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Policy options and strategies for renewed plantation investment

Stage 2 Report

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Policy options and strategies for renewed plantation investment
Stage 2 Report

Prepared for

Forest & Wood Products Australia

by

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Executive Summary

Key findings

- **It is well recognised that, for a variety of reasons, long rotation plantation forestry is not currently economically viable. The wood product returns, coming at a lag after plantation establishment, do not provide a sufficient return on investment.**
- **The premise underlying the policy research presented here is that there may be forestry values — in addition to the wood values — that are currently unable to emerge because they require additional policy interventions. Stage 1 of the overall research project carefully examined possible environmental, economic and social values of plantation forestry. That research focused on appraising the evidence for the existence and importance of values, and the factors that are currently constraining these values from being realised (adopted) through markets and/or governance arrangements.**
- **Based on the outcomes of the Stage 1 research, which are documented in the accompanying report, the project Steering Committee agreed on which values and associated constraints should be targeted. Many (although not all) of the targets of the policy research in Stage 2 are environmental values due to the strong evidence of these values. The objective of the Stage 2 research reported here was to test a series of policy interventions that policy makers could consider to allow these additional values to emerge.**
- **As an ideal, market based policies would be preferred. While governments could currently adopt these for some products (such as carbon), markets for other environmental services require further development.**
- **This report considers 13 distinct groups of policy options covering values such as carbon, biomass, salinity, mixed environmental values as well as options including taxation reform and the removal of pricing distortions. This report tests these groups of policies against a comprehensive set of criteria.**
- **Most of the policies examined have considerable potential for application.**
- **As a minimum, policies allowing the full emergence of carbon values (including carbon stored in harvested wood products) need to be implemented to substantially increase the viability of plantations. Even then, the level of the carbon price is a crucial issue.**
- **There is no single policy intervention that alone can transform the prospects for plantation forestry. A mix of measures will be required.**

- **Some of the policies identified in this report could be adopted immediately, while other will require additional institutional development.**

This report

- **This report presents the findings of Stage 2 of a FWPA research project looking at the case for renewed plantation development in Australia.**
  - The logic of the overall project (Stages 1 and 2) was to (a) identify non-wood values which when recognised may improve the viability of plantations; (b) identify impediments to the realization of these values; and (c) identify policies that would allow these impediments to be removed.
  - The Stage 1 report for this project identified a number of additional values, as well as the impediments (market failures) to those values being realised.
  - This Stage 2 report is concerned with identifying a range of policies that could potentially be adopted to allow the full set of forestry values to emerge.
  - In line will all policy research, a major concern in this report is with the balance of costs and benefits of proposed policies. The policies proposed do not involve ungrounded subsidies to the forestry industry but rather are concerned with the correction of market or institutional failures where there is a strong benefit cost argument to adopt the particular policies.
  - Finally, while this report is concerned with setting out a range of potential policy options, it is not concerned with advocating a particular policy position.

A key policy target

- **The most important target for policy and industry strategies is to capture the value of ecological services provided by plantations.**
  - The government is in a unique position to correct market failures and is the principal (potential) customer of the environmental services provided by trees and plantations.
  - As such, the status quo is unlikely to change unless there is governmental recognition of the benefits associated with removing the impediments identified through the first phase of the CIE's research.

Market based solutions

- **There is a strong public policy argument to address market/regulatory impediments, although the nature of the intervention will vary and depend on the demonstration of net public benefits from the proposed intervention.**
- **An ideal outcome would be to create a generalised market solution (a market) for each of the values recognised. A market solution is a price or quantity-based mechanism, which enables a competitive price to be determined for a value. For instance, this may be a levy, tax or tax concession, a competitive grant/subsidy or an offset determined through competitive bidding.**

Problems in creating market based solutions

- **For several reasons, a general market solution is not *currently* conducive to implement for many of the forestry values. A number of qualifying conditions are required to implement a market, including:**
  - the capacity to establish a property right for an ecosystem service;
  - the integrity of the relationship between the property right and ecosystem service/s;
  - the capacity to enforce property rights; and
  - the existence of sufficient parties willing to purchase and sell the value.
- **As shown in table 1, carbon stored in trees and wood products and bioenergy/biofuels are highly compatible with a general market solution.**
  - While the evidence for salinity mitigation and water quality improvements is strong, there are issues to be addressed before a general market solution can be created.
  - For other values in which there is 'some evidence' or 'limited/uncertain' evidence, further research and market development is likely to be required.

1 Characteristics of values of plantations and suitability for a market solution

	Evidence of value		
	Strong	**Some evidence**	**Limited/uncertain**
Problem amenable to general market solution	Carbon stored in trees and wood products Bioenergy/biofuels	Carbon stored in soil High value markets	Biochar Removal of pricing distortions in domestic market
Problem not (currently) able to be generalised	Salinity Farm forestry Sustainable management of private native forests [a] Price transparency for smallholders Conservation values for semi-natural and natural forests	Biodiversity corridors and landscape-scale networks	Generalised biodiversity value Rural development (social) value

[a] The values of private native forests are incorporated in the study because they represent an important source of wood supply for processors and therefore contribute to the sustainability of markets for plantation wood products.

Source: CIE.

Policy options to target forestry values

- **This report includes a list of options to target each of the values associated with forestry. These are set out in table 2 in order of priority.**
- **The options/strategies relate to the removal of a barrier associated with a value (environmental, economic or social) that was identified in previous research.**
- **In developing this list, a number of factors were considered:**
  - the nature of the impediment;

- the conduciveness of the value to a market-based instrument;
- the instrument or range of instruments that may be applicable;
- the current institutional environment; and
- the role of government and industry.

- **In many cases, such as for salinity and R&D expenditure, the options for accelerating the current level of investment or for achieving a more effective allocation of resources will require further benefit cost analysis at the appropriate level.**
- **In many instances, a broader policy commitment is required to complete this work (further economic and technical analysis) and establish a framework for the recognition of forest values, where net public benefits are positive.**
- **Ultimately, only a subset of environmental assets and projects may warrant public intervention. The consideration of whether to intervene, the selection of the appropriate instrument and instrument design all require a very good understanding of the potential net public benefits and net private benefits. Wherever possible, technical and local knowledge should be incorporated into this assessment (Pannell and Roberts, 2010).**

2 List of policy options

	Value	Strategy
1	Carbon	Establish an offset mechanism, which recognises all types of long rotation plantations as 'additional' forms of carbon sequestration. Carbon sequestration values need to be recognised for all long rotation plantations, irrespective of the level of site rainfall, the ownership structure and species type. This may be undertaken either through: ▪ substantially reforming the Carbon Farming Initiative to ensure the current bias against forestry is removed; or ▪ establishing a separate, internationally compliant carbon offset for forestry that is compatible with the international carbon accounting framework.
2	Carbon	The Australian government to provide upfront payments for carbon sequestration in planted long rotation forests. The value to the owner of trees would be offered as a lump sum, at a discounted rate compared to payments, which accrue as the forest grows and sequesters carbon. The discounted rate would reflect the extent to which risk has been transferred from the landowner to the Australian government.
3	Carbon	The Australian government to recognise the carbon stored in wood products during product use and in landfill. The government may recognise the carbon stored in wood products while negotiating international carbon accounting methodologies that better reflects the amount of carbon retained throughout the product life and in landfill. This would involve recognising that any additional area planted with long rotation plantations and the wood products generated are 'additional' and may provide 'permanent' storage for some of the carbon sequestered during tree growth even where the plantation is not replanted.
4	Forest biomass for fuel and energy	Policy review to incorporate transport fuels into the carbon price.
5	Forest biomass for fuel and energy	Subject to the findings of CSIRO research, develop a national blueprint/strategy for bioenergy to identify R&D requirements and opportunities.
6A+ 6B+ 6C	Salinity including water quality improvements –	Part A — an initial research and planning phase for catchments with valuable environmental assets/services that are salinity affected or at risk. These catchments must also have a reasonable prospect of being able to alleviate salinity through planting perennials, in a cost-effective manner. The research phase would identify projects that may deliver net public benefits and assist in the selection and design of the instrument/s. Part B — funding for CMAs that can demonstrate a project is likely to be cost-effective and technically efficient (see chapter 2). Part C — ongoing R&D funding to develop technologies and the capacity to address salinity.
7A	Mixed environmental values (excluding carbon)	Establish a revolving debt facility that enables the industry to have access to cheaper finance for establishing long rotation trees. The rate of capital would be offered at a flat, fixed rate once a project satisfies eligibility requirements. The design of the scheme may involve: a) A flat rate based on the average bundled environmental benefits from long rotation plantations. b) A flat rate determined by the expected minimum level of finance required to support long rotation plantation investment to a targeted level. The scheme would include mixed environmental benefits other than carbon, which would be addressed through items 1-3.
7B	Mixed environmental values (excluding carbon)	Alternatively, a grant to compensate for non-carbon values provided by plantations.

(Continued next page)

2 List of policy options (Continued)

	Value	Strategy
8A+ 8B/8C	Public benefits from farm forestry	Part A — an economist to identify an appropriate average value of benefits from long rotation farm forestry for use by CMAs and state agencies in the estimation of public benefits from farm forestry. Part B — funding for direct incentives for farm forestry projects, where an independent committee is satisfied that the project constitutes a net public benefit. The direct incentives would be subject to competitive price determination to take in to account supply and demand parameters. Bundled benefits may either: a) Include carbon values. b) Exclude carbon values, with carbon values to be received through the amended CFI or an equivalent carbon offset mechanism for forestry. OR Part C — as an alternative to direct incentives, the Federal government could increase the tax deductibility (beyond 100 per cent) for eligible farm forestry expenditure, to recognise the mixed environmental and social benefits from farm forestry. The rate of tax deductibility would reflect the estimated average public benefit associated with the plantation.
9	Taxation reform to improve tax neutrality	Review of taxation rules affecting landholders investing in trees to ensure equivalent taxation outcomes, in particular, looking at income averaging provisions through Farm Management Deposits and Capital Gains Tax exemptions.
10	Productivity and market development	Industry to review the adequacy of research and development commitments to key areas, including by identifying the minimum threshold, maximum benefit and perceived allocation of benefits between the private and public sector. Potential target areas for R&D, to address barriers to obtaining values, include high quality hardwoods, products from low rainfall environments, metrics for biodiversity in private native forests, carbon stored in soil, salinity, landscape scale values from plantations (such as biodiversity networks), biochar, and second-generation energy and fuel.
11A+ 11B	Future productive capacity and biodiversity in private native forestry	Part A — initial research phase to establish an appropriate metric for biodiversity associated with various management options for PNF. Part B — policy commitment from each State and Territory to review legislation and implement direct incentives, where public goods can be purchased cost-effectively. The review should focus on providing a low sovereign risk environment by safeguarding the future access of landholders to their resource.
12	Reduction of pricing distortions in international markets	The Federal government to continue to use bilateral or multilateral instruments/mechanisms to reduce the supply of forest products from high value forest assets including through incentives for the conservation of high value forests. This would include, but not be limited to, the provision of alternative income opportunities for those harvesting or with the rights to harvest high value forest assets.
13	Domestic market transparency	Seed funding for industry to establish a Hardwood Pricing Index through an independent and trusted firm.

Source: CIE.

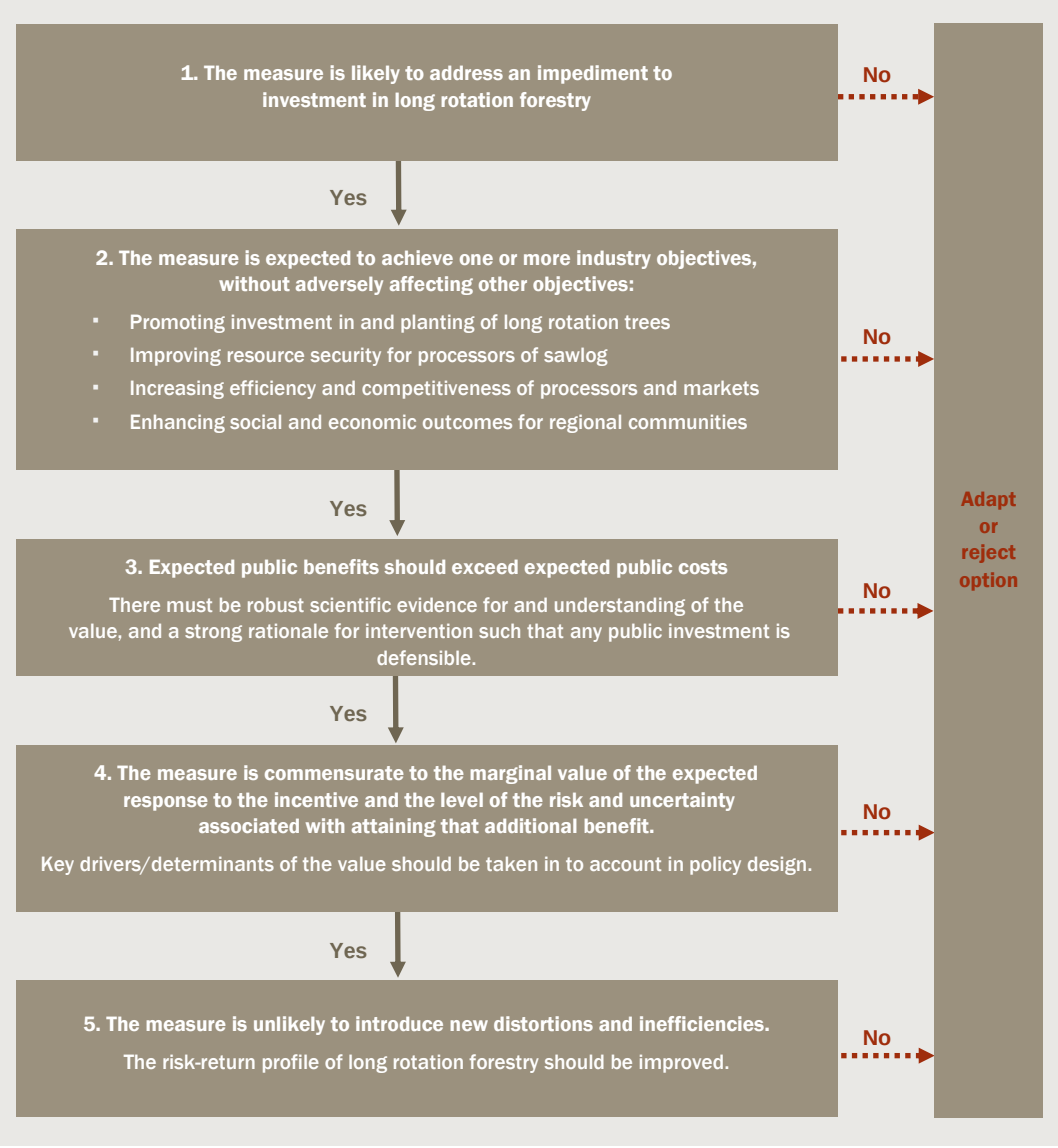
Assessment framework

- **Chart 3 presents the options assessment framework used to assess the robustness of each of the proposed interventions, in terms of economic efficiency and potential effectiveness. The framework involves five key criteria that, where relevant, should be met satisfactorily.**
- **The first two criteria address the potential effectiveness of the intervention:**
  - it should address an impediment to investment in long rotation forestry; and

- it should be likely to achieve one or more industry objectives, without adversely affecting others.

- **The objective of economic efficiency is addressed in the final three hurdles, whereby:**
  - expected public benefits should exceed expected public costs;
  - the measure should be commensurate to the marginal value of the expected response to the incentive and the level of the risk and uncertainty associated with attaining that additional benefit; and
  - it should not introduce new distortions and inefficiencies.

3 Options assessment framework



Data source: CIE.

Ranking the options

- **Each policy option was ranked in terms of the capacity to meet the hurdle with limited risk.**
- **Chart 4 summarises the CIE's assessment of each intervention, in terms of the capacity to meet each hurdle.**
- **Three ticks indicate there is low risk in meeting the objective/hurdle. At the other end of the spectrum, a cross indicates there is significant uncertainty regarding the potential of the instrument to meet the criteria.**
- **Most of the interventions proposed are deemed robust, with two exceptions:**
  - A discounted upfront grant for carbon with reduced liability to replant (intervention 2) is unlikely to be sufficient to satisfy industry requirements (objective 2) and simultaneously be proportionate to the marginal benefit of trees where there even a small rate of non-replanting (objective 4). It is therefore unlikely to satisfy hurdle 3, the net public benefit test.
  - A revolving debt facility for mixed environmental benefits excluding carbon sequestration (intervention 7 — option A) may have low public benefits due to the blunt nature of the instrument meaning that specific environmental benefits cannot be targeted. Carbon, which would be excluded from the intervention, is the only environmental benefit from plantations that is achieved in a predictable/consistent manner across all plantations. It is also problematic and high risk for the government to lend to projects, which may be marginal (at best) until carbon prices increase significantly.
  - Option 7B, which would provide a grant for mixed environmental benefits from commercial plantations, would be associated with a greater level of flexibility to administer the scheme at the regional level, potentially stimulating the attainment of a higher level of public benefit. However, the mixed environmental benefit that excludes carbon (for long rotation plantations) is still modest. It may be considered when a carbon price is in place and forestry projects are close to achieving commercial viability.

4 Assessment of options against criteria

Option	Instrument	Scoring against criteria				
		1 (Removes an impediment)	2 (Meets objectives)	3 (Public net benefit)	4 (Adequate policy design)	5 (No new distortions)
1	Carbon offset mechanism	√√√	√√√	√√√	√√√	√√√
2	Upfront grants for carbon sequestration	√√	√√	√*	√*	√
3	Adoption of carbon accounting for wood products	√√	√√	√√	√√	√√
4	Policy review to incorporate transport fuels in to the Carbon Tax	√√	√	√√	√√	√√
5	National blueprint for bioenergy and second generation fuels					
6A+6B+6C	Salinity mitigation research phase, project funding and ongoing R&D	√√	√√	√√*	√√	√√
7A	Revolving debt facility for mixed environmental benefits excluding carbon sequestration	√	√√*	X	X	X
7B	Grant for mixed environmental benefits excluding carbon sequestration	√	√	√*	√*	√
8A+8B	Review to establish appropriate rate of grant, plus direct incentives for the public benefits from farm forestry and native vegetation improvement	√√	√√*	√√*	√√*	√√
8A+8C	Review to establish appropriate rate of tax deductibility, introduction of tax deductibility for the public benefits from farm forestry and native vegetation improvement	√√	√√*	√√*	√√*	√√
9	Taxation reform to promote neutrality for landholders	√√	√√√	√√	√√	√√√
10	Review of research and development funding amount and allocation (Mixed public and private benefits)	√√	√√√	√√		√√
11A+11B	Future productive capacity and biodiversity - Legislative reform, research to establish metric and direct incentives (as appropriate)	√√	√√	√√*	√√*	√√*
12	Seed funding for a Hardwood Pricing Index	√√	√	√√	√√	√√
13	Pricing distortions in international markets - Range of instruments	√√√	√√			√√

Note: An asterix (*) means that the assessment is conditional on there being an acceptable framework in place to manage identified risks and uncertainties. Where the scoring is left blank, it is because the hurdle is not applicable to the option and/or it is too early or difficult to assess.

