fibre resource. This has resulted in the present predominance of young and semi-mature regrowth forests, many of which are growing at less than their potential productivity.

4.4 LEGISLATIVE AND REGULATORY FRAMEWORK

With respect to the development of the sustainable management of a farm forestry culture, the issues of ecological integrity and economic viability overlap to some extent, and also overlap with legislative and regulatory framework. Without an encouraging and effective policy environment, there will be no confident advancement towards this vision. A strategy to foster this farm forestry culture needs to consider the legislation and regulations that control the protection and use of native forests on farms.

4.4.1 Western Australia

Western Australia has no Statewide regulations controlling use of private native forests. However, planning schemes developed by municipal councils under the *Town Planning*

and Development Act 1928 enable individual councils to impose controls. Some councils require permit applications for the removal of any native vegetation, including individual trees. Such requirements would effectively prevent on-going commercial use of native forest on farms. Regulations under the *Country Areas Water Supply Act 1947* control clearing on private land in several declared catchments. In some catchments, any clearing is prohibited and any attempt to harvest timber is heavily constrained. Where clearing is prohibited, farmers have been paid compensation.

4.4.2 South Australia

South Australia's *Native Vegetation Act 1991* requires that consent be obtained to clear any native vegetation (DENR 1995). Exceptions are provided in specified circumstances such as around dwellings and for fire protection and dam construction or to provide fencing timber and firewood for farm use.

Consent for clearance may be obtained if *"clearance is necessary for better land management purposes as shown on a total property plan and only if the clearance does not conflict with the biological conservation values of the area. Isolated trees will be assessed for their contribution to conservation If approval is granted, this consent will only be given if there is a plan to replace the vegetation elsewhere on the property for a net gain in native vegetation."* (DENR 1995, p. 7).

Applications to clear native vegetation are considered by a broadly based Native Vegetation Council appointed by the Government under the Act. The Council meets monthly, except January, and is advised on each application by the Department of Environment and Natural Resources.

Clause 27 of the Act provides exemption from the clearance controls in several circumstances, one of which refers to forestry:

- (q) where;
- (i) *"the land on which the vegetation is situated was used for ... forestry within five years immediately before the proposed clearance occurs;*
- (ii) *the clearance is necessary to maintain the land so that it can continue to be used for ... forestry to the extent to which it had been used for that purpose within the immediately preceding five years; and*
- (iii) *the vegetation has a stem diameter at the lowest point on the stem above ground level of 150 mm or less.*

The size limit included in this exemption clause makes it clear that the purpose of the clause is not to enable ongoing commercial use of native forests.

4.4.3 Queensland

There is no Statewide system controlling native vegetation or private forest management in Queensland. Individual local governments may use powers under the *Local Government Act 1936* to enact local laws, referred to as "vegetation protection orders", covering the protection of native vegetation. The Queensland government has recently developed new planning legislation, the *Integrated Planning Act 1997*, that is

expected to clarify the circumstances in which local governments may impose vegetation protection orders. The new legislation has the potential to secure long term rights for landholders to manage and harvest their timber, but there are still some issues and interpretations relating to vegetation on private land to be resolved. Local government will still have the ability to regulate timber growing activities, but only at the time they commence, ie. when the initial change of land use occurs. Forestry activities are to be designated self assessable, thus avoiding the need for an initial development application. Forestry activities, by definition, include all timber growing activities from regeneration to timber processing.

4.4.4 New South Wales

The *Environmental Planning and Assessment Act 1979* is the principal legislation dealing with land use planning and development in New South Wales (DLWC 1996). Part 3 of this Act specifies three types of planning instruments and prescribes processes for their development and approval. The three types of instrument are State environment planning policies, regional environmental plans and local environmental plans.

A State environment planning policy (SEPP) may be made with respect to any matter specified by the Minister on the basis that, in the opinion of the Minister, that matter is of significance for environmental planning for the State. State environment planning policies must be considered by planning authorities, including Shire Councils, when administering regional environmental plans and local environmental plans. State environment planning policies are numbered consecutively.

SEPP 46 was introduced in 1995 to protect and conserve native vegetation by requiring that consent be obtained to remove any native vegetation. The consent process included referrals to various State Government agencies. Exemption was provided from development consent for private native forests *"being selectively logged on a sustainable basis or managed for forestry purposes (timber production)"*. On-going management of private native forests for commercial purposes appeared therefore to be provided for in the regulations. The guidelines for application of this exemption indicate that landholders are required to prove that management is "sustainable". Defining what is meant by sustainable has proved difficult in the regional forest agreement process (refer for example FORTECH 1997). It is therefore likely that the exemption would be difficult to administer.

SEPP 46 and some provisions of other legislation were replaced by the *Native Vegetation Conservation Act 1997*, which came into force on 1 January 1998 (DLWC 1998). This Act establishes the concept of regional vegetation management plans that define areas where native vegetation can be cleared without application and areas where application is required. It also allows exemptions to be developed according to regional requirements and provides for voluntary agreements between landholders and the Department of Land and Water Conservation. These agreements *"offer many advantages to landholders, including ... providing greater certainty about the future management of native vegetation"* (DLWC 1998). Whether this provision will facilitate productive farm forestry through sustainable management of native forests on farms remains to be seen.

4.4.5 Victoria

Victoria also has Statewide regulatory controls on native vegetation clearance (DCNR 1996). The controls are included in the State section of all planning schemes and require planning permission for removal of any native vegetation. While exemption is provided in certain circumstances where plantation establishment is proposed, exemption is not provided for on-going use of private native forests for timber production.

4.4.6 Tasmania

Tasmania's *Land Use Planning and Approvals Act* 1993 prescribes a similar system of rural land use planning controls to that applying in other States. However, there is one major distinction. The *Forest Practices Act* 1985 provides for areas of forest and plantation to be declared as "Private Timber Reserves" (Private Forests Tasmania 1995). The *Land Use Planning and Approvals Act* 1993 provides that land with this status is exempted from the requirements of local government planning schemes, and therefore from any municipal planning restrictions on private forestry.

These provisions recognise that forest investment and management is a long term activity and an owner needs security for that future land use (Private Forests Tasmania 1995). Land declared could be native forest, plantation, commercial shelterbelt, woodlot or other agroforestry plantings. Landholders may seek Private Timber Reserve status for all of their land or any part that is at least 5 ha in area. In 1993, there were 230 Private Timber Reserves covering about 160 000 ha of private forest.