Source: CIE.

- **Many of the initiatives could commence immediately. These include the following:**
  - establishing a carbon offset for forestry, in particular long rotation plantations, including for carbon stored in wood products while in use and in landfill;
  - an initial research and planning phase including:
    - … for catchments with valuable assets at threat of salinity, for which there is some feasibility that planting perennials may cost-effectively generate public benefit;

  - ··· to identify the average value of benefits from long rotation farm forestry and plantations in general; and
  - ··· to develop a metric for biodiversity associated with various management options;
- reform to tax arrangements affecting landholders, including the income averaging provisions permitted through Farm Management Deposits and the rules around Capital Gains Tax exemptions in relation to small businesses involved in forestry;
- a review of the performance of PNF legislation with respect to its impact on incentives for sustainable management practices;
- a policy review to consider the incorporation of transport fuels in to the carbon pricing framework; and
- the establishment of an industry index through seed funding.

The importance of a carbon price

- **Importantly, achieving the central objective of making long rotation plantation investment viable will require a carbon price. The CIE's basic modelling demonstrates two important key points.**
  - Carbon contributes significantly to the improvement of long rotation plantation viability.
  - Even with a carbon price, other incentives may be necessary to stimulate investment in long rotation plantations. In particular, the viability of long rotation hardwood species will require improvements in prices from growing high quality species, investment in R&D, and/or other market and non-market values.

Some carbon economics

- **Without a price on carbon, the Internal Rate of Return (IRR) (after tax)[1] for a future long rotation plantation is around 3.8 per cent for softwood (such as Radiata pine) and around 2.6 per cent for hardwood species.**
  - Achieving an acceptable rate of return may require a carbon price of \$48 t CO_2-e for softwood and \$63 t CO_2-e for hardwood species, where the carbon price has a flat trajectory in real terms.
- **Using the Commonwealth Treasury carbon price trajectory (where the real carbon price increases by around 5 per cent a year), long rotation plantations could achieve a 7 per cent IRR (after tax) when the starting price of carbon is just over \$30 t CO_2-e and \$41 t CO_2-e for softwood and hardwood species, respectively.**
  - The impact of a carbon price on the Net Present Value of the first rotation of a plantation, under these assumptions, is around \$3500 for softwood and \$6000 for hardwood (using a discount rate of 7 per cent).

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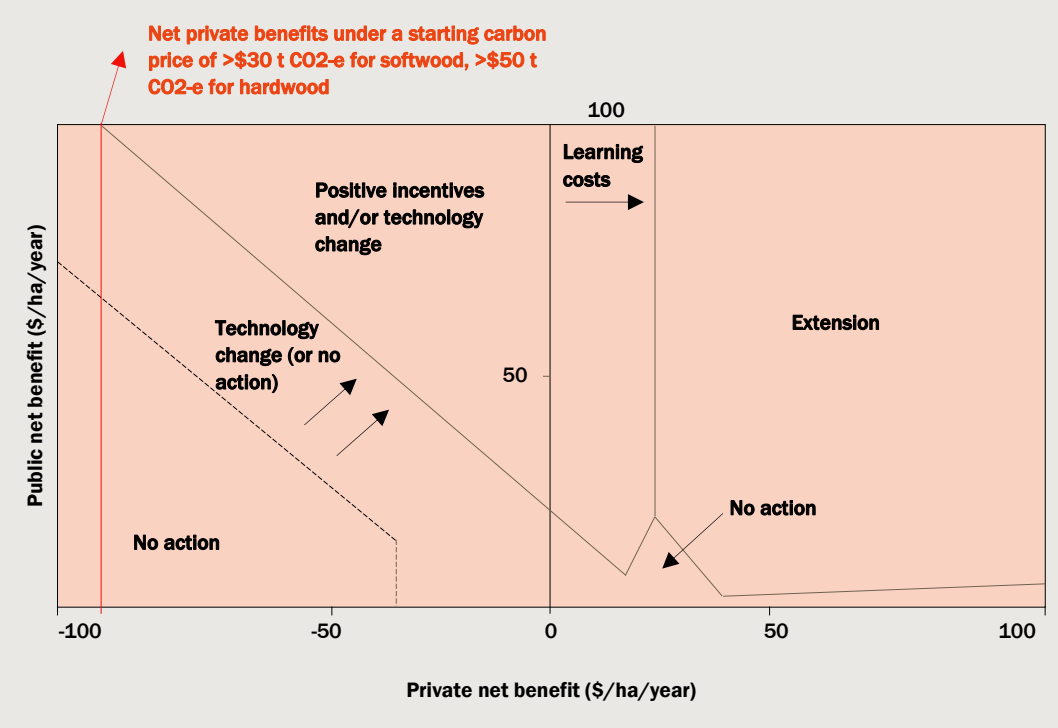
1 Income flows are subject to the standard company tax rate of 30 per cent while all non-land expenses are treated as tax deductible (assuming the company has income to offset expenses).

- **Where a carbon price is not in place, direct incentive measures for non-carbon environmental values are unlikely to deliver both net public benefits and net private benefits.**

Ensuring net benefits

- **Chart 5 shows Pannell's (2008) graphical representation of the point at which positive incentives should be used in relation to net private and net public benefits. The appropriate time to use extension, investment in technology change or no action is also shown in relation to the level of benefit.**
- **In most cases, the annual public benefits for non-carbon environmental values are expected to be less than $100 per hectare over the life of the plantation or less than $1300 in NPV terms (using a 7 per cent discount rate). The CIE indicates on chart 5 the price of carbon required to make investment in a long rotation plantation viable from a private perspective:**
  - for a softwood plantation, a starting carbon price of at least $30 t CO2-e would be required on top of the incentive with no change in the real carbon price over time; and
  - for a hardwood plantation, the starting price of carbon would need to be at least $50 t CO2-e with no change in the real carbon price over time.

5 Efficient policy mechanisms allowing for adoption lags and learning costs

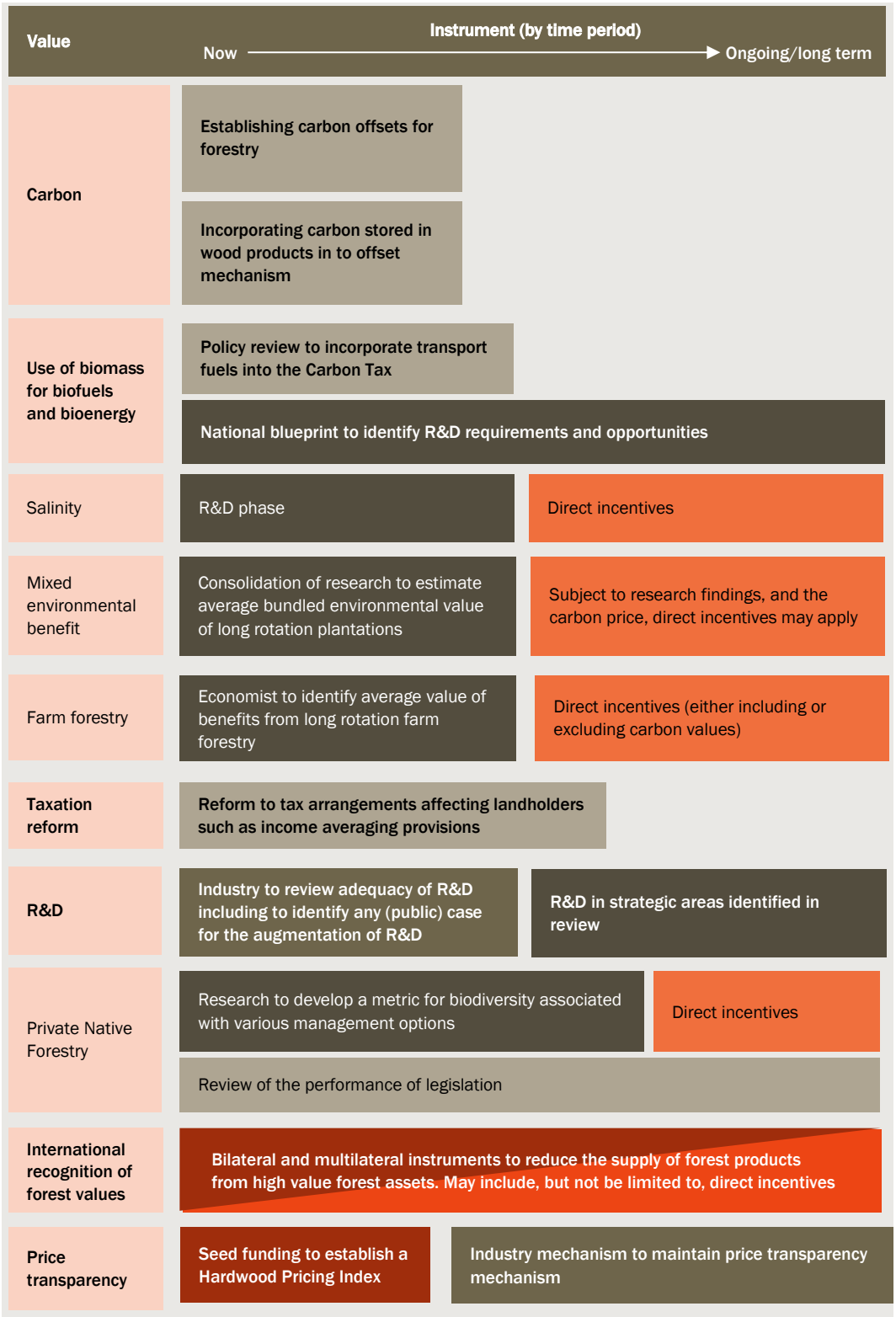


Source: CIE estimates based on Pannell, 2008.

Appropriate timing of policy initiatives

- **An indicative timeframe for the implementation of the initiatives is shown in chart 6. The type of strategies, indicated by the colour coding, include regulatory reform, R&D, direct incentives, other non-competitive instruments and industry-led initiatives.**
- **The establishment of a carbon offset mechanism, which recognises all new acreage of long rotation plantations as internationally compliant, is the first and most critical activity to undertake.**
- **In addition to the establishment of an effective carbon offset mechanism for forestry, R&D is required prior to the implementation of direct incentives in relation to salinity, farm forestry and private native forestry.**
- **Some initiatives may not have a short or certain payback period and would require ongoing investment. These include the ongoing assessment and funding of R&D requirements, including an integrated strategy for biofuels and bioenergy, the promotion of domestic price transparency and bilateral and multilateral instruments to reduce the international supply of forest products from high value forest assets.**
- **All options will require the intervention of the government either through the provision of resources or through regulatory/policy reform.**
  - However, there is a significant requirement for industry contribution to ensure the target objective is attained without compromising other industry and social objectives and that policy design mitigates the risk of unintended consequences.

6 Indicative time trajectory for the implementation of instruments



Reform; R&D/technology adopt; Direct incentives; Other non-competitive instruments; Industry-only initiative

Source: CIE.

1 Introduction

This report presents the results of Stage 2 of a Forest and Wood Products Australia (FWPA) research project designed to identify policy options and strategies to stimulate renewed investment in long rotation plantations.

The Stage 1 report for this project identified evidence for the existence of forest values which are not currently being recognised due to market failures or other market/regulatory impediments. In particular, there is strong evidence for the existence of some environmental values. The Project Steering Committee determined that the these findings constituted a sufficient case to commission research to identify policy options and industry strategies to alleviate the impediments to the realisation of these values.

This Stage 2 report outlines a framework and specific public policy and industry strategies designed to address the barriers to investment in long rotation forestry. The approach reflects:

- the findings of the first phase of the research, in terms of the weight of evidence for the existence of each value and the specific barriers identified;
- a review of sound public policy principles in relation to market failure and policies undertaken in other countries; and
- the requirement for government and industry to establish new structures which promote investment where it is efficient, taking in to account issues of scale.

Background to key issues

Without substantial payments for environmental or other services (such as through a carbon price), or without the alleviation of other substantive constraints, an expansion in the area of plantations will not be viable.

Research by Paul et al (2011) suggests that payments of between $20 and $50 per tonne CO_2-e would be required in order for the area of plantations to expand. Although the carbon price trajectory for carbon offsets is highly uncertain, it is reasonable to expect that a carbon price of $30 per tonne CO_2-e could result in an increase of between $5000 and $10 000 per hectare in net present value terms assuming reasonable tree growth rates and an upwards price trajectory. That is, an improvement in the net present value of between $5000 and $10 000 per hectare may be required in order for investment in long rotation plantations to become viable.

The viability of long rotation plantations is most constrained by (de Fégely et al, 2011):

- the high initial costs of acquiring land;

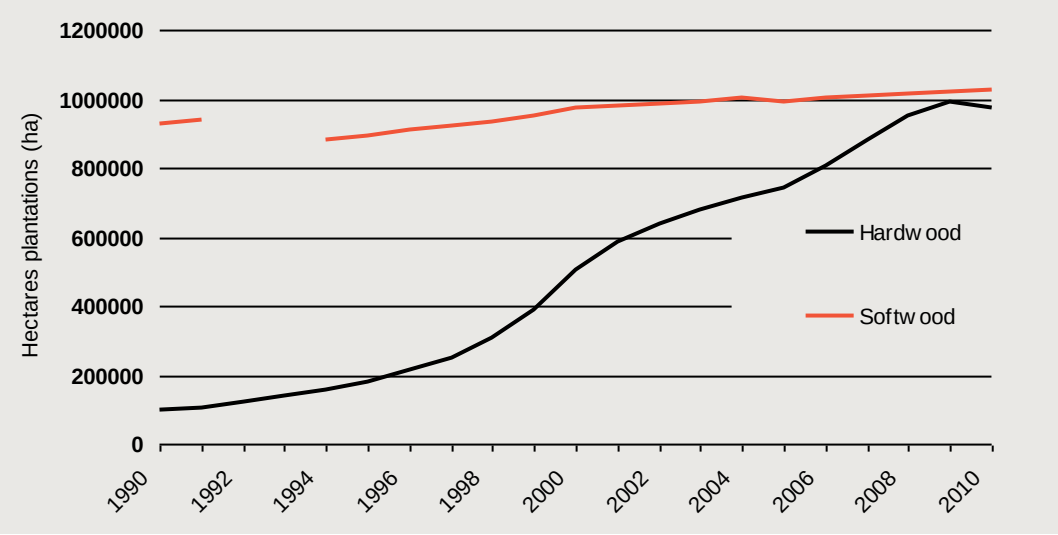
- the high opportunity cost associated with that investment due to the time to revenue generation; and
- the revenue stream being insufficient to counter the long time to harvest.

Due to such constraints, institutional investors in Australia do not invest in Greenfields plantations. Similarly, private individuals and landholders are also reluctant to invest in long rotation trees. Once the resource is 12 years old, there is substantially more interest from commercial entities in acquiring long rotation plantation assets.

Chart 1.1 shows the area of hardwood and softwood plantations on an annual basis since 1990. There has been very little expansion of sawlog since 1990, which is associated with the cessation of Commonwealth funding provided through the Softwood Forest Agreements Act 1967. Although there has been rapid growth in hardwoods grown for pulp and paper, and wood chip (through short rotation cycles), there is expected to be a retraction in the area of MIS plantations (in particular, short rotation Blue Gums) once they are harvested.

Under the status quo, investment in long rotation plantations is expected to remain unviable. With a contraction in the area of short rotation plantations, and no increase in long rotations (or potential contraction occurring in some regions), the processing sector and regional employment may be at risk of stagnation or decline in some regions.

1.1 Areas of plantations since 1990



Note: Figures for 1995 to 1998 are approximate. Totals include fallow, mixed hardwood and softwoods and areas for which species was not reported. There is no data on the softwood estate for 1992 and 1993.

Data source: National Plantation Inventory.

Research on the values of forestry

Stage 1 of the research underlying this report confirmed that there is a case for renewed investment in wood fibre, particularly through careful policy intervention. The research confirmed the existence of market failures and other impediments in the domestic

context, as well as internationally, which are affecting the efficiency of markets for forestry. Table 1.2 shows key values and constraints associated with plantation forestry.

1.2 Environmental, economic and social values of long rotation forestry

	Values		Evidence of value	Constraints to realisation of value	Scope
ENVIRONMENTAL-ECONOMIC	1.	Carbon sequestered in trees	Strong	Domestic market non-existent, carbon legislation prevents recognition of values - political rather than scientific constraints	√√√
	2.	Carbon sequestered in wood and soil	Strong	Excluded from international framework	√√
	3.	Low carbon emissions intensity relative to alternative land uses	Strong	Emissions from major alternative land use (agriculture) excluded from policy framework	√
	4.	Salinity mitigation including water quality improvements	Strong	Highly fragmented exchanges, non-existent markets Opportunities are in low and medium rainfall areas, which are less commercially viable than higher rainfall areas Demand from CMAs in medium rainfall area less consistent, coordination difficulties for industry Significant R&D challenges in low rainfall area	√√
	5.	Biodiversity from commercial plantations	Mixed	Lack of consensus in scientific literature of biodiversity value	√
	5a)	General biodiversity value compared to alternative land uses	Mixed	Some consensus that biodiversity values better than agricultural land uses, but community preferences for expenditure on protection of more mature natural assets	√
	5b)	Biodiversity corridors and landscape-scale networks or other specific biodiversity management strategies	Some evidence	Valuation techniques are still developing. R&D required on role of plantations in broader landscape	√
	6.	Public benefits from farm forestry (salinity mitigation, biodiversity)	Some evidence	Landholder reluctance to plant trees due to commercial reasons, alternative competing uses for trees involving alternate or limited management of trees, resistance to grant rights to harvest to companies, fragmented and small resource pockets	√√
	7.	Environmental benefits from trees in Streamside Management Zones (SMZs) (water quality improvements, aquatic and biodiversity benefits)	Strong	Regulations may be unnecessarily prescriptive or impose excessive constraints on harvesting in SMZ due to low risks shown in research from harvesting in riparian areas	√
	8.	Future productive capacity and biodiversity in private native forests (avoidance of degradation to private native forests)	Evidence of forest degradation. Linkages with biodiversity less defined.	Regulations contain uncertainty around future rights to harvest, depending on jurisdiction (greater security in QLD and Tasmania). Incentive framework does not reward sustainable forest management and biodiversity	√√

(Continued next page)

1.2 Environmental, economic and social values of long rotation forestry (Continued)

	Values	Evidence of value	Constraints to realisation of value	
ECONOMIC	9. Bioenergy as a low emissions alternative to other energy sources	Strong	R&D needed to improve commercial viability, insufficient market signals plus cheap access to fossil fuels, established markets on a knife edge in terms of viability, significant challenge to secure the necessary resource to ensure viability due to cost of transporting the resource, bioenergy markets cannot compete with woodchip for export markets	√√√
	10. Second generation biofuels as an alternative, less energy intensive fuel to first generation biofuels and reduce GHG emissions relative to liquid fossil fuels	Strong		√√√
	11. Biochar (soil productivity and carbon storage benefits)	Uncertain	R&D barriers still high, limited data for model verification purposes, too many unknowns to develop GHG accounting methodology, pyrolysis plant used to produce biochar only viable if other products are developed	√√
	12. Removal of market and pricing distortions (impact on risk, pricing, transparency, market access)	Significant documentation of issue, but extent of impact difficult to assess	State forestry agencies need further reform to improve price transparency and promote competitiveness and transparency Industry solutions required to broaden and deepen markets, particularly in low rainfall areas and for low value product	√√
	13. High value markets	Some evidence	No significant resource base or processing capability for high quality hardwood plantation resource R&D required for tree and wood quality improvement	√√
	14.	Evidence that taxation rates overseas have played a significant role in investment level and structure	Hidden taxation and superannuation barriers: taxation discriminates against long term savings — not all investors can access superannuation, superannuation funds do not typically invest in Greenfields (alignment issue between tax structure and investor needs), small holders and private individuals not always in a position to deduct income up front, lumpy returns impose higher tax rates than other more steady income	√√
	15. Improved risk-return profile of investment in forestry and reduce reliance on native forest harvesting	Evidence that these factors affect social values	Return is insufficient to attract individuals and communities to grow long rotation trees and perception of volatility reduces attractiveness High R&D hurdles to replace native forest harvesting with plantations for high quality appearance grade timber. Significant appeal among community	√√
SOCIAL	16. Socio-economic benefits from forestry compared to alternative land uses	Weak	Agriculture is significantly more socially acceptable than plantations. Higher employment multipliers only represent a case-by-case and politically determined 'value' in near-full employment economy Social perceptions are a barrier — generally forestry is not recognised as environmentally positive in cleared rural landscapes	√
	17. Benefits from reducing negative perceptions: more conducive policy environment	Strong		√√

Source: CIE.

Table 1.2 also summarises the CIE's assessment of the weight of evidence for the existence of these values and the scope of the opportunities offered by removing the constraints.

The most significant constraints identified relate to:

- externalities whereby the free market does not fully take in to account the benefits from the production and consumption of environmental services provided by plantations;
- other policy-induced circumstances where policies to correct market failure may not be conducive to efficient forestry markets, including the Carbon Farming Initiative;
- technical and commercial hurdles in relation to the development of bioenergy, biofuels and biochar, and risk in the development of new products and markets such as high value hardwoods and wood fibre in low rainfall areas;
- coordination issues including between industry and potential customers of environmental services (such as Catchment Management Authorities) and among industry; and
- the negative perceptions of forestry and community or political persuasions against forestry.

Due to the unique position of government in facilitating reform to correct market failures and as the principal (potential) customer of environmental services provided by plantations/trees, there will be a significant focus on identifying options with respect to public policy. The adoption of the measures will be dependent on governmental recognition of the benefits associated with removing the impediments identified through the first phase of this research.

Approach to developing options

The CIE proposes a series of policy options throughout this paper. To derive these options, we commence by outlining the targets (the priorities and goals) for the industry to address, the types of instruments available, and a framework for intervention — in particular, in relation to environmental values. In the subsequent (third) chapter, the CIE outlines the policy instrument(s) that has (have) the potential to deliver the target in line with the principles set out in the previous chapter. For each instrument, we discuss:

- the rationale for the proposed instruments;
- how the instrument/mechanism may achieve the target; and
- where relevant, the appropriate boundaries that must be established around the instrument to reduce public policy risks, in particular, those associated with blunt instruments.

2 Policy approach

Market analysts indicate that the low inflation environment and relative stability of governance in Australia provides a strong basis for forestry. However, the long rotation plantation industry does not have a future under the status quo. International forestry markets have historically been highly distorted, whereby producers do not receive a benefit for the ecological benefits provided by natural (semi-natural) forests and plantations. While there are such international pricing distortions, domestically there are also several regulatory barriers to the recognition of forest values. There is a strong public policy argument to address market/regulatory impediments, although the nature of the intervention will vary and depend on the demonstration of net public benefits from the proposed intervention.

Targets

The targets for policy intervention shown in table 2.1 have been identified from the work undertaken in Stage 1 to identify the forestry values. They represent the areas to be prioritised in order to capture the environmental, economic and social potential of forestry. These targets reflect the impediments which exist under the business-as-usual scenario. Benefits from addressing these targets, through long rotation plantations becoming viable, will be highest when issues are addressed in order of priority and in composite.

The most important target is to capture the value of ecological services provided by trees and plantations. The barriers range according to the specific environmental value. A subset of these issues/barriers is also faced by farm forestry.

Policy options

There is a significant role for government to play in remedying the barriers to investment in forestry. The rationale is related to the government's role in establishing markets where these may be absent or inefficient. This includes markets for ecological services from plantations and farm forestry, but also extends to investment in technology/ research and development where there is public (and not exclusively private) net benefit. There is also a role for government in addressing international price distortions due to the availability of subsidised natural and semi-natural forest products on international markets.

Although not exclusively the role of industry, there is a strong rationale for industry to take ownership in addressing the lack of price transparency in domestic markets and to improve community perceptions of forestry. These issues are complex and may be

2.1 Targets of interventions

Targets	Specific barriers
To capture the value of ecological services provided by trees and plantations	Regulatory impediments, externalities, farm economics/preferences, information barriers and uncertainties
To meet the needs of the investor via fair, efficient investment vehicles	Hidden taxation barriers
To improve the community perceptions of forestry and foster cooperation in agricultural regions	Legacy from use of blunt instruments in past, industry approach to farm forestry
To increase price transparency in domestic markets	Coordination issues, dispersed benefits
To support international price efficiency	Externalities and regulatory failure
To increase capacity to supply to high value markets	Research and development hurdles
To improve the potential to generate revenue from product grown in low rainfall environments.	Technological hurdles
To improve the uptake and success of farm forestry	Farm economics/preferences, learning costs, externalities, legacy issue

Source: CIE.

difficult to resolve in the short term. They require an industry solution and, as such, these are not the focus of this section of the report.

It is important to recognise that subsidies and grants have been utilised widely to establish commercial plantations across the world. This type of support has been provided to *immature* plantation estates in order to accelerate investment in the plantation estate to reach a critical mass, whereby it is intended that the industry reach a position of long term viability without continued dependence on the government. There is an absence of critical mass in the long rotation hardwood plantation industry, and continued requirement for supply to support the long rotation softwood industry.

While it is necessary to expand the area of plantations to achieve critical mass for future viability, scale is not the principal policy target. Long rotation plantations will not become viable through accelerated investment to increase industry scale alone. As such, the direct measures typically utilised in the acceleration phase of a plantation industry such as low interest loans, grants and subsidies are not justified based on the provision of start-up type funding. However, direct incentives may be utilised to expand investment, where there is a net public benefit. The target of instruments must be to address the barriers identified in table 2.1.

Policy instruments

Many of the issues associated with forestry stem from the absence of markets for ecosystem services provided by forestry, including air and water purification, climate stabilisation, biodiversity, salinity, and drought and flood mitigation. The absence of markets for ecosystem services means the total value of the economic, environmental and social benefits of the resource (and the cost of replacement) is not reflected in the market price. As such, prices in domestic and international markets do not sufficiently reward forest owners. This may occur for a number of reasons (Murtough et al, 2002):

- a lack of property rights;
- high uncertainty about the attributes of the good or service;

- asymmetric information in which sellers are more informed than buyers, or vice versa;
- few buyers and sellers; and
- where ownership cannot be defined and enforced in a cost-effective way.

According to the Productivity Commission (Murtough et al, 2002), 'in theory, the problems arising from an absence of markets can be remedied by government intervention'. Establishing a *general market solution* (a market) involves the definition of a new property right that is 'both linked to an ecosystem service and can be exchanged for reward' (Murtough et al, 2002). A general market solution is a price or quantity-based mechanism, which enables a competitive price to be determined for a value. There are different types of market mechanisms (see table 2.2), which vary according to whether they are tradeable and involve offsets, or not.

2.2 Types of environmental markets

	No offsets	Offsets
Non-tradeable	Parties sell their property right to undertake a certain activity. For example, farmers compete in an auction to receive biodiversity conservation grants for maintaining native vegetation on their land. Grants are awarded to those offering the most ecosystem services per dollars granted.	A party can undertake an activity that reduces an ecosystem service if it also undertakes a separate activity, which increases the ecosystem service by at least the same amount.
Tradeable	An upper limit is set on a certain activity, such as emitting pollutants or salinised water.	A party can undertake an activity that reduces ecosystem services if it also pays another party for a separate activity that increases the ecosystem service.

Source: Murtough et al, 2002.

These market mechanisms may involve either *positive* incentives to encourage change or *negative* incentives to inhibit change. Instruments related to forestry in this report will be positive incentives, which are applied where there is a known public benefit from undertaking forestry activities. A general market solution could include a levy, tax or tax concession, a competitive grant/subsidy or an offset determined through competitive bidding. A market-based solution may also incorporate accreditation systems and stewardship payments.

Alternatively, the government may invest in a *non-market solution* including:

- incentives such as grants, ongoing payments for management, funding for infrastructure around the plantation site or reduced rates of taxation, whereby the value of the incentive is determined outside of the market;
- extension — involving technology transfer, advisory services, education, communication, demonstrations and support for community networks; and/or
- technology development — development of improved land management options, such as through strategic R&D, participatory R&D with landholders, provision of infrastructure to support a new management option and so on.

The principal difference between a market-based solution and other financial/regulatory instruments is whether there was a competitive process to determine the value of the incentive (price). Arbitrary and inflexible price setting runs the risk that the value of the

incentive is too high or too low. In addition, non-market solutions are blunt instruments, meaning they are not able to discriminate between project values and target the outcomes that are desired.

General market solutions

Markets are developing for ecological services, including those provided by trees, across developed economies. Ecological values provided by trees are being recognised in Europe, the United States, China, South America and New Zealand (among other places), demonstrating a progressive shift towards the use of incentives to increase the quantity or quality of the ecological services provided. However, the extent to which a good/service is amenable to a general market solution varies according to the characteristics of those goods or services. Where a market has been created for an attribute for which there is a high degree of uncertainty around the value of the property right or offset, there is usually the understanding that the asset is of high value.

Table 2.3 compares the evidence underpinning values from plantations along with the present potential to apply a general market solution to realise that value. As previously noted, a general market solution is a price or quantity-based mechanism, which enables a competitive price to be determined for a value.

A general market solution is conducive where (Murtough et al, 2002):

- the nature and extent of the property right is unambiguous;
- the property right has a clear relationship with ecosystem services;
- future government decisions are unlikely to significantly reduce the property right's value;
- the property right is transferable;
- there are sufficient parties that are willing to purchase the value;
- property rights are robust and can be cost-effectively enforced; and
- there are sufficient natural resource management providers to establish a market and sufficient parties willing to purchase the property right.

Carbon stored in trees and wood products, and bioenergy/biofuels lend themselves to a general market solution. The value of carbon sequestration is defined by the tonnes of carbon dioxide equivalent, a homogenous unit that can be defined and measured, and is transferable. The impact of one unit of carbon dioxide equivalent is uniform on global carbon emissions, irrespective of the location.

There is strong evidence of the capacity for planting perennials to contribute to salinity mitigation. However, site-specific variations cause difficulties in designing markets for dryland salinity, since the impacts of a given activity varies according to the location (such as with respect to discharge and recharge zones), the cause and type of salinity, position in terms of slope and rainfall, and soil type. Importantly, the impact of trees on salinity mitigation is a complex function of what else is being undertaken in the landscape. Also, there is a significant time lag between planting and receiving the salinity mitigation benefits.

2.3 Characteristics of values of plantations

	Evidence of value		
	Strong	**Some evidence**	**Limited/uncertain**
Problem amenable to a general market solution	Carbon stored in trees and wood products Bioenergy/biofuels	Carbon stored in soil High value markets	Biochar Removal of pricing distortions in domestic market
Problem not (currently) able to be generalised	Salinity Farm forestry Sustainable management of private native forests Price transparency for smallholders Conservation values for semi-natural and natural forests	Biodiversity corridors and landscape-scale networks	Generalised biodiversity value Rural development (social) value

Source: CIE.

These factors will determine the extent to which planting perennials will affect natural resources, other landholders and the community. The net value will be affected by the impact of trees on stream flow to downstream users and the value of alternative enterprises (which affects the cost of reduced water flow). Plantations may have additional benefits associated with reduced turbidity of stream water from reduced runoff and erosion. That is, a sophisticated scientific understanding is required in order to correlate the planting of perennials with ecosystem services. Such information constraints may be addressed at a cost.

A Staff Research Paper from the Productivity Commission (Murtough et al, 2002) considered biodiversity to be the least amenable to a market solution. The linkages between inputs and outcomes are still being determined, including with respect to the type of plantation (dimensions, species, mix of species, general location), location with respect to remnant vegetation, water and biodiversity corridors, the local species and habitat requirements, and the management of the plantation for the identified species. Market-based solutions to biodiversity conservation have been utilised in relation to native vegetation (such as through Bush Tender) and farm forestry. In relation to farm forestry, where multiple benefits are derived, but there is a high cost associated with the measurement of site-specific factors, internationally it appears preferred to establish bundled values.

There is a significant amount of scientific uncertainty associated with the following values:

- a generalised biodiversity value for trees/plantations;
- measurement and validation methods for carbon stored in soil;
- values associated with biochar; and
- rural development values.

Over time, it would be desirable for all policies and strategies to be amenable to a general market solution. This will be required to sustain the recognition of, and compensation for, forest values. It may require further technological development, research and

development, and/or policy development in order to establish a viable market. However, some of these values may not ever be conducive to a market-based solution.

Current environmental markets for forests and forest products

Table 2.4 summarises the instruments or measures currently in place in other countries to capture ecological values provided by trees that could be identified. As might be expected, the capacity to implement incentives to recognise ecological values tends to be lower in developing countries due to institutional and resource constraints. The CIE was able to identify only a couple of *developing* countries that have created markets or incentives to increase the ecological services provided by forestry.

The instruments in table 2.4 are distinguished by those that aim to capture a bundle of ecological services and those that target one particular ecological value (for further detail, please see appendix A). In many countries, a generalised incentive is utilised as a proxy for the overall environmental and social values of trees and/or plantations. They aim to reflect the median value of services delivered to the environment across a range of variables: habitat provision and quality; salinity and water quality impact; erosion mitigation; capacity to rehabilitate degraded farmland; and so forth. Bundled benefits also capture the willingness to pay for values stemming from regional or rural development, landscape visual amenity and recreational values. Incentives for bundled goods and services include grants, ongoing payments for management, advisory services, funding for infrastructure around the plantation site and reduced rates of taxation.

A generalised measure is preferred where markets for individual ecological services are not yet developed, but there is recognition of the positive ecological or social values provided by forestry. While these bundled goods can be determined through competitive bidding processes, the price is usually determined through non-competitive processes and grants based on compliance with eligibility requirements and the willingness of the community to pay for the identified values. They are blunt instruments.

In most instances, commercial plantations have limited exposure to such opportunities because the measure targets only landholders or farmers. The initiatives tend to focus on private landholders/ forest owners, marginal cropland and pasture land, and state forests. There are only a few cases where instruments are utilised to capture ecological service values from commercial scale forestry investment. This includes incentives for carbon stored in new forests in New Zealand, including plantations.

Policy framework

Environmental conservation and natural resource management frequently require a change in the management of privately owned lands (Pannell, 2008). This may include a shift from intensive agricultural production or limited production, with or without a change in the ownership of that land. One prominent example of this is farm forestry. A number of programs have attempted to create mechanisms to foster such changes (Pannell, 2008):

2.4 Current policies and approaches to recognition of forest ecological values

Value/ Country	Measure	Nature of measure (temporary, blanket, targeted)
Bundled		
US	Cost sharing (up to 50 per cent), land rental payments based on soil productivity, acquisition via conservation easements	Marginal crop and pasturelands Private non-industrial forestland owners Environmentally sensitive private forestlands at threat of conversion
	Compensation for the reduction in property value due to easement (for enhancement of carbon sequestration, biodiversity or recovery of endangered species)	Private forest landowners
	Incentive payments for up to three years and cost sharing for establishment costs	Individuals or entities
EU	State Aid for advisory services, 'cooperative R&D' between forest land owners, processors, and other parties to develop new products, processes and technologies, infrastructure to improve access or consolidate land Research to quantify the value of goods and services provided by forests, in order to introduce instruments to compensate for non-market goods and services	Agricultural land and non-agricultural land (forests)
China	Direct compensation	To establish trees on cropland or wasteland
Costa Rica	Compensation to undertake conservation or sustainable forest management activities, with the commitments recognised on the deed to the property (as a legal easement for the contract life)	Small and medium sized farmers, focusing mostly on primary and secondary forest areas (rather than plantations)
Chile	Incentive payments (up to 90 per cent) to subsidise the establishment costs for afforestation/reforestation on eroded lands and sand dune areas, and degraded areas. Sloped areas may be fully subsidised, subject to harvesting restrictions Exemptions on property and inheritance taxes, and guaranteed land tenure once trees were planted	Aims to engage small holders
Uruguay	Promotion of plantation development on vacant or unused areas of land.	
Carbon		
New Zealand	Grant for establishment costs – carbon offsets are surrendered	New permanent forests New productive forests
	Internationally compliant carbon offsets, including with liabilities for reductions	Post-1989 forests receive carbon offsets, pre-1990 attract a liability for any reduction
Biodiversity		
EU	Early form of biodiversity banking or offsets (through a legislated instrument),	Protected sites within the NATURA network (limited) and in the early stages of development
	Funding to reduce fragmentation such as through the creation of habitat corridors and protect ecosystem resilience	Assets that could be developed to support biodiversity corridors (unknown)
Finland	Voluntary-based conservation agreements, focusing on land with high value biodiversity assets. Also involves research to assess the program's long term ecological, economic and social impacts.	Semi-natural forests, offered for temporary conservation or permanent protection
Water quality		
US	Trading	Targets non-point, single pollutant — involvement by forest owners has been limited
Wastewater management		
China	Direct compensation	State forests of significance
	Tax breaks, low interest loans, payments for afforestation, agroforestry extension	Individuals, the community and the private sector

(Continued next page)

2.4 Current policies and approaches to recognition of forest ecological values

(Continued)

Value/ Country	Measure	Nature of measure (temporary, blanket, targeted)
Biomass		
US	National plan with directives for R&D, research from lab to market, development of regulations to reduce barriers to the acceleration of regulatory processes, update training programs to create a workforce aligned with requirements, and public-private partnerships and precompetitive collaborations (building on Biomass Research and Development Act of 2000) Renewable Fuel Standard with minimum applicable volumes of biofuels, state renewable portfolio standards, and a production tax credit Grants available through Energy Independence and Security Act	Organisations performing R&D (state and private)

Source: CIE.