The declaration process involves the landowner applying to Private Forests Tasmania, the government agency which regulates and promotes private forestry. The application is evaluated by the Forest Practices Board and public comment is invited. Objections can only be made on the basis of five criteria outlined in the *Forest Practices Act* 1985, which also contains appeal provisions for both landholders and objectors. The landowner has the right to seek compensation if a Private Timber Reserve application is rejected.

Harvesting operations must be planned and undertaken in accordance with the Forest Practices Code. This requires preparation and approval of a Timber Harvesting Plan by Forest Practices Officer who are accredited under the Act. Forest Practices Officers may be employees of forestry companies, officers of State agencies or private individuals. This process is based on self-regulation, that is, forest owners are responsible for compliance. The Forest Practices Board arranges an audit of 15% of operations annually to ensure compliance. An appeal determination in August 1996 confirmed that approved Timber Harvesting Plans do not require planning permission. Local government and other planning authorities can therefore not require further regulatory processes.

The Private Timber Reserve system appears to provide an efficient and consistent planning system for private forestry.

4.4.7 Legislative and regulatory issues

In all States except Tasmania, the legislation and regulations in place to control use of native vegetation are significant impediments to sustainable management for timber production of private native forests. Even for those States, such as South Australia and New South Wales, that provide exemptions from regulations controlling use of native vegetation, it is not clear that those exemptions provide sufficient security for landholders who are interested in long term management for timber production.

All States have some form of "conservation covenant" arrangement whereby landholders can choose to apply for a covenant to be placed on the title to their land. The covenant protects native vegetation from clearing by future landholders. This sort of mechanism could also be used to provide security for sustainable forest management. For example, private native forests could be exempted from other regulatory requirements once a management plan has been prepared and a code of practice is established with a mechanism for ensuring on-going compliance. This would be similar in some respects to the Tasmanian Private Timber Reserve system. A covenant system for farm forestry could provide a foundation for a 'Forest Trust Fund' arrangement, as employed overseas and notably in Norway (Oistad *et al.* 1992), to generate a pool of funds for projects that enhance farm forestry and its culture across the broader landscape. These possibilities are options that need to be addressed in a strategic directions context at the regional and national level.

4.5 SOCIAL AND CULTURAL FACTORS

The history of native forests on farmland in Australia commenced with initial exploitation. Particularly in higher rainfall regions this often involved the clearing of large tracts of land. This was followed by various degrees of further exploitation, including selective logging of trees with the greatest financial returns. Forests on farms have been considered an exploitable resource in the path to development of more valued grazing and cropping activities. Forestry on private land as an on-going and serious agricultural enterprise was not generally entertained because returns have traditionally been quicker in the more familiar agricultural enterprises.

Government policies encouraged the development of this culture by requiring clearing as a condition of land settlement and providing taxation deductions for clearing costs. Timber production has come to be considered a State sector responsibility, and more recently a corporate sector activity, rather than a genuine business for a small private landowner.

During early settlement there was a perception that the taller and thicker the forest, the better were the soils beneath it. This gave the incentive for clearing of many of the most productive forests for agriculture. Native forests remained on farms either because the forested land was seen to be of insufficient value to the farmer or because on-going management for timber production and/or other purposes was considered of value to the farm business.

There is now generally some form of free extension service for farm forestry in most regions provided by State forest management agencies. However, this service is relatively poorly funded and staffed compared to traditional agricultural extension services. The lack of suitable extension agents is often cited by farmers interested in farm forestry as an impediment to their decision making process. If the desired surge of landowner interest eventuates, State agencies will not be able to provide adequate advisory resources. This

highlights an opportunity for private advisory agents to provide advice to landholders and education programs for increased community awareness.

Table 4.1 summarises many of the knowledge, techniques and skills necessary to sustainably manage native forests to produce commercial products as a viable source of revenue. A landholder does not have to possess all of these skills because they can be purchased. However, the table provides an outline of the key issues that a landowner needs to understand.

Table 4.1: Summary of knowledge, techniques and skills for forest management

Subject	Knowledge	Techniques	Skills
Products	size and quality specifications growth rate markets	growing harvesting regeneration	harvesting marketing
Forest management	silviculture and forest ecology species and community fire protection site resources and competition seed production stand dynamics sustainability markets	appropriate methods sustainability indicators species and community identification succession management fire management seed collection/identification sustainability indicators	forest measurement regeneration procedures road and track construction machine operation fuel treatment species identification succession management

Landowner Intent

In a 1994 study of about 2 000 broadacre and dairy farms across Australia, farmers were asked about the area and main function of their native forest, and whether they intended to clear any of this vegetation over the 5 years from 1993/4 to 1998/99 (ABARE 1995). Around 81% of farms in the wheat sheep zone and 68% of farms in the high rainfall zone, have some areas of native forest. The average forested area was 348 ha and 163 ha, which is about 18% and 20%, respectively, of the average farm area in these two zones. Provision of shelter and shade was the most common function listed. Other functions included conservation. Few farmers listed commercial timber production or non-timber forest products as a main function of their native forest.

The proportion of farmers who indicated they intended to clear native forest within the 5 year period ranged from less than 5% in Victoria, Western Australia, South Australia, Tasmania and the Northern Territory, to 27% in Queensland's wheat-sheep zone. The average size of intended clearing generally increased as the size of the property increased.

This study indicated that it was relatively common for landholders to not consider native forest as a productive resource which can form an integral element of their farming business. Returns from any forest harvesting operations would therefore tend to be regarded as windfall income rather than a return from long term sustainable forest management.

Information on farmer intentions for use and management of their native forests is scarce. It is understood that Private Forests Tasmania has conducted considerable studies relating to

farmer perceptions and intentions. Unfortunately, this information is not available to the public at this stage. However, research conducted by the Forestry Commission of Tasmania in 1994 indicated that over half of the private native forest in Tasmania harvested in 1992/93 was intended to be converted to plantations or other agricultural land (Table 4.2). The proportions shown are the percentages of management plans written in 1992/3, not the percentage of area.

Table 4.2: Intended post harvesting land use, 1992/93

Logging system	Proportion of intention
Clearfelled and converted to:	
silvicultural regeneration	2%
hardwood plantation	26%
softwood plantation	1%
agriculture	26%
Selectively logged	45%

Modified from Forestry Commission Tasmania (1994).