- in the United States: the Conservation Reserve Program, the Environmental Quality Incentive Reserve Program and the Conservation Security Program;
- in the European Union: the Rural Development Regulation which recognises at an intra-national level regional development and environmental values from small scale forestry on private land; and
- in Australia: the Natural Heritage Trust and more recently, Caring for Our Country.

A range of instruments can be observed from such programs, including 'education, awareness raising, technology transfer, research and development, regulation, subsidies and other economic instruments' (Pannell, 2008).

Pannell (2008) argues that there has been a lack of analysis of the use of these disparate types of policy mechanisms, including how key variables interact to determine when one arrangement will be more effective than another. Previous attempts to address complex environmental problems in Australia, such as through the National Action Plan for salinity and previous salinity programs, have been criticised for their lack of attention to environmental *outcomes* in program design and execution.

Broadly, these issues were associated with:

- a lack of understanding of farm economics and the incentives of landholders, in particular, with respect to private attitudes to risk and uncertainty and private rates of time preference;
- and consequently, poor choice of instrument to encourage land use change:
  - A market-based instrument is not always the most effective choice, particularly where off-site benefits of market-based instruments are limited or on-site costs are high, or both;
- overestimation of the extent of the externalities associated with the land use change;
- the failure to integrate research and development and best available scientific knowledge into policy instrument design; and
- inadequate planning to identify high priority, cost-effective projects, and failure to resource properly the protection of these high priority assets.

Principles for the design and selection of policy mechanisms

To reduce the risk of these policy pitfalls arising from the implementation of options in this paper, the CIE refers to a number of principles that should guide the selection and design of policy mechanisms to encourage beneficial land-use change (see Pannell, 2008).

1 The positive incentives for land use change should only be used if the public net benefits of such a change are positive, after accounting for transaction costs associated with the administration and protection of property rights. Public net benefits arise where the benefits accruing to those other than the landholder exceed the costs paid by anyone other than the landholder.

2 Although public benefits may result from all types of land use change, positive incentives are not required where landholders would adopt land use changes anyway.
   – This parameter is designed to ensure that public funding can purchase as many *additional* units of environmental goods and services as possible from a given resource allocation.
   – Research shows that all investment in new long rotation plantations should be treated as additional, given that investment in long rotation plantations has been shown to be unviable without a payment for ecological services.

3 Positive incentives should not be used if the private net costs outweigh the public net benefits.
   – Although extension is a relatively cheap policy instrument, many extension initiatives to target salinity in the past were directed towards landholders where the off-site (public) benefits from revegetation were low while the on-site costs were high.

4 The positive incentives required to induce change (the reservation price) should be inflated to cover costs associated with learning.

5 Extension should not be selected as an instrument unless the change being advocated would result in positive private net benefits (in excess of learning costs). It should be sufficiently attractive to landholders to facilitate adoption before and after the extension program. That is, the benefit from extension arises from public and/or private benefits that arise from earlier adoption of the management approach.

6 The regulator should not inflate the reservation price beyond that necessary for adoption or to foster adoption where it is not economically efficient.

7 Research and development (including technology change) should be considered where the private net costs exceed the public net benefits. Technology change has received little attention for investment in environmental programs, but can provide a cost-effective strategy to generate new technologies that yield positive net benefits overall. R&D is compatible with public benefit generation in relation to natural resource management. The merits of such investment would 'depend on the public and private benefits of the best available projects, and how much these can be improved through technology change' (Pannell, 2008).

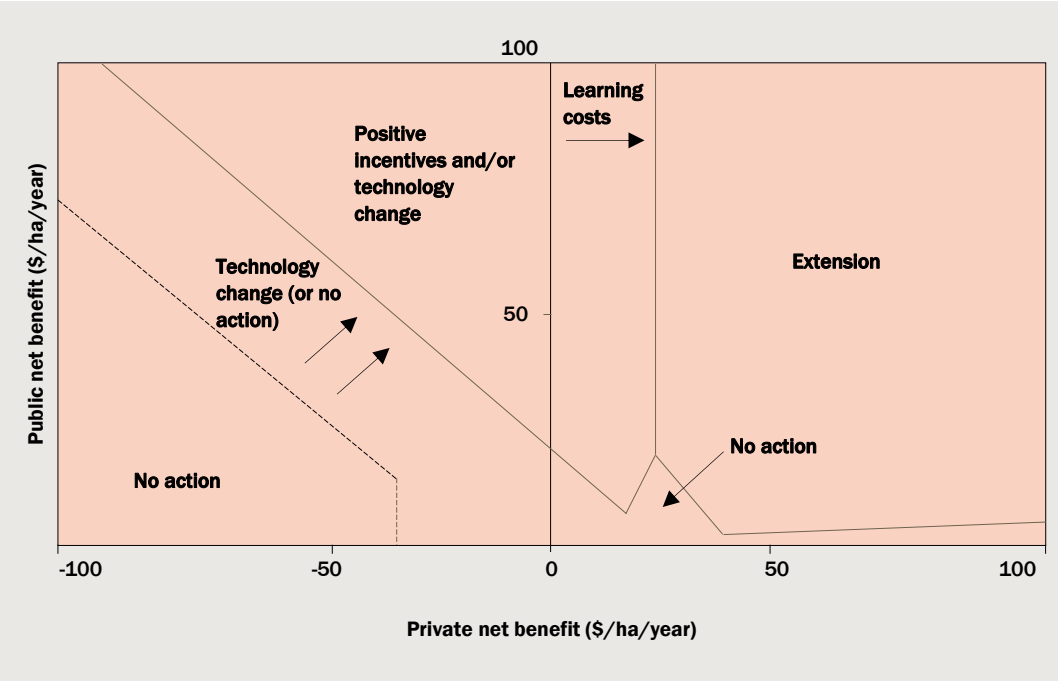
8 As suggested by Pannell (2008), 'in all cases, the suggested action needs to be weighed up against a strategy of no action'.

To apply the principles listed above requires natural resource managers to have very good information about *both* the public and private net benefits, or use a mechanism that reveals this information (Pannell, 2008). Market-based instruments are not always compatible or desirable to implement. As previously discussed, for carbon, there is a sound rationale to support the implementation of a market-based solution because of the conduciveness of carbon to the creation of property rights. For environmental values for which there is greater variation between sites and uncertainty, it is essential that there is sufficient analysis and planning prior to government intervention.

Only a subset of environmental assets and projects may warrant public intervention. Projects should assess the perceived values of the intervention, targeting those that meet a number of conditions. These conditions include that (Pannell and Roberts, 2010):

- the environmental assets is particularly valuable;
- the assets are facing a high degree of threat or current degradation;

2.5 Efficient policy mechanisms allowing for adoption lags and learning costs



Source: Pannell, 2008.

- there is high feasibility of reducing that threat at a reasonable cost; and
- the required works are reasonably attractive to land and water users.

Technical and local knowledge should be, wherever possible, incorporated in to this assessment (Pannell and Roberts, 2010).

Behavioural responses should be considered when determining the appropriateness and selection of policy interventions. Projects are more likely to generate high payoffs to investment if the private net benefits are reasonably close to zero (Pannell, 2008). Private benefits are also likely to be higher where the opportunity cost of the management change is lower (such as from targeting underutilised land), the new management option

is perceived to be less risky (and therefore, lack of market transparency is a real impediment to adoption) and where the landowner gains greater personal satisfaction. For example, perceived risks associated with carbon liabilities from the Carbon Farming Initiative represent a cost to landholders that may (otherwise) consider growing trees, and could have a significant impact on the uptake of the scheme.

To estimate the private net benefits of landholders, options for natural resource managers include investments in economic modelling, surveys of farmers or farm advisers, or observing farmers current management practices (Pannell, 2008). An auction may reveal the level of private benefits (see Stoneham et al, 2003).

3 Carbon sequestration and abatement opportunities

The recognition of carbon sequestration values provided by plantations represents the most critical intervention required for the forest industry. Without the recognition of the value of the carbon sequestered in trees during the planting, harvest and replanting cycle of plantations, investment in long rotation plantations will remain unviable. There are few opportunities in voluntary carbon offset markets for the forest industry. They therefore rely on being able to participate in the domestic market for internationally compliant carbon offsets. As identified in Stage 1 of the project, there are significant barriers to the recognition of carbon sequestration in the growth and utilisation of forest products despite there already being a scheme aimed to recognise land sector abatement.

Impact of a carbon price

A simple one period model of a long rotation plantation illustrates the potential returns to a commercial plantation with and without a carbon price. In order to be considered potentially viable by commercial investors, plantations must have an after-tax internal rate of return (IRR) of at least 7 per cent (in real terms). Without a price on carbon, the IRR (after tax)[2] for a future long rotation plantation may be around 3.8 per cent for softwood (Radiata pine) and around 2.6 per cent for hardwood species. To achieve an acceptable rate of return may require a carbon price of $48 t CO_2-e for softwood and $63 t CO_2-e for hardwood species.

These estimates are based on a flat carbon price trajectory (in real terms), whereas other modelling exercises assume a steady growth in the carbon price over time (see Burns et al, 2011 and Paul et al, 2012). ABARES modelling of reforestation scenarios under a carbon price (Burns et al, 2011) utilises Treasury forecasted growth of carbon prices of around 5 per cent a year in real terms.

- **Utilising the Treasury carbon price trajectory, long rotation plantations could achieve a 7 per cent IRR (after tax) when the starting price of carbon is just over $30 t CO_2-e and $41 t CO_2-e for softwood and hardwood species, respectively.**

Burns et al (2011) project the quantity of reforestation likely to occur under a medium global action scenario from 2012–13 to 2049–50. According to Burns et al (2011), investment in long rotation hardwood plantations remains very small (at around 10 000 hectares) until beyond 2030 when the carbon price reaches $55 t CO_2-e in today's terms. Approximately 180 000 hectares were projected to be planted from 2032–33 to 2049–50,

2 Income flows are subject to the standard company tax rate of 30 per cent while all non-land expenses are treated as tax deductible (assuming the company has income to offset expenses).

which remains a relatively modest amount and subject to reasonable access of the plantation industry to the government's carbon offset scheme (Burns et al, 2011).

A model for carbon sequestration

The one-period model established by CIE and Rob de Fégely aims to represent the likely characteristics of a new plantation. Key assumptions are shown in table 3.1.

3.1 Assumptions utilised — one-period model of long rotation plantation viability

Year		Expected value	Sensitivity test range
Hardwood plantations			
0	Land acquisition cost ($/ha)	5000	2000-8000
	Establishment costs ***a***	1550	
1	Post plant weed control and replanting ($/ha)	360	
13	Road Upgrade for harvesting and marking ($/ha)	800	
14	First Thinning ($/ha)	1000	
22	Road Upgrades and Annual Maintenance ($/ha)	245	
23	Second Thinning Harvest ($/ha)	2200	
34	Road Upgrade and Annual Maintenance ($/ha)	335	
35	Clearfall/harvest ($/ha)	23 050	
	Annual maintenance value ($/ha)	150	
	Average growth (mai)	15	10-16
	Log price average over rotation ($/m3)	49.5	42-70
	Merchantable volume (m3)	530	
	Carbon price inflator (%/year)	1.0	1-1.05
0-12	Total sequestration (until steady-state achieved)	228.9	
Softwood plantations			
0	Land acquisition cost ($/ha)	5000	2000-8000
	Establishment costs ***a***		
1	Post plant weed control and replanting ($/ha)	230	
13	Road Upgrade for harvesting and marking ($/ha)	440	
14	First Thinning ($/ha)`	1800	
22	Road Upgrades and Annual Maintenance ($/ha)	190	
23	Second Thinning Harvest ($/ha)	3150	
32	Road Upgrade ($/ha)	230	
33	Clearfall/harvest ($/ha)	26 410	
	Annual maintenance value ($/ha)	120	
	Average growth (mai)	21	15-21
	Log price average over rotation ($/m3)	45	
	Merchantable volume (m3)	695	
	Carbon price inflator (%/year)	1.0	1-1.05
0-12	Total sequestration (until steady-state achieved)	228.9	

a *Refers to site cleaning and cultivation, seedlings and planting, weed and pest control and fertiliser.*

Source: CIE, 2011.

We can expect some plantations to perform better than illustrated. However, the growth rates indicated in the model represent what should be achieved in order for the project to be considered viable, rather than the median growth rate currently achieved. The right hand side of the table provides a confidence interval around key variables, indicating the distribution of potential outcomes around key assumptions utilised in the base case. This model is utilised in quantitative analysis in chapter 5, which discusses the potential impact of various policy interventions on investment viability.

The model is based on the recognition of carbon sequestered during tree growth until the first thinning (at year 13) after which it is assumed that the plantation reaches the steady state equilibrium of permanent replanting[3]. Once the plantation is harvested, it must be replanted to avoid a liability for the lost carbon. In the base case, the model does not count the carbon stored in wood products such that the total carbon sequestered in the steady state is understated.

As shown in table 3.1, land is the single most significant expense. Due to the treatment of land as a capital item, it cannot be deducted against income.

The CIE's basic modelling demonstrates two important key points.

- **A price for carbon contributes significantly to the improvement of long rotation plantation viability.**
- **Even with a carbon price, other incentives may be necessary to stimulate investment in long rotation plantations. In particular, the viability of long rotation hardwood species will require improvements in prices from growing high quality species, investment in R&D, and/or other market and non-market values.**

Illustration: hardwood plantation in Queensland

Table 3.2 provides an illustration of the financial and economic performance of a potential hardwood plantation in Queensland. The study presents estimates of the maximum price that can be paid for land while still making a profit from plantation forestry, assuming a discount rate of 7 per cent.

Carbon has a significant impact on project viability, however, additional values from salinity and other public goods are required in order for plantation investment to be considered. Even after accounting for ecosystem service values identified for this plantation, given a MAI of 15 m^3 per hectare, the maximum price that could be paid for land is still lower than the expected actual cost of land. There is significantly greater viability once a MAI of 20 m^3 per hectare is achieved, although this rate of growth would not be expected.

The study assumes a carbon price of $20 per tonne CO2-e, which is equivalent to approximately $26 t CO_2-e in 2011 terms. Salinity payments are assumed to be $520 per hectare (in today's terms), which is at the lower end of the range of estimates for salinity amelioration values. An annual value of $65 per hectare is assumed to account for other (public) ecosystem service values.

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3 In international carbon accounting, permanence means for at least 100 years.

3.2 Land expectation value for hardwood plantation investment in Queensland

	Land equalization value ($/ha) by Mean Annual Increment (m3/ha/year)				
Benefit categories	**5**	**10**	**15**	**20**	**25**
Timber values only	-4333	-2695	-749	111	2971
Plus carbon sequestration values	-3945	-1881	363	2607	4852
Plus salinity amelioration values	-3343	-1280	1006	3250	5495
Plus 'other ecosystem service values'	-2346	-283	2009	4254	6499

Note: CIE has converted LEVs from 2002 to 2011 dollars.

Source: Venn, 2005

The current policy framework for carbon

Plantations should benefit from carbon pricing in several ways. These include:

- from the recognition of values for carbon sequestered by all 'additional'[4] trees planted which should include, at a minimum, all new areas of long rotation trees:
  - Accounting methodologies for quantifying offsets should incorporate carbon stored in wood products including when placed in landfill;
- indirectly, through substitution effects in the construction and building sector where carbon intensive substitutes such as concrete and steel become more expensive relative to wood products; and
- through there being a price on carbon, the improved viability of biomass as a fuel and energy source compared with fossil fuel generated electricity/fuel.

Australia has an offset mechanism to recognise emissions avoidance and sequestration in forestry and agriculture. The Carbon Farming Initiative (CFI) covers land sector abatement meaning that any land management practice or activity that enhances biosequestration (sequestration) or reduces agricultural emissions or some waste emissions *could* be included.

- **In Stage 1 of this project, the CIE concluded that, effectively under the current CFI legislation, the forest industry and investors are unable to value any opportunities of commercial scale due to high levels of uncertainty and prescriptiveness around which projects are likely to be eligible and ineligible.**

The carbon pricing mechanism, which came in to effect in July 2012, will create substitution benefits from using wood over more emissions intensive materials such as steel and concrete. These impacts may not yet be apparent due to the implementation pathway for the scheme, which aims to ease the impact on industry. Due to the exclusion of imported products from the scheme, imported construction materials such as steel will not bear the full burden of the carbon pricing scheme. In addition, the coverage of the scheme is not extensive in relation to the transport sector, which limits the benefits

4 Under the current accounting framework which adheres to the principle of 'additionality', certain types of investments undertaken in Australia will be regarded as additional whilst others will not.

associated with reducing and switching fuel use (to biofuels). The inclusion of agricultural emissions within the carbon pricing framework is also likely to improve policy neutrality and the affordability of land for forestry activities, although it is unlikely for political and social reasons.

These issues, as well as some proposed policy interventions, are discussed in further detail below.

Establishing offsets for carbon sequestration in forests

Effectively, there are two options to establish carbon offsets for forestry. This is either to introduce significant amendments to the CFI or to establish a new carbon offset mechanism for forestry. Both options are discussed below.