4.6 IMPEDIMENTS

Many of the impediments to native farm forestry are the same as those for plantation farm forestry eg., access to appropriate skills, farm cash flow, infrastructure, and lack of suitable demand for non-sawlog yield, exacerbated by access to suitable markets restricted by competition from larger public resources. These impediments have been well documented elsewhere (eg., RIRDC 1996). However, there are some issues which are particularly important for native forests. These include:

- uncertainty over the impact of RFAs on the role of private land in comprehensive, adequate and representative forest reserve systems, either through compulsory or voluntary acquisition of land;
- confusion over the impact of native vegetation clearance regulations and what constitutes sustainable forest management practices (Section 4.4 provides an outline of the State government regulations that control use of native vegetation on private land);
- lack of markets and silvicultural regimes for thinnings from native forests;
- lack of evidence apparent to landholders that, given appropriate management, their native forests have the commercial potential to provide a long term sustainable input into the viability of their farms; and,
- conflict between forestry objectives and other farming activities, particularly grazing when there is limited funds available for fencing boundaries between these land uses.

Related to these and other more general impediments, there are considerable gaps in our knowledge of farm forestry. Table 4.3 summarises these gaps.

Table 4.3: Gaps in knowledge relevant to native farm forestry

Subject	Gaps in knowledge
Ecological	Data on native forests on farms: - extent - distribution - condition - types Manipulation of function and structure of forest communities (silvicultural skills): - management and manipulation of plant succession - identification of forest structure, floristics, and condition - regeneration skills - ecological assessment and inventory: - productivity - determination of sustainable yield
Economic	Markets and marketing Silvicultural methods Contribution (potential and current) to farm revenue Values and uses of forests
Cultural	Forest management skills within planning, regulation, and legislative requirements Non-commercial values of native forests Silvicultural methods: - manipulation of growing stock - improving productivity - harvesting and regeneration - pest and disease management - forest measurement - fire management - genetic improvement
Social	Community interest and sentiment Social acceptability Compatibility with other farming enterprises Federal and State government private forestry agencies Communication and pathways

5 Developing a Farm Forestry Culture

5.1 SUMMARY OF ISSUES

There is significant opportunity to promote the development of a farm forestry culture in Australia through greater realisation of the potential for native forests on farms to be sustainably managed for wood and other products. This potential includes both commercial and environmental benefits. While increased support for farm forestry in Australia has provided considerable focus on planting trees on cleared agricultural land, there has been little recognition to date of the potential for enhanced commercial use of native forests on farms.

With existing resources, private native forests can provide a more immediate starting point for farm forestry than plantation development. However, there are many impediments to the development of sustainable management of native forests on farms. Key impediments include:

- **State and National policy development** - while there are some State-based organisations providing an effective forum and voice for policy development, there is no national policy body providing coordination of strategic directions and political support for the sustainable management of native forests on farms. This sector requires a ‘champion’ to lead the address of impediments to farm forestry development, and provide the guidance and support of sector-building activities, such as the establishment of private native forest covenants and forest trust funds.
- **Legislative and regulatory environments** - sustainable management of native forests on farms is restricted by laws and regulations aimed at control of clearing native vegetation. By restricting sustainable management, these laws and regulations create uncertainty over returns that may come from investing in native forest management and therefore reduce the value of the forest.
- **Quality of resources** - much of the resource has been neglected, which reduces its commercial value, and the vast majority of resources are regrowth which will require development to realise commercial potential.
- **Cash flow** - while native forest on farms can sometimes supply an immediate cash flow, this is often regarded by farmers as a windfall gain. In addition, the investment required to develop regrowth forests before returns can be achieved can also present cash flow problems for landholders.
- **Markets** - virtually all regions lack sufficient markets for thinnings and other non-sawlog yields. Consequently, tending regrowth forests to enhance their potential for sustainable returns is cash flow negative and is therefore seen as uneconomic. As with plantations, this substantially inhibits private forestry investment.
- **Farmer knowledge and skills** - most landholders lack the knowledge and skills required to practice sustainable forestry and do not have access to suitable extension services.
- **Viability** - the viability of investing time and money into sustainable management of native forests on farms is unclear to landholders and other potential developers of suitable

markets, and neither have access to sufficient information for assessing the potential of private native forests achieving commercial viability.

- **Information** - there is relatively little information on private native forest resources and the benefits from investing in these, both from an individual's point of view, and from a broader social and economic viewpoint.

5.2 POSSIBLE SOLUTIONS

Actions to address the impediments to development of farm forestry as a viable land use are similar to those that have already been implemented as a means of promoting the development of plantations on cleared agricultural land. These actions must address impediments, provide a clear and stable framework for sustainable development, allow for sharing of costs related to public and private benefits, and provide access to as wide a range of landholders as possible.

Specific actions proposed for consideration are:

Strategic direction

- Inclusion of policy development for private native forests in the charter of a national forest policy body or establishment of a new national policy body to guide and support the development of farm forestry.
- Inclusion of sustainable management of native forests on farms in existing State and Commonwealth farm forestry programs. This will allow the development of regional approaches to information and advisory services.

Information and advisory services

- Completion of resource inventories for private native forests. The absence of adequate data is likely to continue to constrain development of appropriate policies and programs by Commonwealth and State governments. Resource inventories will also assist with identification and development of potential markets.
- Provision of independent forest management advisory services for landholders. While the relevant State forest agency is usually the source of information and extension services, there are perceptions in some States that there may be conflict of interest with the forest agencies as they may in effect compete with private growers for markets. Also, State forest agencies do not necessarily have a presence in all regions where native farm forestry could be viable.

Resource security

- Agreement is required that private native forests will have the same status as public forests when Regional Forest Agreements have been completed. Native forests not required for reservation may then be utilised commercially without constraint from native vegetation protection legislation and regulations, subject to the requirement for sustainable forest management.
- Recognition by government and policy bodies of the environmental benefits of sustainable forest management through appropriate cost sharing. Similar to plantations of trees on cleared agricultural land, sustainable management of native forests on farms can have both public and private benefits. Where this is the case it is appropriate that

there be some sharing of the investment costs in proportion to the benefits. At one extreme, where private native forests are required for reservation systems, associated costs should be borne by the public.

Market development

- Recognition by government and policy bodies that the substantial development of commercial farm forestry is fundamentally dependent on developing markets for the full range of yields, including by-products generated by silvicultural practices used to produce and protect the primary wood products.

Research and monitoring

- Encouragement for the incorporation of commercial use of farm forest resources into property management planning (PMP). PMP provides an overall framework for sustainable development and presents an ideal framework for landholders to explicitly consider the potential commercial use of their native forests. It is likely that specific forestry inputs may be required to contribute to such plans.
- Establishment of research and monitoring programs and systems to provide for increased understanding of ecological processes within native forests on farms, and to ensure that these forests retain their ecological integrity. These programs provide the basis for a culture of perpetual management of private native forests, which may feature initiatives such as private native forest covenant and forest trust funds.

Encouraging and facilitating the sustainable management of native forests on farms by the above actions may hasten the development of a farm forestry culture in Australia.

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APPENDIX

SILVICULTURAL ISSUES

APPENDIX: SILVICULTURAL ISSUES

Silviculture is the "theory and practice of managing forest establishment, composition and growth" (Victorian Government 1986 p38). A silvicultural system "prescribes the application of ecological, social and economic knowledge to manipulate forest development to fulfil specific management objectives" (Squires *et al.* 1987, cited by RAC 1992a, p. 70).

A silvicultural system consists of a series of treatments or practices which manipulate biological processes to achieve specific objectives. In Australia, silvicultural systems in native forests are primarily used to produce wood, to ensure optimal regeneration and growth of the forest, and protect the forest from fire, disease and pests. They have been used to manage forests for uses other than wood production, such as the maintenance of a well-regulated supply of potable water (RAC 1992a) and could also be used for other objectives, including wildlife conservation.

Silvicultural practices in native forests are dictated by the biological requirements for regeneration and optimum growth which vary according to the type and character of the forest. Cost, price, technical efficiency, safety, and environmental effects also affect silvicultural practices. In reality, economic considerations may be considered more important than other factors. For example, silvicultural options for overstocked and degraded stands will often be limited if there is no market for small diameter, low value products.

Silvicultural management of native forest on farms will directly influence the extent to which they are sustainably managed and commercially productive. Sawlogs are the most common prime timber product. Areas of silvicultural management likely to be of most concern to the farmer will be the harvesting, regeneration, thinning, pests and diseases, and measurement of the forest.

Silvicultural systems and growth of the forest. One of the main objectives of many silvicultural treatments is to optimise the growth of individuals of the tree species to be harvested.

Rainfall, light, temperature, soil and topography affect growth but most of these factors cannot be readily manipulated. Thus, growth is usually influenced by manipulating the growing stock and altering the genetic material of the forest. "Growing stock" is defined as the collection of individual plants that occupy an area of forest. Manipulation of forest soils, for example, by cultivation or fertilisation, can also affect forest growth. These practices are uncommon in native forests except for enhancing or creating seed beds.

Growing stock condition. Assessment of the growing stock is one of the primary steps in evaluating management options. Residual trees may or may not respond to release after a selective cutting and clearfelling may destroy useful advance-growth.

Manipulation of growing stock. The forest can be viewed as having a number of limited resources such as light, nutrients, and space, for which individual plants compete. Influencing the extent to which individuals compete for these resources is a primary way of manipulating the growing stock. Competition between individuals and between forest species is manipulated to favour selected species or individuals.

Improving productivity

The management of native forest is governed by:

- the forest type;
- its logging, or other disturbance, history;
- available markets; and
- the practical ability of the forest manager to control superimposed factors such as wild fire.

There are benefits for the land owner and the commercial production forest in having a long term management plan. This could use the existing structures of property management planning supported by many state agencies.

Native forest management should aim to enhance future productivity of the forest. Depending on the type and condition of the native forest a range of management options can be considered. For example, Northern NSW Forestry Services and State Forests NSW (1996) outlined the following silvicultural options, based on timber production site quality classes, for private native forests of the mid north coast of New South Wales:

Degraded and low site quality forest

- Option 1. Cull the poorer quality stems for chipwood and salvage to increase the number of better quality stems which in turn will increase the amount of potential sawlogs and other high value products. Markets for chipwood, firewood, or other low value products may be necessary so as to provide some revenue to help off set the costs of thinning.
- Option 2. Leave for many years (ie. up to 50-100 years) and hope for a commercial crop for your descendants.

The latter option, being somewhat facetious, was intended to emphasise the need for stand treatment (especially culling and thinning) to prepare stands for commercial timber production.

Medium site quality forest

Thin over-stocked stands to release better quality trees, create sufficient disturbance for regeneration and to harvest a range of products. This should be economically viable unless the stand was recently intensively logged. Again, chipwood, firewood, or other markets may be necessary to provide some revenue to help off set the costs of thinning.

High site quality forest

These forests contain more commercial species with better form and age class distributions. Because of the increased growth rates of these forests they respond better to a range of management options. The best growth rates are found in flooded gum and blackbutt stands. Thinning every 15-20 years may be possible whilst still retaining a full range of trees sizes. Aim to create sufficient disturbance while thinning to stimulate regeneration. Use selection system methods to maintain a suite of timber tree species and ages.

A chipwood market is also seen as an integral part of logging operations in these forests.

Harvesting. As most silvicultural methods in Australian native forests are designed to produce wood, the main types of silvicultural practices are harvesting and regeneration, which are both central to all silvicultural methods. Harvesting methods can be classified according to the method of regeneration, whether they are used to create even-aged or uneven-aged stands, and whether they are extensive or intensive methods.

Table A1.1 outlines common silvicultural systems used by professional forest managers in Australia. These are based on clear felling or selection methods, or variations or combinations of these.

Clearfelling.

In clearfelling, a coupe (the area to be logged) is harvested in a single operation (Figure A1.1). All merchantable trees are harvested except those required for seed supply or other management purposes. Trees that have no merchantable timber are also felled. As a consequence, even-aged stands of regrowth are created, eventually leading to a forest mosaic of small scattered even-aged stands of various ages. The coupe size in extensive forest estates is usually from 10-50 ha.

After logging a clear-felled coupe, a regeneration burn is often used to initiate seed fall, create a receptive seed bed and enhance seedling establishment. The fire is implicated in the increased rate of germination and establishment success. There is also a soil sterilising effect in moist forest types. The ash bed contains soluble nutrients which are readily available for seedlings.

The alternative to burning is to disturb the soil mechanically during or after logging to create a seed bed of exposed mineral soil. Regeneration burning is usually successful in moist forests. Mechanical soil disturbance is usually satisfactory in dry forests.

Table A1.1: Classification of silvicultural methods

A. High forest methods:	produce stands originating from seed and usually used to grow trees to larger sizes.
1.	Methods of producing even-aged stands:
	clearfelling
	seed tree methods
	shelterwood or uniform methods
2.	Methods of producing uneven-aged stands.
	selection method
	single tree selection
	group selection
B. Coppice methods:	based on repeated cutting of coppice stems arising from stumps.