Amending the CFI

With an instrument already available to the government, one obvious solution to capture the full sequestration benefits of forestry would be to reform the CFI. This would include amending the Negative List to enable fair and efficient access of commercial plantations to carbon offsets and reduce the uncertainty surrounding project eligibility. Specifically, reform would need to:

- remove the blanket exclusion of trees planted in areas with long term annual rainfall of more than 600mm;
- introduce greater transparency and neutrality with respect to the prioritisation of environmental and social objectives, which may preclude some projects from being eligible:
  - While some or all of the safeguards for environmental and social objectives may be relevant, better definition is required of the conditions under which these safeguards may be employed; and
- remove other discriminatory aspects of the regulation such as provisions that exclude plantations of non-native species and MIS plantations.

These amendments are expected to result in improved access of new long rotation plantations to the domestic market for internationally compliant carbon offsets. It would also assist in promoting a neutral policy environment around land use.

Establishing an alternative offset mechanism

Another option is for a new offset mechanism to be established that is specifically tailored to forestry. The mechanism would need to interact with the current international carbon agreement, the Kyoto Protocol, and any subsequent agreements from 2013. The domestic offset mechanism for forestry would therefore need to comply with international

principles including permanence[5] and additionality. All investment in new acreage for long rotation plantations should be treated as additional as it is currently unviable.

Providing upfront grants

Alternatively, foresters/investors could access upfront grants for establishing new trees on Kyoto-compliant land, while the Australian Government retains the carbon credits (and liabilities) over the agreement period. A review of incentives in other countries suggests that, while the value of carbon is being recognised through compensation for bundled ecological services, markets for the carbon sequestered by trees (in plantations) are still developing.

However, New Zealand has implemented several instruments to value carbon, which vary in terms of the onus of liability for carbon, the target forest type and the timing of the compensation (see appendix A). One such program includes the Afforestation Grants Scheme where *landowners* received a grant for establishing new forests on Kyoto-compliant land, while the Crown retains the carbon credits (and liabilities) generated over the ten-year period of the grant agreement. Importantly, the NZ scheme also recognises other public goods provided by plantations, including for reducing erosion, nutrient leaching and flood peaks, and improving indigenous biodiversity.

The aim of such an instrument is to provide an alternative, low risk mechanism to encourage landholders to plant trees without being required to accept liability for carbon emitted in the event that replanting does not occur after harvest. The rationale for the government to become involved in the provision of discounted grants for carbon in Australia is that other entities such as banks and trading institutions would not be willing to provide an upfront grant in exchange for carbon liabilities in the short to medium term. The NZ scheme has concluded and the private sector appears to be performing this function.

Incorporating carbon stored in wood products

The CIE's research in stage 1 identified a strong scientific underpinning for recognising a value on the carbon sequestered in wood including when recycled and/or stored in landfill. In the 'default' approach within the international carbon accounting framework, a forest will sequester carbon until a steady state[6] is achieved and carbon will be treated as released if the trees are cut down (and not replanted). Countries can voluntarily report carbon stored in wood products in accordance with the Intergovernmental Panel on Climate Change (IPCC) methods if a country can document that existing stocks of long term forest products are in fact increasing. These methods may lead to conservative estimates due to the assumed rates of decomposition of products and recovery of products from stem wood. While Australia voluntarily reports estimates of the carbon

5 To be eligible, carbon sequestration projects are required to satisfy the 'permanency' principle, which is usually set at a threshold of at least 100 years.

6 The concept of steady state involves the assumption that a forest is replenished at the same rate it decays (BTCE, 1994).

stored in harvested wood products based on international guidelines, the CFI does not recognise the carbon stored in wood products. Yet research has shown that storage of carbon in wood products in service, at least in Australia, continues with subsequent minimal degradation and even beyond this in landfill over long periods.

The IPCC Guidelines currently assume that 50 per cent of the carbon in wood products in landfill is released due to decomposition (Ximenes et al, 2012). The Department of Climate Change and Energy Efficiency recently revised this factor to 23 per cent (Ximenes et al, 2012). However, NSW DPI research (Ximenes et al, 2008) and a US study (Wang et al, 2011) found that minimal decomposition of harvested wood products occurs when in landfill and that harvested wood products in landfill represent a long term carbon store (Ximenes et al, 2012). The assumed rate of decomposition has a significant impact on the estimated carbon in wood products. As such, accounting for harvested wood products with a lower rate of decomposition based on this recent science could mean:

- a higher level of total sequestration than is currently recognised for continuous replanting whereby it is assumed carbon is released after harvesting; and
- a large percentage of the carbon sequestered in trees in single rotation harvested plantations could be treated as permanent, factoring in only a very small rate of decomposition. This may enhance the flexibility in the carbon accounting system to provide carbon credits to landholders without an associated liability to repay the carbon credits if trees are not replanted.

Paul et al (2011) show that additional sequestration values from carbon stored in wood products could be modest to substantive for a long rotation plantation, depending on what assumptions are made with respect to the rate of decomposition. Paul et al (2011) conducted a 100-year period stimulation of case study plantations, whereby carbon credits are issued annually according to the actual sequestration rate until the modelled long term average carbon stock is attained.

A variation from the base case scenario where trees are assumed to sequester carbon until harvested is utilised to show the impact of including the carbon stored in wood products as per current international guidelines. Based on IPCC (2006) rates of decomposition of wood products[7], Paul et al (2011) suggest that in longer rotation sawlog scenarios an additional 0.75 to 1.32 t CO_2-e per hectare each year may be recognised (until the steady state is reached), accounting for around 7 per cent of total sequestration. Utilising the basic model discussed previously (see page 33), an average of 7 per cent of total sequestration would represent just 17.2 t CO_2-e per hectare and have a very modest impact on the IRR and NPV.

However, basic modifications to these assumptions to bring the amount of carbon sequestered in wood products closer to potential would have a significant impact. Paul et al (2011) do not incorporate the proportion of each product that enters landfill as waste where rates of decomposition may be relatively slow, compared to recycling or burning,

7 Paul et al (2011) assume an average rate of decomposition of 33 per cent for very short products, 11 per cent for short, 4.2 per cent for medium, 2.9 per cent for long and 2.1 per cent for very long term product pools.

due to uncertainties around these. These uncertainties include the type of product and extension of product life that is achieved through recycling as well as the extent of any loss of carbon during the recycling process. Where the vast majority of wood products in Australia are deposited in landfill after use, incorporating the carbon stored in landfill would slow the rate of decay employed in carbon accounting models.

Paul et al (2011) suggest that carbon sequestration may increase by up to 17 per cent if the UNFCCC (2010) decomposition rate for construction timber (sawlog products) of 1.4 per cent each year is applied instead of the 2006 IPCC rate. The 2011 study also assumes high rates of mill wastage (low product recovery). If there was no wastage from mill residues (for instance, mill residues are used for other products or placed in landfill), Paul et al (2011) suggest maximum sequestration in products could increase by up to 50 per cent. In addition, if the assumed decomposition rates of (all) products were halved the level of sequestration may increase by up to 34 per cent.

Accumulatively, these changes could equate to a one third increase in total carbon sequestration. Utilising the basic model, for instance, carbon sequestration would increase from 229 t CO_2-e per hectare (or 62 t C per hectare) where the carbon is treated as released after harvest to approximately 310 t CO_2-e per hectare (or 84.5 t C per hectare). This represents over half of the carbon sequestered in sawlogs produced in an average hectare during the first rotation, excluding pulpwood[8]. However, the percentage of carbon retained over 100 years from trees grown in the first rotation could in fact be higher.

Under the above assumptions, at a low carbon price of $20 t CO_2-e per hectare (and no real price increase), the IRR for a long rotation softwood plantation would increase by half of one per cent, from around 6.0 per cent to 6.5 per cent. If the carbon price were increasing each year by approximately 5 per cent over the forecast period, the IRR may increase by a whole percentage point from around 7 per cent to nearly 8 per cent. If trees were replanted after harvest, the carbon from the second and subsequent rotations would be additional.

The Federal government may provide permits for the carbon stored in wood products, based on current international guidelines. However, as discussed above, these guidelines may be overly conservative as a measure of carbon that is retained in wood products over 100 years. Changes to international guidelines should be pursued at the international level. Prior to international agreement on the incorporation of wood products and the methodologies (including the rate of decomposition), the Federal government may provide permits for carbon sequestered in long rotation plantations and associated products including in landfill based on the latest available science relevant to Australia. However, this may also expose the industry to future liabilities for net emissions from products stored in landfill (FWPA, 2008). The potential cost/risks of this should be weighed against the benefits from the recognition of wood products in carbon accounting.

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8 About half of the dry weight of a tree or wood product is carbon, while one tonne of carbon represents 3.67 tonnes of carbon dioxide. If we assume that 435 cubic metres of sawlog is produced, with a conversion ratio of approximately 700 kg per cubic metre, this is equivalent to around 150 tonnes of carbon (or 558 tonnes of carbon dioxide).

Biomass for bioenergy and second generation biofuels

Some of the possible values to be obtained from utilising forest biomass include a low emissions alternative to other energy sources, a less energy intensive fuel to first generation biofuels, a reduction in greenhouse gas emissions relative to liquid fossil fuels, and the potential to use biochar to enhance soil productivity and carbon storage benefits. Many countries overseas have a national strategy for second-generation biofuels, including forest biomass as a feedstock. Most aggressive is the US government's approach to the development of bioenergy, including through forest biomass (see box 3.4). However, the viability of forest/plantation biomass for bioenergy in Australia, for which there are currently no markets, still needs to be demonstrated.

Further R&D is required to develop commercially viable technologies. Australia essentially has two means of acquiring the technological capability to utilise biomass for energy generation and fuel. R&D could focus on importing research and adapting this research to the Australian context to develop viable technologies. Alternatively, or in addition, research could be pure basic research undertaken by Australian institutions and enterprises.

To develop the capacity to extract value from biomass, R&D is required in relation to:

- improving the process and feedstock integration and lower production costs via improvements to feedstock characteristics and pre-treatments, and increasing the efficacy of enzymes;
- developing cost-effective harvesting, transportation, processing and storage opportunities; and
- resolving the uncertainties surrounding the impact of biochar on soil carbon in order to be able to develop a reliable greenhouse gas accounting methodology.

Currently, CSIRO is undertaking a project to identify the true potential of second-generation biofuels and capacity to generate biomass production systems to be grown at sufficient scale, addressing the question of whether further investment could cause a step change in technological development.

Even with the development of cost-effective technologies, stable policy settings will be required to encourage investment in biomass for renewable energy and less energy intensive fuels. Substantive private investment in the capital required to generate renewable energy simply cannot occur under uncertain and unattractive market conditions.

- Australia has already undertaken reform of the Renewable Energy Target scheme pricing to reduce the level of support provided to small-scale solar PV systems.
- Despite the introduction of the carbon tax there is still significant uncertainty around the price trajectory. This could favour technologies that have smaller upfront costs (such as wind) over those that require upfront capital but are potentially more cost-effective (such as a biomass power plant).
- The carbon tax currently excludes transport fuels. This effectively reduces the incentive for investment in emissions abatement including through substitution to less carbon intensive fuels, such as biofuels, because the market does not differentiate fuels

on the basis of carbon content. The exclusion of some parts of the transport sector from the carbon price has implications for the returns from biofuel.

- The carbon price is earmarked to cover heavy on-road vehicles from 1 July 2014, although this measure has not been agreed to by all members of the Multi-Party Climate Change Committee.
- Fuel tax credits will be reduced for some businesses although agriculture, forestry and fishery industries will be exempt from any reductions.

Additionally, further market development is required to coordinate supply chains and develop efficient and cost-effective mechanisms to supply feedstock to regional biomass plants. This would assist if such coordination were able to improve the cost-effectiveness of the technology or, in the event that viable markets were to develop, to ensure sufficient and reliable supply to these markets.

3.4 US Bioeconomy Strategy

The US's aggressive strategy to develop biotechnologies includes actions to strengthen the potential for forest biomass to contribute to energy generation and fuels. The current National Bioeconomy Blueprint sets out a plan to achieve the directive from the US government for the realisation of the full potential of the US bioeconomy. It sets out a coordinated framework to address constraints and drivers in the development and adoption of new technologies. These five areas include:

- for coordinated, integrated R&D to support the future bioeconomy;
- to accelerate the transition of biointerventions from research lab to market;
- to develop and reform regulations to reduce barriers, increase the speed and predictability of regulatory processes, and reduce costs while protecting human and environmental health;
- to update training programs and align academic institution incentives with student training for national workforce needs; and
- to support opportunities for the development of public-private partnerships and precompetitive collaborations.

The US policy framework provides stability for investment in bioenergy. The factors contributing to the stable market environment include not only the Blueprint but also the robust R&D funding, the fully funded Farm Bill energy title and the Renewable Fuel Standard containing minimum applicable volumes of cellulosic, biomass-based diesel and other advanced biofuels (Lane, 2012) and the state governments' Renewable Portfolio Standards. The United States also provides a Production Tax Credit of $0.02 per kWh for biomass power.

Significant funding for proposals on advanced biofuels is available until 2015 through the Energy Independence and Security Act (2007). In addition, provisions to advance biotechnologies are available through the American Recovery and Reinvestment Act and other policies. Eligibility for grants is determined by the capacity to reduce lifecycle emissions, increase efficiency in bioreferineries and other criteria.

The commitment to biomass has been longstanding in the United States. In 2000, the Biomass Research and Development Act of 2000 created the Biomass R&D Technical Advisory Committee and the Biomass R&D Board. It also instrumented a role for the US Department of Energy and US Department of Agriculture to coordinate all Federal R&D related to biofuels and bioproducts.

Depending on the findings of the CSIRO research, it may be appropriate for Australia to develop a national strategy (blueprint) for bioenergy. Such an instrument could assist in providing coordination across R&D and in the development of policy. More importantly, it may assist the private sector to gauge the role of public R&D in this area, and offer some certainty around the principles and approach to governance. Currently, the carbon pricing regulation on fuel is being applied to achieve political and social objectives rather than to establish an efficient market, which discriminates between fuel types based on carbon content and therefore rewards those that invest in lower emissions fuel.

The proposed interventions in relation to carbon sequestration and forest biomass are summarised in tables 3.5 and 3.6, respectively.

3.5 Policies for carbon sequestration in trees, wood and soil

1 Establish an offset mechanism, which recognises all types of long rotation plantations as 'additional' forms of carbon sequestration. Carbon sequestration values need to be recognised for all long rotation plantations, irrespective of the level of site rainfall, the ownership structure and species type. This may be undertaken either through:
   - substantially reforming the Carbon Farming Initiative to ensure the current bias against forestry is removed; or
   - establishing a separate, internationally compliant carbon offset for forestry that is compatible with the international carbon accounting framework.

2 The Australian government to provide upfront payments for carbon sequestration in planted long rotation forests. The value to the owner of trees would be offered as a lump sum, at a discounted rate compared to payments, which accrue as the forest grows and sequesters carbon. The discounted rate would reflect the extent to which risk has been transferred from the landowner to the Australian government.

3 The Australian government to recognise the carbon stored in wood products during product use and in landfill. The government may recognise the carbon stored in wood products while negotiating international carbon accounting methodologies that better reflects the amount of carbon retained throughout the product life and in landfill. This would involve recognising that any additional area planted with long rotation plantations and the wood products generated are 'additional' and may provide 'permanent' storage for some of the carbon sequestered during tree growth even where the plantation is not replanted.

3.6 Policies for forest biomass for fuel and energy

4 Policy review to incorporate transport fuels into the carbon tax.

5 Subject to the findings of CSIRO research, develop a national blueprint/strategy for bioenergy to identify R&D requirements and opportunities.

4 Other (non carbon) values

This chapter considers other accompanying policy measures to address each of the barriers identified in the first research phase (as summarised in table 1.2). This involves identifying the instrument or range of instruments to be considered for implementation, taking into account factors such as the conduciveness of the value to a market-based instrument, the current institutional environment and the role of government and industry.

In many cases, such as for salinity and R&D expenditure, the options for increasing investment levels or more effectively allocating expenditure will require further benefit cost analysis at the appropriate level. In such instances, a broader policy commitment is required to complete this work and establish a framework for the recognition of forest values, where net public benefits are positive. Following policy discussion on each environmental, economic and social value, this chapter summarises the relevant policy option(s) in a box.

Salinity and other catchment scale environmental benefits

The CIE's research in Stage 1 concluded that the market for salinity benefits is highly fragmented. This is caused by coordination issues, which make it difficult for commercial entities to access potential buyers in any systematic way. At the same time, potential buyers of salinity benefits such as catchment management authorities (CMAs) may be inhibited by a lack of technical expertise and/or resources to enable a determination of the potential benefits that could be obtained from tree planting at the catchment scale, under different scenarios, relative to other solutions such as engineering options. Under the key program for environmental issues at present, Caring for our Country, salinity is not a priority for investment. However, existing programs could lend themselves to commercial tree planting activities if the priorities for investment were compatible with the benefits provided by commercial forestry[9].

While water quality trading markets do exist, they usually exist for a single pollutant or discharge of saline water from point sources responsible for significant discharges - for example, coal mines and power stations. The impacts of the discharges from these

9 The Environmental Stewardship Program (within Caring for Our Country) provides funding for land managers, for up to 15 years, to manage targeted matters of national environmental significance on their land, where the activities are additional to legislative responsibilities. Current program objectives include to: improve habitat across the landscape; increase the viability, integrity and buffers to high quality remnants for ecological communities; and improve the long term protection of nationally endangered species and ecological communities.

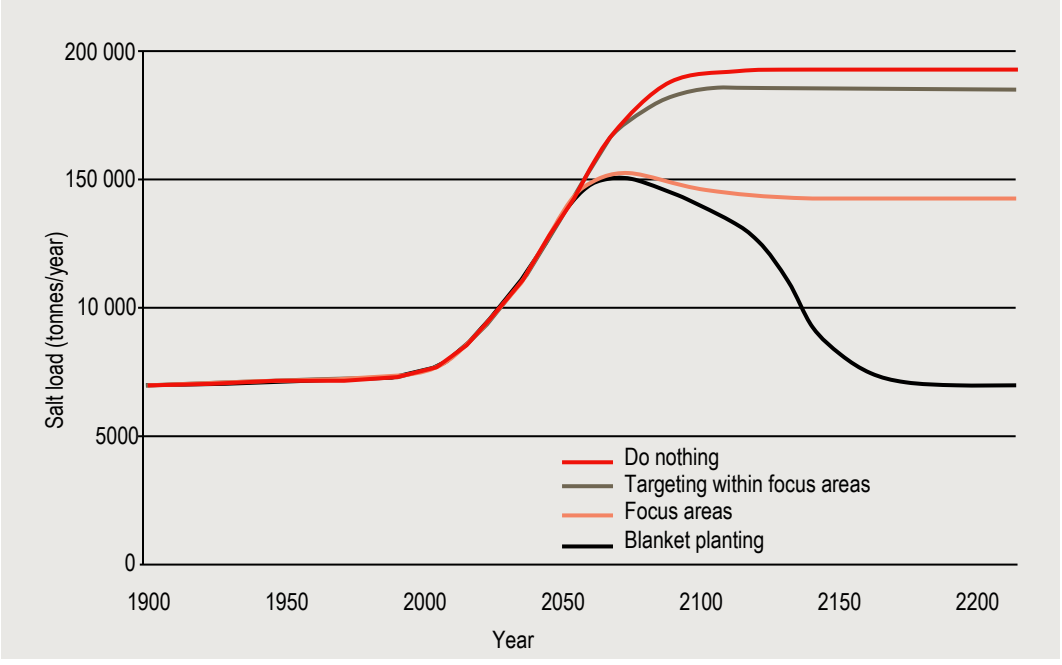
sources can be measured on a daily basis and the public benefits from containing discharges can be captured at a reasonable cost.