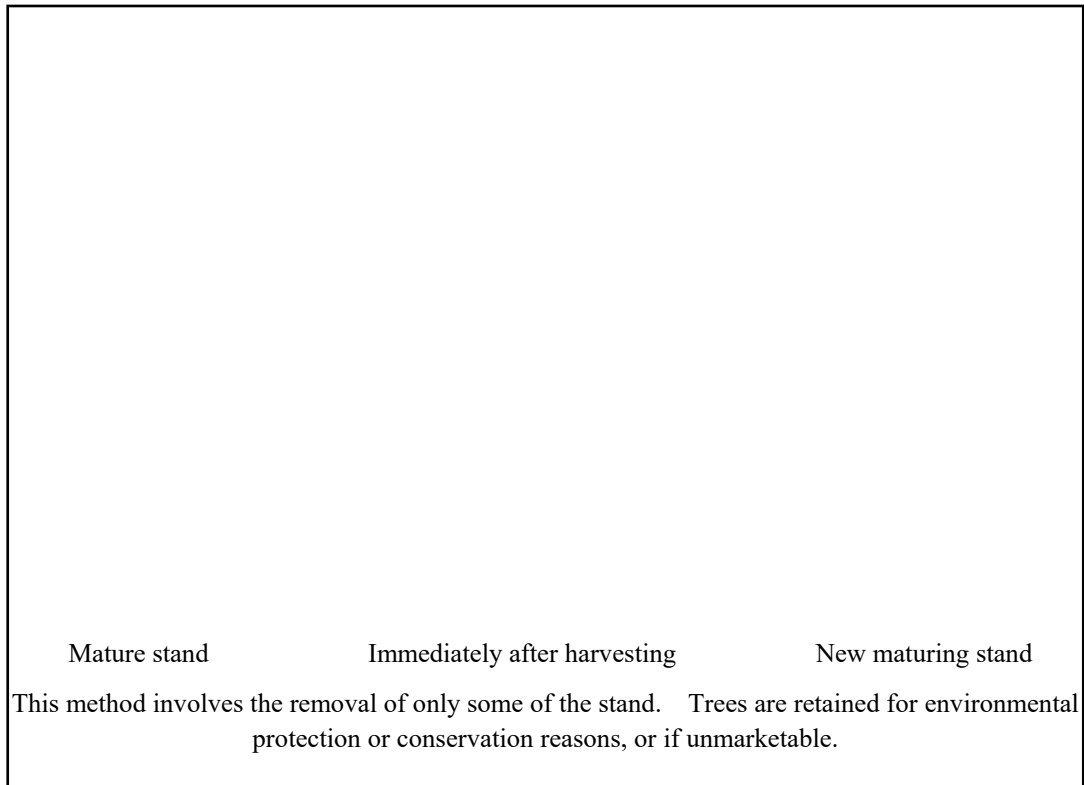
Figure A1.1: Clear-felling



Clear-felling is most common in the highly productive moist and wet sclerophyll forests of Western Australia, Victoria, and Tasmania, mainly because of its regeneration success. Intensive burns after logging are necessary to create seed beds and control competition. Regeneration burns increase sawlog productivity and operational efficiency, decrease road and harvesting costs, and facilitate control of the growing stock. Clear-felling is also used in the drier forests of the south east New South Wales and eastern Tasmania, and lower elevation mixed forests of Victoria.

Modified clear-felling. Modified clear-felling can retain, for a number of reasons, some of the stand, Figure A1.2. Reasons for retaining some of the stand may be for environmental protection; conservation; wood production; aesthetics; or lack of a market for the product.

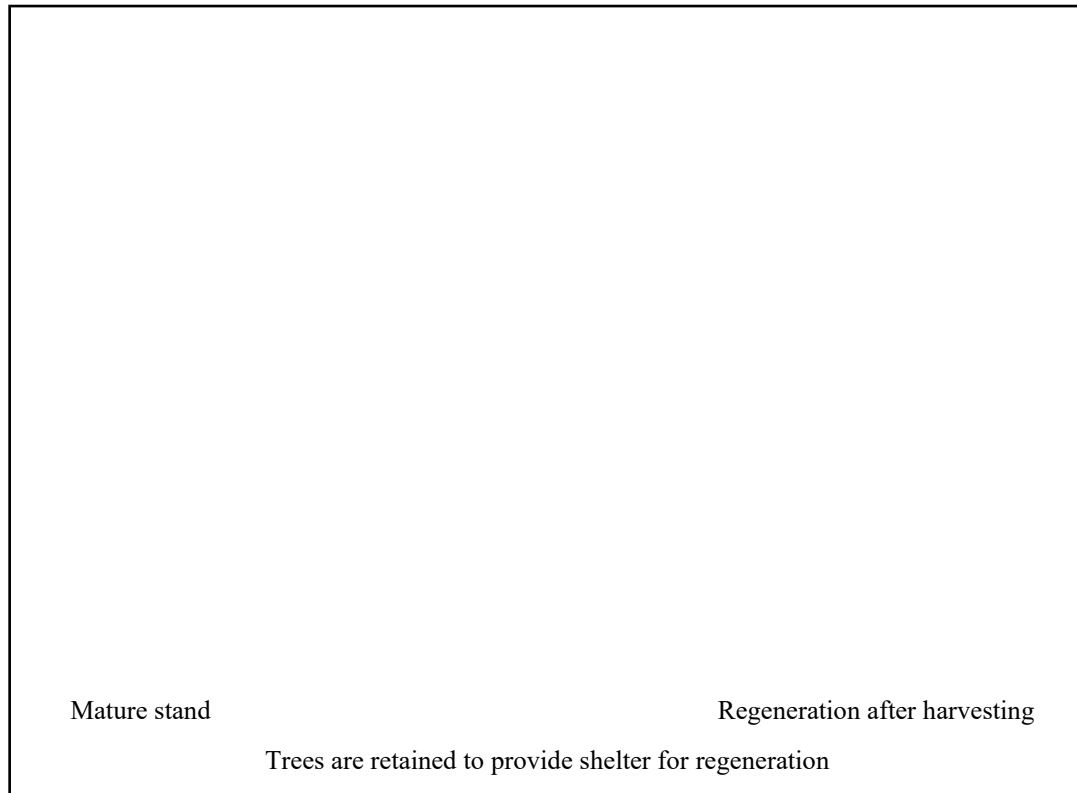
Figure A1.2: Modified clear-felling



Shelterwood methods. Shelterwood methods are used in the highlands of Tasmania and Victoria where frost and snow can damage seedlings. In Western Australia, shelterwood methods are used to encourage the development of lignotuberous advance-growth in jarrah stands some years in advance of the final harvest.

As the name suggests, a pool of trees are retained to shelter the regeneration (see Figure A1.3). Normally, once the regeneration has reached a certain age or size the shelter trees are logged, creating an even-aged stand. Other reasons for leaving shelter trees are to retain stems to increase their commercial value, to establish advance growth, or for aesthetic reasons.

Figure A1.3: Shelterwood system



Selection systems. With selection systems, only a well defined portion of the stand of trees is removed in any single harvesting operation (see Figure A1.4). It is often important that a defined pattern is retained. Selection criteria depend on the forest and the products required. The harvest is normally repeated at shorter intervals than in clear-felling, which leads to regular regeneration of new seedlings. Selection systems include:

- | | |
|----------------------------|---|
| diameter-limit cutting: | only trees above a set diameter are felled; |
| group selection: | groups of trees are harvested; |
| quality stem retention: | quality, not size, is the selection criteria; |
| special purpose selection: | trees with desirable attributes are harvested, ie. poles; |
| flexible selection: | meets multipurpose objectives. |

Variants are used in Queensland, northern New South Wales, in jarrah forest in Western Australia, and in the drier mixed forests of Tasmania and Victoria. On the north coast of New South Wales, the intensity of selection varies according to the forest type and condition. *Eucalyptus maculata*, (spotted gum) is regularly thinned but will be clear-felled and seed trees left and the mineral soil exposed. For *Eucalyptus pilularis*, (blackbutt), group selection is used, and in Queensland, areas up to 5 ha are clear-felled in larger areas of selectively logged forest.

Figure A1.4: Selection method

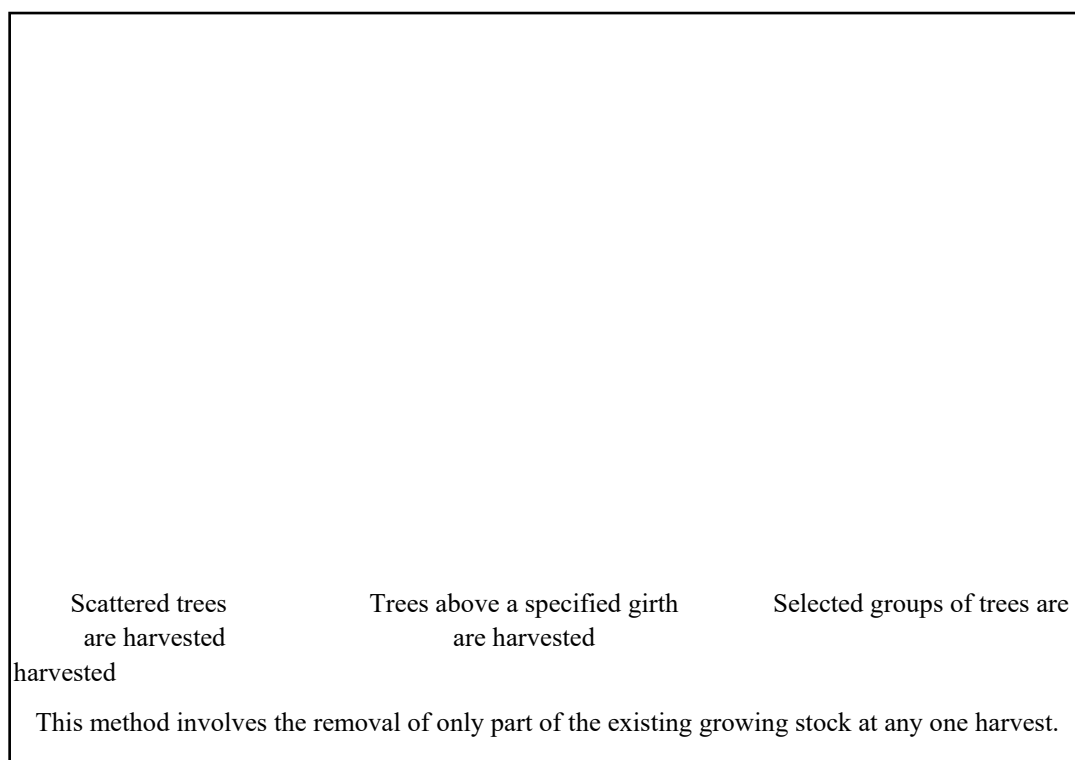


Table A1.2 summarises from Florence's (1996) classification of silvicultural practices in Australian eucalypt forests.

Table A1.2: Classification of silvicultural practices in Australian eucalypt forests.

- A. **Silvicultural regimes where distinctly uneven-aged stands will be maintained**
 1. **Diameter-limit cutting.** Only those trees greater than a prescribed diameter are harvested; commercial thinning of trees below that diameter may also be permitted.
 2. **Group selection.** This has often been based on diameter-limit cutting, but with specific openings made in the tree canopy to encourage growth or regrowth of the commercial species (the Australian group selection system). The regeneration 'groups' may cover a prescribed proportion of the stand at each harvest.
 3. **Quality stem retention.** Selection is based on tree quality not size and conserves trees with good boles and growth potential through the full range of size, and immediately utilises trees with poorer form or growth potential.
 4. **Special purpose selection.** Only those trees with specific attribute are harvested, for example, trees of durable species used for poles and piles.
 5. **Flexible selection practice.** A regime which aims to meet a number of objectives, and can result in or maintain a highly variable structure. It may take account of both short and long term wood supplies, and at the same time, maintain on environmental grounds, a good level of ecological, structural and aesthetic diversity throughout the forest.
- B. **Silvicultural regimes where even-aged regrowth will form the only or major component of the post-logging stand:**
 1. **Shelterwood type cutting (or uniform selection cutting).** A silvicultural regime which has some of the characteristics of the classical shelterwood system, designed to

maintain a largely even-aged forest. While shelter for young trees may only be necessary under extreme circumstances in the eucalypt forest, the regime may be used to achieve other management objectives. For example, to conserve better quality trees to realise their increment potential; to establish a pool of well developed advance-growth before harvest of the remnant overstorey; or to develop an even-aged stand without the adverse aesthetic impact of clear-felling.