The private and public net salinity benefits from forestry operations, both small and large scale, are highly site specific. The benefit cost equation is complex and requires significant technical information to assess. Public benefits from planting trees may display a weak relationship to those of other catchments, and vary across time and by the land use in surrounding properties in the catchment. To receive externalities (public benefits) associated with salinity mitigation usually requires a dramatic scale of land use change from agriculture to forestry. Even with such large-scale intervention, there will still be land and other resources that are lost to salt and a significant delay in catchment scale benefits such as reductions of saline discharges into waterways (Pannell, 2001).

To resolve dryland salinity issues, a significant commitment to land use change is normally required, which may involve the conversion of more than 20 per cent of catchment to perennial vegetation, as opposed to just a few trees planted on the uplands. Chart 4.1 shows modelling outcomes for the mid-Macquarie catchment, which is dominated by saline groundwater discharge, under a range of reforestation scenarios. The scenarios include:

- blanket replanting of 100 per cent of the mid-Macquarie catchment;
- complete planting of focus areas which account for 22 per cent of the catchment;
- targeted planting within the focus areas (2.6 per cent of the catchment); and
- no change to the current scenario (do nothing).

4.1 Impact of reforestation (0 to 100 per cent) on salt load



Note: Total catchment salt load from the Mid-Macquarie Catchment for: blanket planting (100 per cent of the catchment); targeted planting of areas (22 per cent of the catchment); planning within focus areas (2.6 per cent of the catchment); and maintaining the status quo.

Data source: Zhang et al, 2007

Targeted planting within focus areas has very little impact on the salt load of the catchment compared to the baseline trajectory. Reforestation of 22 per cent of the catchment has a significant impact on the baseline trajectory, although salt loads remain higher than in the base year. While blanket planting has a significant impact, it is unlikely to be economically (or socially) viable. The optimal level of planting would be determined by the benefits associated with the reduction in salt load, reflecting the value of the natural assets, and would vary for each catchment.

Another study examined scenarios for improving salinity and biodiversity in the Little River catchment in New South Wales (Bathgate et al, 2008). It showed that broad scale revegetation with woody perennial plant species would be required to have a substantial impact on the condition of the catchment. To improve environmental values would involve either:

- replanting of 20 per cent of the catchment (which equates to more than 30 per cent of pre-clearing extent); or
- a mixed solution including interception plantings or farm forestry on 13 per cent of the catchment, the enhancement of vegetation on approximately 5 per cent of the catchment, and the adoption of pasture cropping and alley farming.

While these two options were most effective, they were associated with a substantial reduction in both farm profit and total financial benefit to the catchment. As a result, the appropriate approach to land use change would depend on the value associated with environmental assets and their improvement (Bathgate et al, 2008).

The study by Bathgate et al (2008) reinforces the importance of the quantitative assessment of the impact of management changes on multiple catchment characteristics. Table 4.2 summarises the net change in catchment outcomes under the land use scenarios. Farm System Shift refers to the adoption of alley farming and pasture cropping on 100 per cent of the area considered suitable by an expert panel.

4.2 Case study — net change in catchment outcomes under different land use scenarios

	Units	Farm System Shift [a]	Native vegetation management in focused areas (<10 per cent of catchment)	Replanting across 20 per cent of catchment	Mixed solution [b] including interception plantings
Total benefit	$m	53.38	-11.78	-42.73	-36.14
Change in farm profit	$m	48.43	-12.17	-46.57	-37.11
Benefit of reduced stream salinity	**$m**	**0.09**	**0.01**	**0.28**	**0.59**
Change in saltload	**'000 t**	**-0.9**	**-0.1**	**-3.6**	**-5.8**
Cost of reduced water yield	$m	-0.24	0.02	-0.89	-1.11
Carbon income	$m	5.10	0.37	4.44	1.47
Increase in Biodiversity Condition Score		0.1	2.5	7.7	4.0

[a] Farm System Shift refers to the adoption of alley farming and pasture cropping on 100 per cent of the area considered suitable by an expert panel. [b] Refers to interception plantings or farm forestry on 13 per cent of the catchment, the enhancement of vegetation on approximately 5 per cent of the catchment, and the adoption of pasture cropping and alley farming.

Source: Bathgate et al, 2008.

According to Pannell (2001), 'it has commonly been assumed that external costs from salinity are pervasive across all or most agricultural land'. This assumption has led to the perception, without proper discernment in each context, that there is widespread market failure associated with salinity mitigation. The cost of abatement for salinity is generally high, while in the majority of cases the *offsite* benefits from revegetation are low (Pannell, 2001). As a result, in some cases, market-based instruments may be ineffective in changing farm management on the scale required for technical effectiveness unless incentives offered exceed the level of public benefit.

- **There may be a role for market-based instruments in salinity mitigation, but significant technical and economic analysis is required prior to committing public funding to salinity mitigation.**

The rationale for public policy intervention has been to capture positive externalities from salinity mitigation. There are several other issues that may form a type of market failure (Pannell, 2008).

- There is a divergence between public and private rates of time preference. Private investors require a return earlier than the public, usually within 10 years.
- There are limited incentives for the private sector to invest in research and development associated with salinity mitigation from perennial farming systems, due to the long period of such research, high uncertainty about the payoffs and difficulty in capturing the benefits. Limited private sector investment in perennials for low to medium rainfall areas may be explained by these factors (Pannell, 2001).
- Public and private attitudes to risk vary, with farmers sensitive to uncertainties associated with mitigation benefits from specific salinity treatments, the timing of the payoffs and the long term prices for products from woody perennials.

- These factors are likely to inhibit private sector (including landholders) investment in perennial-based farming systems.
- Some environmental benefits may only be cost-effective to obtain if profitable perennials become available. Less costly perennial vegetation systems will increase the area over which economic policy instruments can operate, by reducing the average cost per hectare of benefit (Pannell, 2001).

Framework proposed

While salinity was deemed to be in crisis only a decade ago, in the current policy context it is not a priority. This is attributed to many factors including the overstatement of salinity as a crisis, the impact of the drought on visible salinity impact, an improved understanding of the cost of salinity abatement and strong criticisms of previous attempts to address salinity (Pannell and Roberts, 2010).

A coordinated and systematic approach is required to mitigate the impact of salinity and capture other catchment-based environmental benefits, where there is a strong likelihood that there will be a net public benefit. The CIE recommends the implementation of a framework for decision making and funding, recognising the principles outlined by Pannell (see chapter 2), to:

- increase the access of potential providers to markets in a systematic way; and
- assist buyers to determine the value of salinity options with respect to their hydrological system.

Initial research phase

The framework should incorporate a period of planning and research, for CMAs with high priority salinity, biodiversity or other catchment based issues. The requirement for CMAs to integrate catchment scale planning is extremely complex and requires significant capabilities, including quantitative modelling capacity, and access to adequate resources. Project assessment requires spatial planning that considers hydrology, economics, social impacts, environment, agriculture, spatial variability and timing effects across the catchment.

It is envisaged that this initial research phase would enhance the capacity of CMAs to assess the potential benefit of environmental management options. This investment may be channelled towards:

- identifying projects that meet Pannell's four key assessment criteria. That is, the project must involve valuable environmental assets that are facing high threat or high current degradation, with high feasibility to address that threat/degradation at reasonable cost and the required works are reasonably attractive to relevant land and water managers:
  - this would include filling knowledge gaps with respect to hydrology, farm economics, social issues, forestry, engineering solutions, and other required disciplines;

  - increasing the capacity for integrated assessment of the net private and public benefits associated with planting perennials, in addition to or as opposed to other salinity mitigation and adaptation strategies; and
  - enhancing the capacity to integrate quantitative modelling in to decision making;
- calibrating existing models to individual catchments and addressing data input requirements, which are often lacking or outdated, to conduct model calibration; and
- ongoing work to improve the viability of perennial vegetation systems and enhance knowledge of the costs and benefits and issues associated with salinity mitigation and adaptation.

Following demonstration of project viability, and review by an independent committee, CMAs should be properly resourced to implement market-based mechanisms to capture salinity, biodiversity and other environmental benefits.

Extension

In the National Action Plan (NAP) for salinity, more than half of the money allocated was for extension-related activities, with only small and ad hoc payments to landholders (Pannell, 2008). South Australia and Western Australia were the exceptions, both of which strongly emphasised on-the-ground works. As outlined in chapter 2, extension is an appropriate instrument where net private benefits are sufficient to sustain planting following extension, or where direct incentives are being utilised. Most of the practices advocated through salinity programs were unattractive to landholders for economic or other reasons (Pannell, 2008). The mechanisms implemented through the NAP were not sufficient to promote the level of land use change necessary.

Direct incentives

There is a strong argument for the implementation of direct incentives where the net public benefits are positive, but the net private benefits are negative. The net private benefits should not exceed the level of net public benefit. Direct incentives designed with a competitive mechanism will ensure that prices are set in an economically efficient manner.

Ongoing R&D

The reason for recommending technology development is that it may provide a cost-effective strategy to generate new technologies with positive net benefits (Pannell, 2008). Beyond the initial investment in CMA capacity, ongoing technology development may be required to increase the commercial attractiveness of treatment options for regions and to examine ways to capture salinity mitigation benefits from various technologies.

R&D should be well integrated with CMAs, which are the principal agent to purchase environmental goods and services at the catchment scale. In previous programs that address salinity, there has been limited uptake of the latest science for use in decision-making, which affected the capacity of CMAs to prioritise program funds towards the most beneficial projects (Pannell and Roberts, 2010).

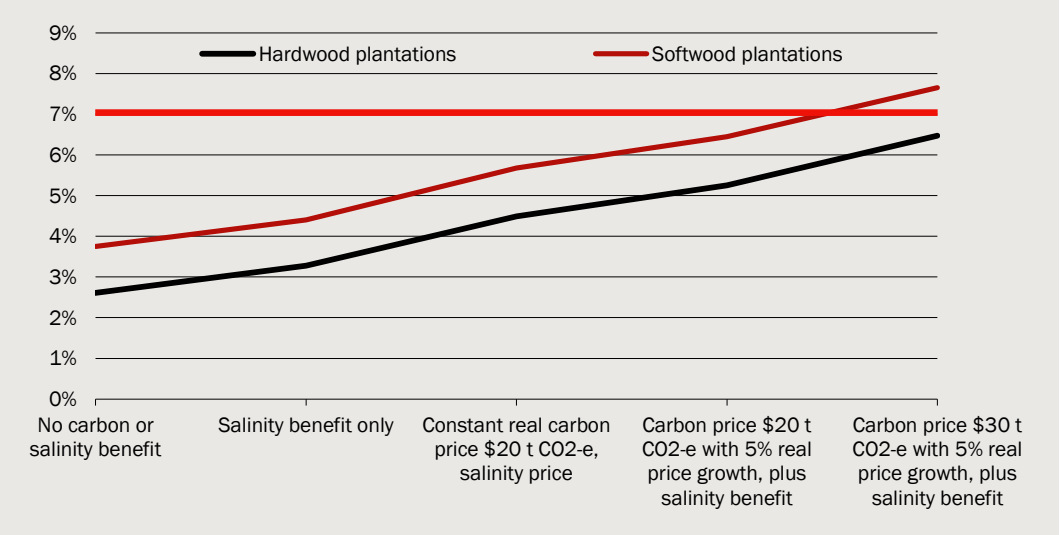
Potential impact on plantation viability

In Stage 1, the CIE investigated the value of salinity compensation that has been granted to landholders, providing a proxy of the future value of salinity benefits from plantations in salinity-affected or at risk areas. The likely order of salinity payments is between $900 per hectare and $1350 per hectare. In present value terms, assuming a discount rate of 7 per cent, this is equivalent to annual payments of between $70 and $105 per hectare.

Table 4.3 illustrates the returns to investment in hardwood and softwood plantations, with and without a price on carbon. It adopts an average salinity price of $87.50 per hectare each year. Where the return is below the red line, investment in plantations is unviable.

The implications of this analysis are two-fold. First, a salinity benefit alone would not make commercial investment in long rotation plantations viable — particularly in medium rainfall areas where salinity abatement would be carried out. Consequently, the provision of a salinity benefit for plantations in low or medium rainfall areas should not be conditional on there being no other environmental benefit received for carbon, and vice versa.

4.3 Impact of salinity benefit on after-tax Internal Rate of Return



Data source: CIE.

4.4 Salinity policy measures

6 Part A — an initial research and planning phase for catchments with valuable environmental assets/services that are salinity affected or at risk. These catchments must also have a reasonable prospect of being able to alleviate salinity through planting perennials, in a cost-effective manner. The research phase would identify projects that may deliver net public benefits and assist in the selection and design of the instrument/s.

Part B — funding for CMAs that can demonstrate a project is likely to be cost-effective and technically efficient (see chapter 2).

Part C —- ongoing R&D funding to develop technologies and the capacity to address salinity.

Biodiversity values of plantations in the landscape

The CIE's literature review concluded that biodiversity values of plantations are likely to be higher than those associated with agricultural production, but the willingness-to-pay for their marginal benefit was minimal. However, it was also acknowledged that there is the potential for commercial plantations to reduce landscape fragmentation and thereby enable species to move between patches of native remnant vegetation, to provide complementary forest habitat and buffering edge effects.

The capacity to estimate the potential contribution of a plantation, given its unique location and dimensions, with respect to the broader landscape is still developing. Currently, indexes utilised to estimate potential biodiversity outcomes based on inputs or outputs are not yet robust. As such, further R&D may open the possibility for compensation for such values and/or support the industry's profile in the community.

Bundled environmental benefits

Industry has suggested a bundled approach to the recognition of externalities provided by plantations, including biodiversity and salinity. The scheme would not include carbon, for which the preferred approach is to establish a distinct market.

The proposal is for a revolving debt facility that enables investors to gain access to funding at a lower interest rate than offered in the market. The rationale for such a facility is to recognise the spillover benefits associated with *long rotation plantations*, in particular, carbon. The government could provide access to capital at a rate of 6 per cent each year, which one industry expert has suggested could enable commercial returns for softwood plantations of approximately 7 to 8 per cent.

The rate of capital could be determined in several ways, such as:

- a flat rate based on the average environmental benefits expected to be generated by long rotation plantations across Australia.

- a flat rate determined by the expected minimum level of finance required to support the investment in plantations to a targeted level.

Prior to lending, the government would undertake its assurance processes to reduce the level of exposure to poor investments.

An alternative measure, which may be implemented at the regional level and may be less blunt, is for a competitive grant to be provided in recognition of the general non-carbon environmental benefits provided by long rotation plantations. Although a national scheme, regions/catchments could establish the parameters of eligibility and may introduce competitive price determination.

4.5 Revolving debt facility for mixed environmental benefits

7 Option A — establish a revolving debt facility that enables the industry to have access to cheaper finance for establishing long rotation trees. The rate of capital would be offered at a flat, fixed rate once a project satisfies eligibility requirements. The design of the scheme may involve:

a) A flat rate based on the average bundled environmental benefits from long rotation plantations.

b) A flat rate determined by the expected minimum level of finance required to support long rotation plantation investment to a targeted level.

The scheme would include mixed environmental benefits other than carbon, which would be addressed through items 1-3.

Option B — a grant to compensate for non-carbon values provided by plantations.

Viable smallholder long rotation forestry

The rationale for direct incentives associated with plantation investment is to increase the public benefits recognised from farm forestry including mixed environmental benefits and social values. Initiatives to promote farm forestry are widespread and usually motivated by environmental benefits provided by trees. In some cases, the support for farm forestry is underpinned by regional development objectives. For example, in 1992, the European Union introduced Regulation 2080/92 to retire land from agricultural production and utilise this land for plantation establishment. The EU regulation provided funding for a significant proportion of plantation establishment (up to A$6250 per hectare) and annual management costs (up to A$600 per hectare) for 20 years, plus a woodland improvement payment, payments for forest roads, and contributions towards firebreaks and dams (de Fégely, 2011).

In many countries, former or marginal cropland is targeted for farm forestry to improve soil productivity, including through planting trees. In the US Conservation Reserve Program, an Environmental Benefits Index rating system is used based on expected long run benefits. Many projects require an approved management plan. However, a report by the USDA Forest Service and partners (Mercer et al, 2011) suggests that very few

landholders participated in such programs, indicating there are barriers to the uptake of planting schemes by landholders.

The social and environmental values (public benefits) of farm forestry vary by locality. Competitive price determination for farm forestry has demonstrated the cost of planting and potential for cost-effective farm forestry varies significantly between catchment areas. This suggests both that the preferences of landholders and value of the best alternative land use vary significantly.

An assessment of net public and private benefits is required to ensure technical efficiency and cost-effectiveness of public investment through the selection of appropriate projects and instrument design. Private net benefits should be near to positive or positive. Net private benefits are driven not only by compensation for any externalities, but by the potential for commercial returns. In the past, farm forestry projects were undertaken in anticipation that processing facilities would be established, but in some instances this did not eventuate. The scale of investment required to ensure that it is viable for logs to be processed must be considered in policy design, including through discussions with industry. It is important that species selection and silvicultural management practices are conducive with generating a commercial return on the asset. As such, there is a role for the commercial sector in farm forestry projects from their inception to the time of harvest.

Access to land and competition with agriculture are difficult issues for the forest industry to resolve. Some industry participants support renewed partnerships between industry and landholders, in light of the difficulties in securing land at an affordable price. Some farmers have been disenfranchised by previous dealings with the forest industry. There are also higher management costs/risks associated with farm forestry and challenges in securing the scale of the resource required. However, many industry representatives hold the view that there is an important role for farm forestry and integrated landscape management to achieve its objectives.