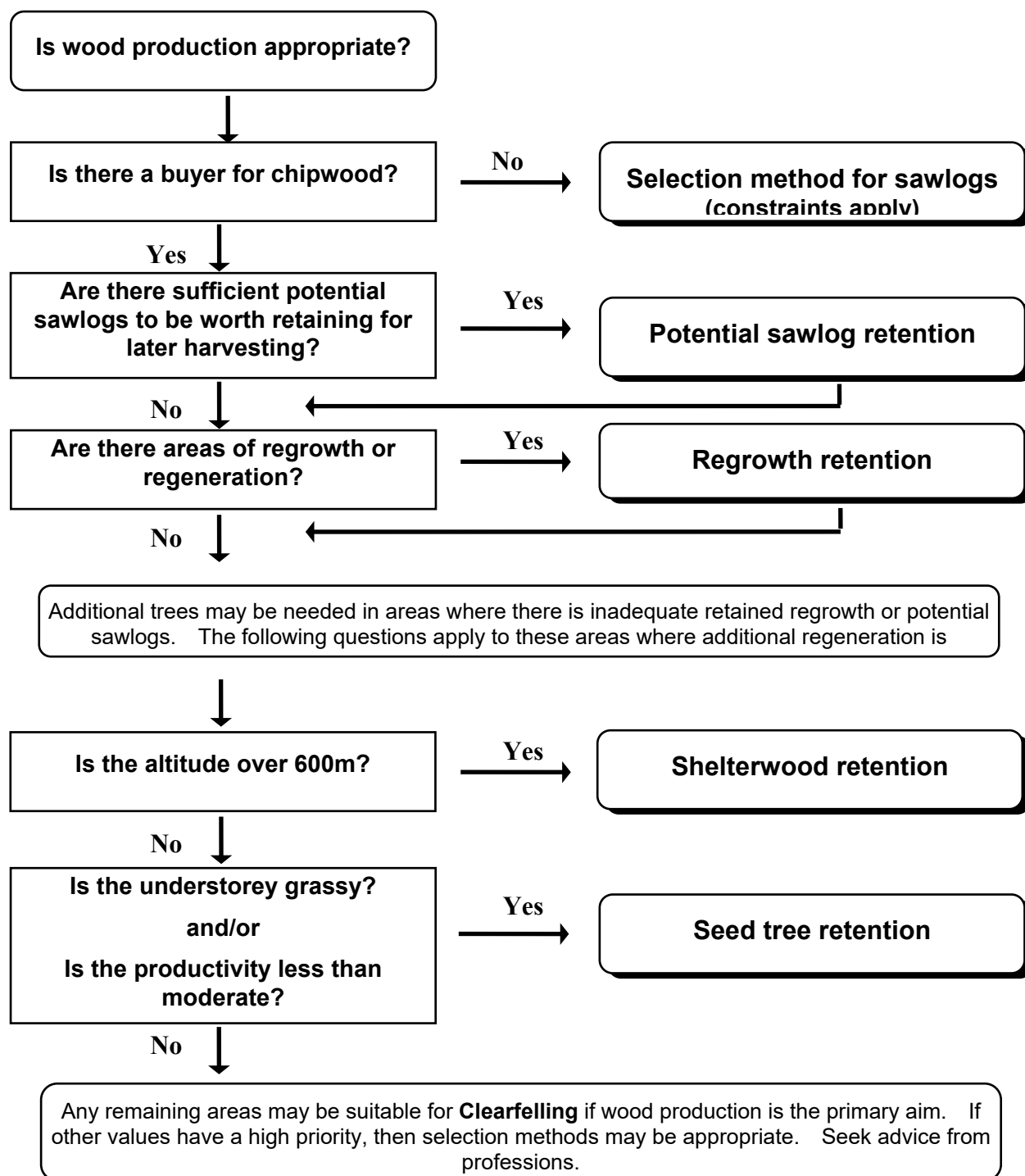
2. **Clearfelling.** All of the existing growing stock and sometimes all of the understorey is removed; clearfelled coupes may be in blocks or in strips of variable size and shape, often distributed in some defined pattern throughout the forest.

There are a number of sub-categories based on the source of regeneration:

3. **Clearfelling with natural regeneration.** Regeneration develops from advance growth, from seed falling immediately before or during logging, or from seed within the heads of felled trees.
4. **Clearfelling with seed trees.** A prescribed number of trees are retained as a seed source. The number varies with species, site, crown quality, and size of the seed crop. The seed trees may be harvested subsequently, felled to waste or retained standing.
5. **Clearfelling with direct seeding.** Seed is manually sown or distributed from aircraft on to a prepared seed bed.
6. **Clearfelling with planting.** A prescribed number of seedlings (or clonal stock) per unit area is planted after harvest, usually following heaping and/or burning of slash from logging.
7. **Modified clearfelling or 'clearfelling with retention'.** These terms may apply where the basic aims are to maintain or create a forest with even-aged regrowth as a major component, but where some of the growing stock is retained at the time of harvest. There a number of sub-categories.
8. **Clearfelling with retention of non-commercial trees.** All commercial trees are harvested and all, or most non-commercial trees are not. Justified where a silvicultural treatment would be uneconomic, where the retained trees may become merchantable in the future, or where it is desirable to retain part of the growing stock on environmental grounds.
9. **Clearfelling with retention of prescribed components.** Prescribed components may include saplings, pole and early mature trees retained for future sawlogs, wildlife habitat and seed trees, gullies and streamside-retention strips.
10. **Clearfelling with emphasis on environmental conservation.** This may apply where a forest is environmentally significant but clearfelling is still regarded as the most effective silvicultural regime in terms of stand regeneration and future productivity. A number of environmental objectives might be met by retaining within the coupe a wider range of stand components than described above, by applying principles of landscape design, and through the use of dispersed small coupe designs, strip felling and so on.

Choosing a harvesting method. The decision of which harvesting method to use is largely dictated by forest type, condition, productivity and markets. Within any particular forested region across Australia, one or more appropriate methods of harvesting will be used. For example, in "Managing Your Dry Forests" (Private Forestry Council of Tasmania 1991), a flow chart 'Choosing a Logging Method' was used as a guide, in conjunction with a forester, to choice of harvesting method. The flow chart is shown below as Table A1.3.

Table A1.3: Choosing a logging method



Regeneration. Like harvesting, regeneration is at the core of all silvicultural methods. Regeneration of native forest can be achieved through the germination of seed or vegetatively by means of coppice shoots from established root-stock. Eucalypts vary widely in their seed production, seed germination and vegetative reproduction characteristics.

Given appropriate conditions, seed on the forest floor or falling from retained trees germinates to produce seedlings. A suitable seedbed and climatic conditions favourable for growth are needed for seed germination and seedling establishment. Seedling based silvicultural systems aim to create a suitable seedbed for seed during optimal seasonal conditions, and to enhance growth by controlling competition from other individuals and species.

Using clearfelling systems, sources of seed for regeneration include:

- (i) seed store in soil, natural seed fall from adjacent stands and the heads of felled trees;
- (ii) seed trees retained inside the coupe;
- (iii) hand or aircraft distribution of seed manually collected from trees; and
- (iv) planting nursery-grown seedlings.

After logging using selection systems, regeneration normally readily takes place although as described, as the forest type becomes moister moving from dry to wet sclerophyll the intensity of disturbance to the forest soil must be increased accordingly.

Vegetative regeneration includes the coppice method, whereby regeneration occurs from shoots produced by stumps of harvested trees; or the coppice-with standards method whereby some or most of the regeneration is obtained from shoots but some trees of seedling origin are selected and carried through to a much longer rotation than the coppice. Coppice regrowth has not been extensively used in native forests as a form of regeneration. It is however popular overseas in fast growing, short-rotation plantations.

Vegetatively, dry sclerophyll forest has a simpler, more open and less complex forest floor and thus regeneration of eucalypts requires little disturbance to the forest floor. Regeneration of new growing stock may therefore be from existing trees.

Regeneration of eucalypts in wet sclerophyll forest requires greater disturbance of the forest and forest floor because there are often more species on the forest floor and in lower canopies competing for resources such as light, water, and nutrients. This extra competition can make it difficult for eucalypt seedlings to establish. Regeneration in wet sclerophyll forest may therefore be from direct seeding after major forest and forest soil disturbance.

Thinning. Thinning is used in regrowth eucalypt forests as a major means of manipulating growing stock. The aim of thinning native forest is to optimise competition between species and individuals. When less desirable trees are removed, resources may become available to the remaining trees and their growth and vigour thus increased. The area a growing tree occupies influences the diameter of the stem and hence the length of time taken to produce the desired product.

Thinning can also be used to harvest products, such as poles, from trees that may be suppressed or die due to competition if left in the stand and to manipulate the quality of the wood in the tree stems by controlling the number and size of knots. Thinning a native forest therefore decreases the total production of wood in a stand, but usually aims to increase the

quality and volume of the remaining useable wood in the stand. Thinning should be undertaken when its effect will optimise the long term productivity of the forest.

Thinning can also be used to control disease, undergrowth, insect damage, death due to drought, and damage by wind or snow; and influence water and light characteristics of the site. Thinning is usually restricted to even-aged native forests.

Because eucalypts naturally self-prune in native forest, silvicultural pruning is uncommon. Pruning native forest trees on farms may be beneficial where tree stocking is low and self-pruning is delayed or fails to occur.

Pests and Diseases. Grazing of native forest by larger animals, including cattle, sheep, kangaroos, wallabies, and rabbits, apparent by loss or damage of seedlings or regeneration, can be controlled by fencing off areas of the forest which need protection, or by shooting or poisoning. Possums may damage vegetation higher in the forest canopy. The control of possums and other native fauna is regulated by wildlife protection legislation.

Insects have the potential to cause much damage. The cause of death or damage to a tree is not always readily visible if damage is caused to roots, or if timber is eaten away beneath the bark. Defoliating insects can quickly strip trees, especially if trees are under stress from other environmental factors. The use of insecticides may remove natural predators of the target insects which may result in a rapid increase in the population of the destructive insects without natural controls.

Air and soil-borne fungi are a major cause of disease in trees. The extent of infection and consequential damage will depend on the species affected and their health and vigour in the forest. The root rot fungi *Phytophthora cinnamomi* and *Armillaria luteobubalina* can infect and damage understorey and some timber trees and in certain regions poses a major threat.

Fungal disease may be introduced in soils, often when new tube stock is planted, or by material introduced by animals or landholders including equipment or machinery. Action by the land holder to reduce the risk of introduction of diseases, or limit the consequences of diseases that are currently present in their forests, is often dependant on the type of fungal disease being addressed. Expert advice should be sought when fungal disease is suspected.

Forest Measurement. The measurement of native forest aims to estimate both the quality and quantity of forest products within the forest. The sustainable management of commercially productive native forest requires regular and standardised measurements to be taken.

Land holders can estimate the total volume and value of their native forests by measuring established plots in their forests and extrapolating the plot measurements to the whole forest.

Measurements are taken of the diameter of the tree under bark at 1.3m above the ground and the tree height from the ground to the top of the useful log. State forestry agencies have their own standards and methods of measuring native forest. The technology used for measuring is becoming more complex but is dramatically increasing the efficiency of measurement.

Measurements of native forest quality include tree condition, including the bole form, branching pattern, level and types of knots, damage and straightness. The amount, type, and quality of regeneration is also important.

Regular measurements of native forest on farms are also used to assess the affect of any silvicultural or other managerial practices.

Fire Management. Private property owners with commercial production native forests need a credible plan for fire management. Fire protection planning should comprise a number of aspects including:

- development and maintenance of a network of access tracks;
- development and implementation of a fuel management plan;
- participation in local volunteer fire brigade activities; and
- provision of dams and fire suppression equipment.

A fuel management plan should allow for vegetation characteristics which affect fuel loads and flammability and slopes, aspect and climate, which affect fire behaviour. Tree susceptibility to fire damage varies widely within species.

The most effective means of fire control is the minimisation or removal of fuel from strategically located parts of the forest. Property boundaries, especially those to the north and west of a property, and along roads and tracks are the usual strategic locations. Fuel reduction burning is of lower intensity than wild fires, removing only a proportion of litter, debris, and understorey species, usually every three to ten years depending on the rate of fuel accumulation and the desired residual fuel load. Confining periodic fuel reduction burning to strategic locations minimises the biodiversity and nutrient loss impacts that can result from frequent burning.

A well maintained road and firebreak network through the forest, water supplies and fire fighting equipment is necessary in fire-prone forests. Participation in volunteer bush fire brigades is a valuable means for a landholder to develop fire protection and suppression skills and to develop communication and support mechanisms in the community.

Genetic Improvement. Genetic improvement aims to increase the growth and form of trees, and the quality of the wood. Measures used include the retention of the superior trees, seed collection from superior trees and subsequent broadcasting through the forest and planting seedlings grown from selected seed sources.

BACK COVER BLURB

About one-quarter of Australia's native forests and woodlands occur on private property. This represents an important resource for both production and conservation.

Yet analysis of private native forest resources is severely limited by a lack of basic information on the extent and nature of these forest resources

This report addresses that information gap by examining the extent of native forests across Australia and summarises available information on forest types, condition, uses, and values. It also assesses the current and potential contribution of native forests on farms to regional economies and farm businesses, and recommends key actions in a strategy to encourage and enable sustainable management, and consequently help develop a farm forestry culture.

The report is part of a Joint Venture Agroforestry Program project to develop such a strategy and culture.

It is also a new addition to RIRDC's diverse range of over 250 research titles, available for online viewing or purchase at www.rirc.gov.au

SPINE TEXT

Native Forests on Farms

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