New Forests (2011) suggest that a landscape-based vision for land management is required, whereby plantations are integrated with production and conservation. It suggests that integrated landscape-scale management could enhance value through ensuring the protection of core reserves, from commercial biodiversity banks and REDD projects, connectivity corridors and the protection of critical features such as wetlands and riparian zones. New Forests (2011) propose partnerships between high impact land uses and conservation components.

Direct incentives

There are aspects of the New Forests proposal that could be considered in the near term. One possibility is for landholders (or forestry companies working in partnership with landholders) to be compensated for rehabilitation and regeneration works on native vegetation and riparian areas on private land. The surrounding area would be planted with species for commercial production, which may include single or mixed species plantations. A generalised subsidy may capture the potential *public* benefits associated

with the proposed rehabilitation plan and ecological service values of the forest (such as from biodiversity corridors, habitat value and offsite salinity mitigation).

This proposal extends the approach for salinity, and may cover a broader number of catchments than those targeting salinity. An initial research period would be required to investigate the case for public investment within each catchment. Following the identification of suitable projects, funding must be made available on a scale sufficient to ensure that the private landholders are able to access forest processors/markets and the scale of plantings expected to achieve biodiversity or other environmental benefits is met. In designing the incentive, it would also be desirable to consider how the incentive would encourage the management of the resource to maximise environmental and commercial values. Where the incentive is solely an upfront grant, there are often problems associated with poor silvicultural management causing the resource to be incompatible with industry requirements.

A proposal put forward by industry is for an economist to estimate an average value per hectare, utilising a relatively blunt scaling system. The scaling system may involve a spectrum based on factors known to influence the biodiversity value of plantations, such as the tree species type. The rationale is that the literature has supported the evidence that farm forestry delivers a range of ecosystem service benefits, including biodiversity.

- A conservative approach would be taken to these estimates. This exercise could be undertaken at the national level, and adapted to suit regional requirements.
- It would be utilised to inform CMAs of the potential value of public benefits from farm forestry, rather than as a fixed measure of compensation. This would ensure the public could purchase environmental goods and services at lowest cost.
- The raw public values determined through economic analysis could be subject to a period of review. The scheme would involve only long rotation forestry and could involve a legal agreement such as through it being registered on the land title to ensure accountability for the agreement period.
- The public benefits may exclude carbon values, which would be determined through the Carbon Farming Initiative or similar appropriate carbon policy.

Option to incorporate carbon in direct incentives

Another important barrier to farm forestry for landholders is the perceived risks associated with the requirements surrounding carbon offsets. The potential liabilities that would be attached to landholders' properties for 100 years (to achieve 'permanence') are a source of great concern. In particular, landholders are concerned about the inherent uncertainty in the carbon price trajectory and, therefore, the high transaction costs which may result from land use change.

To appeal to risk-averse landholders, a value for carbon could be provided through a direct incentive for farm forestry. The value of the carbon would be discounted to reflect any transfer of risk and liabilities for the carbon from landholders to the government.

Table 5.3 presents one of the few studies that has quantified the potential value of farm forestry. Benefits would vary substantially between sites: public good aspects of farm

forestry have been estimated to range from $6 to $115 per hectare each year (Paul et al, 2011a). The estimated value of public environmental benefits of $1466 per hectare in net present value terms (461+628+314+63) as shown in table 5.3 represents the upper limit of the range of public benefits quoted in Paul et al (2011). However, the estimated salinity benefit is significantly smaller than the payments previously made to address salinity, such that farm forestry may attract additional salinity values in some catchments.

The receipt of public benefits of this magnitude has the capacity to change landholder behaviour in some regions through improving the commercial viability of plantations. Nevertheless, landholder incentives vary in each region, as illustrated in studies which show vastly different responses to payments for tree planting (for example, see Lowell et al, 2007). In one auction-based market, an upfront payment of $850 per hectare in the Corangamite catchment was sufficient to promote a sufficient volume of tree planting to reduce the overall cost per salinity benefit (Lowell et al, 2007).

An additional carbon payment would significantly increase the benefit to landholders, particularly where price risk is adequately reduced through the market (or government schemes).

4.6 Public benefits from farm forestry

Type of value	Net Present Value (2011 dollars) a $/ha	Estimated annual value (2011 dollars) $/ha
Public benefits		
Biodiversity	461	28
Riparian restoration and water quality	628	38
Salinity	314	19
Soil erosion	63	4
Aesthetics/scenic improvement	481	29
Total social and environmental benefits	1947	118

[a] At a 6 per cent discount rate.

Note: URS 2003. Values have been updated from 2003 to 2011 terms.

Taxation incentives

Another proposal introduced by the industry is for a 150 per cent deduction in the cost of planting trees in an integrated farm and forestry landscape. There is precedence for the Australian government providing tax incentives to encourage practices with environmental benefits. For example, conservation tillage refundable tax offsets are currently available for practices in farming which reduce soil disturbance, increase soil nutrients, reduce water loss and protect against wind erosion and land degradation (ATO, 2012).

The rate of the tax deduction would reflect the collective environmental and social benefits to the community from the planting of trees, rather than the amount required to induce investment in trees. The deductions would be applicable to eligible establishment and management costs, excluding the cost of land, which is treated as a capital

investment. Increasing the rate of tax deductibility would partially offset the high cost of land acquisition and reduce the high opportunity cost associated with the long period to asset maturity. The public receives ongoing benefits throughout the life of the plantation, as opposed to at the time of harvest. The tax deductibility would reflect the average estimated benefit to the public as opposed to the exact value at each site. It would be a blunt instrument.

Carbon leasing

Carbon leasing is also a possible model for the industry and/or government to adopt to encourage tree planting. In New Zealand, a company called New Zealand Carbon Farming provides a guaranteed annual income stream and takes on the responsibility for the liability to repay the carbon credits at the end of the lease term (through planting new forests). The scheme compensates forest owners with an established forest planted after 1990, which is at least 200 hectares. The carbon credit for existing plantations is utilised for the establishment of new plantations. The New Zealand example suggests that the private market can respond to the problem of risk associated with carbon credits established under a flexible carbon pricing mechanism and the requirement for permanence, provided there is an effective and sufficient incentive for carbon. The private sector might consider what it might take to establish such a scheme, once a carbon offset market was in place for forestry.

4.7 Farm forestry policy initiatives including landscape management

8 Part A — an economist to identify an appropriate average value of benefit from long rotation farm forestry for use by CMAs and state agencies in the estimation of public benefits from farm forestry.

Part B — funding for direct incentives for farm forestry projects, where an independent committee is satisfied that the project constitutes a net public benefit. The direct incentives would be subject to competitive price determination to take into account supply and demand parameters. Bundled benefits may either:

a) include carbon values; or

b) exclude carbon values, with carbon values to be received through the amended CFI or an equivalent carbon offset mechanism for forestry.

Part C — as an alternative to direct incentives (Part B), the Federal government could increase the tax deductibility (beyond 100 per cent) for eligible farm forestry expenditure, to recognise the mixed environmental and social benefits from farm forestry. The rate of tax deductibility would reflect the estimated average public benefit associated with the plantation.

Taxation reform

Forestry is a long term investment, held for a long period in the same way as investment in a house or superannuation portfolio. Investor returns from forestry would therefore

become a form of retirement income. When considering the current taxation framework for forestry, the CIE sought to identify any issues which prevent forestry from being treated in the same way as other assets, or any unique issues for which forestry needs individual treatment in order to achieve the same taxation outcome as other assets.

Greenfield forestry assets are not well suited to superannuation funds that gain access to concessionary taxation rates. In Australia, there is limited Greenfield investment in forestry by institutional investors. This is because institutional investors, which invest in superannuation companies, are selecting the assets that deliver the preferred rate of return relative to risk and other desired investment characteristics such as liquidity and cash flow.

The CIE considered the question of whether there was any strong argument for a taxation bias, which inhibits access to the discounted rate of taxation available to super funds. We did not identify any taxation barriers impeding investment by superannuation companies in Greenfield assets.

- Investment in forestry MIS assets is unlikely to be attractive to superannuation companies, which have a low marginal rate of tax and would only benefit from a small upfront tax deduction. As such, institutional investors do not receive significant benefits from undertaking this type of investment.
- In theory, however, problems associated with the lumpy returns of forestry and lack of liquidity can be addressed through companies, which have a balanced portfolio. A superannuation company is capable of purchasing shares in a forestry company which could provide an annual dividend.

4.8 United States: level playing field or unfair tax advantages?

US timberland investments have been able to compete favourably with other investment options. Returns from timberland ownership averaged around 7.8 per cent from income generated and more than 12 per cent from the appreciation in asset values. These rates of return have been attainable in part due to favourable taxation arrangements. Forest assets have also remained viable due to the low cost of land and low opportunity cost associated with maintaining existing forest assets.

Investors who own just forestland can normally pocket at least 85 cents out of every dollar of profit (US FS, 2007). Real Estate Investment Trusts (REITs) buy, manage and sell real estate assets on behalf of private investors. REITs have utilised the investment in forestry assets as a risk diversification strategy (US FS, 2007). REITs are able to enhance their after-tax investment returns from forestry through the Real Estate Investment Trust Simplification Act of 1997 whereby only the shareholders of REITs pay income tax. This is normally computed at a rate of not more than 15 per cent and compares favourably to the 35 per cent rate applicable to any income realised by regular Sub-chapter C Corporations, which is then subject to further taxation for profits disbursed at the stockholder level (at approximately 15 per cent). Timber Investment Management Organisations (TIMOs) are typically engaged by pension funds and have benefited through having access to favourable taxation arrangements associated with pension funds (US FS, 2007).

State and Federal cost-share incentives also encourage private landowners to invest in timberlands. For example, legislation was passed in 1997 to allow open land converted to timber production to continue to be appraised as open land for the next fifteen years (URS, 2007).

There are, however, several hidden taxation barriers which could affect the attractiveness of forestry relative to other crops. These taxation barriers need to be addressed in order to maintain taxation neutrality. The correction of such distortions is particularly important as landholders are expected to play an important role in the future of the industry, given the constraints to land access that are faced by the industry.

At present, landholders are effectively required to pay the highest marginal tax rate on profits from trees rather than the rate charged if income was accrued on an annual basis or at concessional rates such as those applying to money withdrawn from a superannuation fund for retirement or those withdrawn from Farm Management Deposits (FMD). To enable marginal or good agricultural land to be considered on the same merits as other crops, a number of changes would be required. The scope of these changes has been suggested to include:

- providing income-averaging provisions that are afforded to other annual crops. This could be undertaken through increasing the maximum limit of funds held in deposits at any one time, amending the rules to enable greater participation by those with taxable off farm incomes, redefining the withdrawal threshold in relation to death or retirement from primary production and enabling FMD to be made on behalf of partnerships and family companies;

- reforming Capital Gains Tax exemptions to improve the suitability for farm foresters and lower economic barriers to planting trees. This could include:
  - amending the 'active asset' condition of the small business CGT concessions to enable a farm to qualify if leased; or
  - deleting the requirement for the retiring taxpayer to have an active asset at the time of sale or transfer of the property; and
  - removing or raising the arbitrary asset value threshold in relation to private forests to account for the appreciating nature of the asset;
  - resolving lingering uncertainty around profit a prendre or landholder interest; and
  - reducing the current holding requirement of four years before an investor is able to claim a tax deduction on planted trees;
- enabling current forestry assets to be acquired by self-managed superannuation funds.

Managed Investment Schemes (MIS) sought to enable private individuals investing in forestry to be treated as if they were planting the trees themselves, thereby enabling an upfront deduction to be made against any income. By aggregating the investment of private individuals, a sufficient scale of resource could be developed to ensure viability.

- The CIE understands that the industry is currently seeking to bundle MIS plantations to sell at the wholesale level.
- There may be the requirement for some form of see-through taxation arrangement to ensure the ownership and management of these assets can be resolved.

As it is well documented, the taxation arrangements had unintended consequences on the structure of forestry investment. MIS companies were required to secure land and undertake reforestation operations within just 14 months of the initial income deduction being claimed by the investor (New Forests, 2011). This caused considerable pressure on companies to establish new areas of plantations, forcing developments into regions where it was unviable. In addition, as land acquisition is not tax deductible to the investor under the Managed Investments Act, the companies financed land purchases through considerable debt (New Forests, 2011). The requirement to service loans and pressures on cash flow continued to place pressure on companies to attract new investment and roll over debt. As such, a relatively small taxation benefit was significantly outweighed by risks associated with a cost structure skewed towards client management and marketing, and exposure to changes in equity, credit and asset markets.

MIS encouraged the organisation of forestry investment around inefficient vehicles with high administration costs and sales commissions, as well as an asymmetry of information between investors and administrators.

- **The MIS schemes have significantly impeded confidence in forestry investments, whilst also not encouraging investment in long rotation forestry assets as short rotation investments continue to have returns that are more attractive.**
- **For such reasons, many in the industry are strongly opposed to the introduction of blunt taxation instruments where these may cause such unintended distortions.**

4.9 Taxation policy instruments
9 Review of taxation rules affecting landholders investing in trees to ensure equivalent taxation outcomes, in particular, looking at income averaging provisions through Farm Management Deposits, and the rules around Capital Gains Tax exemptions for landholders.

Research and development funding

There is usually a substantial lag in the benefits derived from R&D such that it may not be the most attractive option to address the problems faced by the industry. However, R&D is fundamental to improving the commercial viability of forestry and supporting the establishment of markets for public goods associated with forests. Many of the impediments to capturing higher values for forestry are associated with R&D. It forms a critical component of the strategy to promote industry improvement. Some key opportunities for R&D include:

- to improve the capacity to supply product to high value markets such as for quality hardwoods:
  - R&D is required in the areas of tree improvement, wood quality, harvesting and transport efficiency, product innovation and product and market sophistication;
  - R&D would need to be accompanied by market development to provide greater certainty behind the assumptions underpinning industry investment. The government typically provides seed funding to investigate whether it is worthwhile for investment to be undertaken by the private sector;
- to increase the viability of perennial vegetation, in the form of farm forestry, to improve the potential for environmental values to be captured. In particular, public investment is required to improve tree performance in low rainfall environments;
- to investigate management practices and instruments/regulation to promote sustainable harvesting practices and biodiversity outcomes in private native forests:
  - there is a lack of knowledge of how to manage private native forests for a range of values and the implications of alternative regimes (Thompson and Connell, 2009);
  - research to develop a metric for the measurement of biodiversity values from silvicultural management from private native forests should continue;
- to underpin the establishment of environmental markets associated with forests. This would include any value for which there is not yet the capacity to implement a general market instrument: salinity, landscape scale values from plantations (such as biodiversity networks), and biochar.

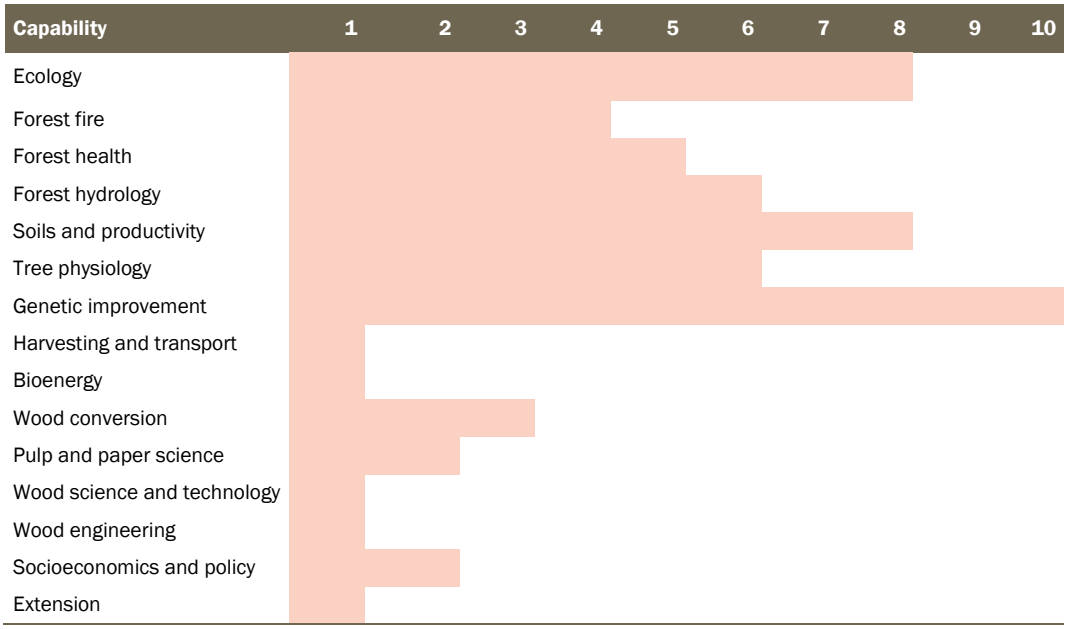
Presently, the industry is concerned that the commitment to funding R&D has declined and that future research capability is being impacted. Research by FWPA shows a decline in real expenditure in aggregate terms as well as per unit area or per unit harvested wood volume.

- According to FWPA (2010), funding has reduced in aggregate terms by approximately 0.6 per cent each year from 1981–82 to 2007–08.

- Funding for the Cooperative Research Centres, the major cooperative research, development and extension (RD&E) mechanism in the forest and wood products sector since 1991, is due to cease this year.
- The scope and scale of research at the CSIRO has reduced significantly; there has been a shift in focus towards strategic research areas that concern national priorities and away from research areas assisting near-to-market areas (FWPA, 2010).

There are related concerns of a decline in the institutional capacity to undertake strategic R&D (see table 4.10).

4.10 Adequacy of current RD&E capability



Source: FWPA, 2010.

As shown in table 4.10, the areas in which there are severe deficiencies in R&D and extension (RD&E) capability, based on a survey of key RD&E providers, are in relation to areas that typically derive benefit to the private sector.

An analysis of strategic funding capabilities and priorities identified several key needs. These include (FWPA, 2010):

- strengthened coordination and planning of RD&E capacity and capability at the national level to address national sector priorities, and the linking of RD&E capability to career pathways;
- enhanced critical mass of investment and resource utilisation to better deliver RD&E outcomes to the forest and wood products sector.
- new models for cost-effective delivery; and
- the effective use of extension.

The concerns of industry could be addressed either through reallocation of existing funding to meet the industry requirements better, or through an increase in overall

funding. There are three reasons that justify a modification to the existing allocation of resources.

- The first two relate to a change in the allocation of a fixed budget.
  - The minimum threshold to achieve benefits from R&D is not being met.
  - There are risks that warrant investment as an insurance policy. Major threats to the forest industry are associated with regulatory biases that affect the operating environment for forestry.
- A flexible budget may be increased where funding is available to augment investment in an area that is not receiving sufficient funding. An objective assessment is required of the value proposition for more R&D funding. If the value proposition is for government to spend more money on R&D, the industry must be able to identify spillover benefits to the public.

As outlined by the Productivity Commission, the key rationale for public funding for rural R&D is 'to address spillovers and related market failures that would otherwise mean that socially valuable research would not proceed (or would be reasonably delayed)'. In relation to forestry, spillovers may occur in two main ways:

- through increasing the commercial viability of forestry to achieve land use management change that derives net public benefits, through the strategy being effective for landholders;
  - long periods for benefits to arise from research, for instance in relation to perennial vegetation in low to medium rainfall, and the diffuse nature of the benefits discourage private sector investment;
- through improving the understanding of natural resource management issues and the relative technical and economic performance of various technologies/instruments.

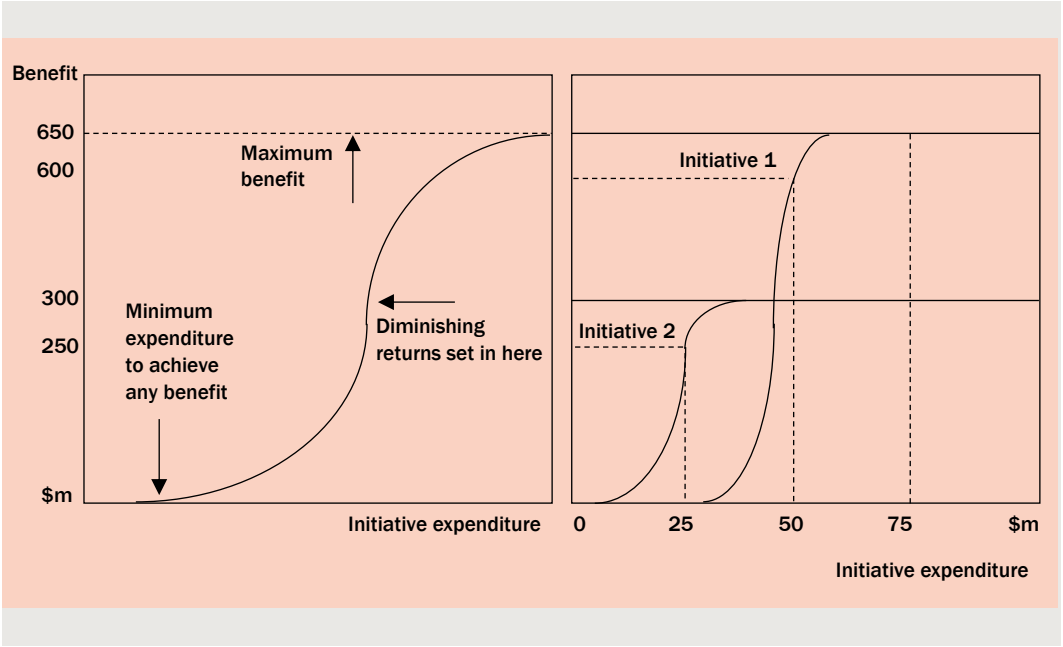
An overarching question for industry is to determine whether there is evidence that R&D expenditure is less than desirable at present or could be better targeted than it is at present. That is, to examine which specific areas are not funded at all, or to an optimal level? The rationale for more funding on the basis that it was provided in the past is not a sufficient economic argument.

Below in chart 4.11 is a framework for industry to think about their funding requirements and targeting. An overall funding framework can be established through the evaluation of threshold expenditure required to achieve a minimum level of benefit, the point at which diminishing returns is met in each portfolio, and the distribution of the potential benefits (between government and industry). Chart 4.11 reflects the following principles.

- The more expenditure allocated to a particular strategic initiative, the more likely it is that the maximum benefit of that program will be realised. The probability of success and rate of adoption will depend on how much is spent on each initiative. The more that is spent, the higher both will be.
- As more is spent on a particular program, after some point the effectiveness of each additional dollar of funding will decline due to diminishing returns.
  - Diminishing returns and risk will limit how much should be spent on any one program. To allocate scarce funds to achieve the best result for the industry it

should spend dollars in those initiatives up to the point at which spending on one program is expected to derive the same expected benefits from others.

4.11 Payoffs from investment in R&D



Source: CIE.

In reality, the application of these principles is very difficult. The reason is that uncertainty surrounds many factors affecting benefits and costs. The risk profile of an R&D investment may reduce if the level of expenditure is associated with greater certainty around achieving the outcome. However, risk may increase as funding increases if the maximum benefit can only be determined in a probabilistic sense.

Examining the level of public benefit from R&D is an important consideration for governments and beyond the scope of this study. The Productivity Commission (2011) suggests there is a role for government where government investment is required for the project to proceed, and where the environmental and social benefits expected are a relatively large component of the total benefit stream. This involves distinguishing those projects whereby there is already a strong incentive for private sector participation, even where the benefits derived may be environmental or social (PC, 2011). Rarely, however, will there be sufficient information available to determine the funding configuration to deliver the greatest funding benefits to the community (PC, 2011).

4.12 R&D

10 Industry to review the adequacy of research and development commitments to key areas, including by identifying the minimum threshold, maximum benefit and perceived allocation of benefits between the private and public sector. Potential target areas for R&D, to address barriers to obtaining values, include high quality hardwoods, products from low rainfall environments, metrics for biodiversity in private native forests, carbon stored in soil, salinity, landscape scale values from plantations (such as biodiversity networks), biochar and second-generation energy and fuel.

Management of private native forests

Private native forests (PNF) provide a significant resource, equivalent to around 22 times the area of plantations in 2007. While the PNF resource is too disparate and transaction costs are too high to enable the resource to provide security for processing mills, the resource offers a market to supplement log supply through a spot market. Currently, however, the status of private native forests is generally regarded as poor due to 'a long history of indifferent management and/or high-grading… without due attention to silvicultural improvement treatment' (Jay et al, 2009). Thompson and Connell (2009) state that 'the current lack of incentives, combined with an emphasis on regulation provides little scope for improved management outcomes and results in a decline of the genetic and commercial potential of many of these forests'. Poor silvicultural management is a significant threat for processors, which lack capacity in most regions for processing lower grade or smaller diameter products (AFG, 2010).

Uncertainty arising from government policies and regulation is thought to be having perverse effects on landholder behaviour in relation to the management of Private Native Forests. A key aspect of PNF regulation is the Forestry Codes of Practice, implemented to deliver Ecologically Sustainable Forest Management (ESFM) outcomes in accordance with the Regional Forest Agreements in the mid-1990s. Key objectives of the legislation are to maintain or increase the full suite of forest values for present and future generations including biodiversity, productive capacity and sustainability of forest ecosystems, forest ecosystem health and vitality, and long term social and economic benefits (Thompson et al, 2007).

Researchers contend that the outcomes of the PNF regulation are not actually meeting the intent of the regulation: to maintain or increase the full suite of forest values including productive and biodiversity values. Many landholders are managing their forests for short term profits without due regard for long term sustainable management (Jay et al, 2009). In most jurisdictions, there appears to be uncertainty surrounding the long term right to harvest. There is also a risk in some jurisdictions, such as NSW and Victoria that silvicultural investments may ultimately result in more restrictive harvesting rights as forest condition improves. With uncertainty around the payoffs to sustainable forest management, it is rational for forest owners to seek to maximise short term gains.

Furthermore, in some jurisdictions, such as NSW, the current codes allow poor practices to meet standards, such as high-grading without culling older degenerative trees.

The CIE understands that presently, Queensland and Tasmania deliver the highest level of certainty to owners of private native forests.

- Queensland enables PNF to operate as an exemption on land, subject to the Vegetation Management Act 1999, without a development approval provided operations comply with the Code. Under the Integrated Planning Act 1997, there are existing provisions, which override local government strategic plans giving some certainty that existing land uses may prevail in future. There are also no forest-type exclusions based on conservation status, as there are in Victoria, although the Code does set out various management practices which apply to each (Thompson et al, 2007).
- In Tasmania, where an area of land has been declared a Private Timber Reserve under the Forest Practice Act 1985, a forestry operation does not require local planning authority approval where landholders have a certified Forest Practices Plan. This provides greater certainty around the right of landholders to use their land for forestry in the long term (Thompson et al, 2007). Thompson et al (2007) suggests that the requirements under the Code are, however, the most extensive.

Approach

A package of legislative reform and direct incentives may be required to achieve the outcomes intended in line with the intent of PNF regulation. This involves a two-pronged approach. First, State governments would review and adapt their legislation to ensure there is not an incentive for short term opportunism and that the intent of legislation is met in reality. Second, the provision of direct incentives may be required for landholders to enhance the current state of their forests, where this exceeds what is required to meet 'duty of care' principles.

At present, however, there are a number of deficiencies in the capacity to value PNF management options. Thompson and Connell (2009) indicate:

- There is insufficient capacity to detect differences between silvicultural legacies and simply the recovery of vegetation from harvest.
- Harvesting by high-grading is expected to pass the general habitat scoring metrics, which could be associated with significant adverse effects on future wood production. For example, high-grading can preserve many large trees in the stand which may produce hollows and thereby meet habitat scoring measures.
- The metrics require modification for a forestry environment, including greater integration with landscape attributes and a silvicultural sustainability component.
- Metric scoring is still not able to deal with the inter-temporal nature of sound silvicultural management in which there may be a short term reduction in biodiversity habitat for longer term gain.

An initial research phase is required to establish an appropriate metric for biodiversity. In addition, knowledge gaps would need to be filled such as the potential costs associated with management changes for PNF in each jurisdiction. Following this, direct incentives may be required (where the conditions outlined in chapter 2 are met) to ensure community outcomes are maximised. Sufficient funding is required to ensure that, within each region, there will be adequate participation to encourage sustainable management at a scale that permits long term market viability.

There may also be a case for extension to support other incentives, given the lack of knowledge among private landholders of how best to manage private native forests for a range of values and the implications of alternative regimes (Thompson and Connell, 2009). Extension could commence earlier than direct incentives, if landholders were assured of a commitment to direct incentives and regulatory reform, upon demonstration of the technical and economic efficiency of available instruments.

In addition, there is a requirement for ongoing research to deliver credibility to biodiversity outcomes that are to be purchased by the government. A commitment to review incentives may be required on a regular basis, such as every five years.

4.13 Policies for Private Native Forestry

11 Part A — an initial research phase to establish an appropriate metric for biodiversity associated with various management options for PNF.

Part B — policy commitment from each State and Territory to review legislation and implement direct incentives, where public goods can be purchased cost-effectively. The review should focus on providing a low sovereign risk environment by safeguarding the future access of landholders to their resource.

Price transparency in international markets

One of the most significant impediments in forest markets, particularly with respect to long rotation forestry, is related to price distortions from subsidised semi-natural and natural products. Historically, wood products have been released cheaply at a rate reflecting the cost of harvest and extraction from the forest. The public environmental values provided by the resource over time are not reflected in the price. The oversupply of cheap wood has kept the commercial returns from international timber pricing well below the cost of capital (New Forests, 2011).

- **Primary harvests from natural forests in countries such as Canada, Russia, Indonesia, Papua New Guinea, the Democratic Republic of Congo and Gabon have acted as a natural buffer on timber pricing (New Forests, 2011).**

According to New Forests (2011), the commercially accessible timber supply from natural forests is declining. A number of factors have culminated in the reduction in the supply elasticity of products from long rotation plantations and semi-natural and natural resources (New Forests, 2011):

- The marginal cost of extracting remote or poor quality natural timber from Siberia and PNG is now becoming similar to the cost of plantation-produced timber in Brazil, New Zealand and other high productivity plantation regions.
- The total availability of semi-natural and natural forest products for harvesting should reduce following agreements to curtail harvesting in the Canadian boreal forest, a halt to new concessions for the conversion of natural forests in Indonesia and an agreement to limit natural forest harvesting in Tasmania.
- The timber supply in Europe and North America is still very large, but is being slowly reduced by conservation easements, regulation and land fragmentation.
- There is limited opportunity for expansion of semi-natural forests and managed plantations, primarily in the United States, Canada, Scandinavia and Europe, with limited opportunity for expansion.

New Forests (2011) suggest that the most attractive investments are shifting towards high quality intensively managed plantations, many of which were established through government support.

However, continued pressure is required to reduce pricing distortions in forest markets particularly with respect to the lack of recognition of non-wood forest values. The Australian government has several initiatives to increase the protection of forests related to the Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) scheme. The aim of REDD-plus (REDD+) is to reduce rates of deforestation and forest degradation, by recognising the value of carbon stocks, conservation and sustainable management of forests. The Australian government has contributed to the development of REDD+ schemes through the Kalimantan project in Indonesia and intends to work with the Jambi province of Sumatra.

The implementation of REDD+ in developing countries is commonly complicated by issues associated with forest carbon ownership and governance. The complexity of land tenure issues has significantly constrained the progression towards the target area of replanting in the Kalimantan project in Indonesia[10]. There is often a gap between legislative intent and compliance, and issues surrounding implementation and enforcement (Norton Rose, 2010). Weak property rights and the imbalance between formal and informal right holders cause deforestation in many countries (Norton Rose, 2010).

Financial offset schemes for ecosystem services (such as REDD+) will play a role, however there is also growing recognition of the requirement for regulations and institutions for law enforcement, clarification of tenure rights, land use planning and infrastructure development and other areas for national regulatory approaches (Angelsen et al, 2012). That is, 'measures are needed on the supply and demand side to stimulate the adoption of forest-conserving land uses, de-incentivise the conversion of forestlands, and incentivise increased production of non-forestlands' (Angelsen et al, 2012).

10 With approximately one third of the $100 million spent in relation to the Kalimantan project, there have been only 1000 hectares of the 50 000 hectares of the replanting planned for degraded peatland (Lang, 2012).

4.14 International recognition of forest values

12 The Federal government to continue to use bilateral or multilateral instruments/mechanisms to reduce the supply of forest products from high value forest assets including through incentives for the conservation of high value forests. This would include, but not be limited to, the provision of alternative income opportunities for those harvesting or with the rights to harvest high value forest assets.

Price transparency in domestic markets

The lack of price transparency for forest products, particularly from hardwood forests/plantations, represents an impediment to the uptake of farm forestry. Unlike other commodities, price information for forest products is not published through the newspaper or accessible online. Better price transparency is required to encourage small-scale investment in trees.

Provision of information

An instrument to increase price transparency for smallholders would complement other initiatives that promote the uptake of forestry by landholders. One possibility to improve price transparency is for the establishment of a hardwood pricing index, similar to the existing Softwood Price Index. Such an index may reduce the reluctance of landholders to invest in farm forestry, particularly where this reluctance is caused by the perceived inadequacy of commercial returns and price risk.

Although there has been strong advocacy for a Hardwood Price Index, key stakeholders that have the potential to contribute to the index have withdrawn from discussions. The reasons include a lack of will or incentive for potential contributors to participate and the complexity involved in establishing the index, which would involve integrating four to five pricing scales for native hardwood products. Transacted wood values cannot be observed for long rotation hardwood plantations, which are still maturing, such that an index would be based on native hardwood products. There are confidentiality issues and limited direct benefits for potential contributors. There has also been some doubt raised over the potential to construct a meaningful index for new or thin hardwood industries even if the data is provided.

While an industry solution is required, seed funding could be provided by the government to create a composite index. This could pay for an external and trusted firm, such as an accounting/auditing firm, to both manage sensitive commercial data and derive and publish the appropriate index. There is concern among industry leaders that the capacity of government agencies to analyse industry data and report industry statistics is diminishing. As such, it is anticipated that there would be a greater willingness for stakeholders to provide sensitive information to an external firm. It is envisaged that industry would need to transition to self-funding arrangements.

4.15 Hardwood pricing index

13 Seed funding for industry to establish a Hardwood Pricing Index through an independent and trusted firm.

Regional development values

In Europe, values are systematically provided for rural development opportunities including through forestry. These values are usually related to payments to landholders, rather than commercial enterprises. The European Agricultural Fund for Rural Development (EAFRD) is the key funding instrument for Ecosystem Service Projects available for the period 2007–13. The Rural Development Regulation, which underpins the EAFRD, contains a directive for State Aid for activities that are 'directly contributing to maintaining or restoring ecological, protective and recreational functions for forests, biodiversity and healthy forest ecosystems' (EUSTAFOR and Patterson, 2011). Other forms of support afforded because of social values include: State Aid for advisory services; 'cooperative R&D' between forest land owners, processors, and other parties to develop new products, processes and technologies; and infrastructure to improve access to forests or to consolidate land (EUROFOR and Patterson, 2011).

In the first phase of this research, however, the CIE concluded that there is limited basis to assume a willingness of taxpayers at present to pay for social values[11] provided by forestry and no systematic regional development opportunities. The Australian forest industry has also been unable to extract a true price premium for investing in social values that appeal to consumers via forest certification schemes. Importantly, forestry is less preferred than agriculture as a land use (see Williams, 2008).

Public policy on regional development in Australia has not been able to define a clear vision of what it is trying to achieve. Collits (2011) suggest that the current approach involves disparate regional programs that are inadequately resourced and are perhaps disproportionately dependent on infrastructure projects. Public policy has not been able to define (Collits, 2011):

- the objectives including definition of the problem;
- the role of the respective levels of government in addressing these problems; and
- when the government should intervene and how (the linkages between problem and solution). EU-style interventions may not necessarily improve the economic viability of regions in decline.

Objectives need to be clear and transparent, and disconnected from the political process. For example, Collits (2011) suggests that a statutory authority (at arm's length of politicians) could be given responsibility for the implementation of regional policy and policy funding.

11 Social values are derived from perceived or actual benefits or costs imposed by land use for forestry as opposed to other forms of use.

There could be a Pareto improvement[12] from investment by the industry to improve social values. This is likely to require a long term commitment to regional engagement and a multi-faceted approach. This is largely the role of industry, although it is recognised that such interactions with the community are costly.

12 An improvement whereby no one is worse off.

5 Analysis of options

This chapter provides a detailed assessment of the policy options set out in chapters 3 and 4. In doing so is sets out a systematic framework to assess the public and private benefits, costs and potential risks and uncertainties associated with the policy options. While many of the interventions, if appropriately designed, may satisfy all hurdles/objectives, without a carbon offset mechanism the options are unlikely to overcome commercial impediments to investing in long rotation plantations.

Consolidated options

The options proposed from the previous chapters are summarised in table 5.1.

5.1 Consolidated list of policy options

	Value	Strategy
1	Carbon	Establish an offset mechanism which recognises all types of long rotation plantations as 'additional' forms of carbon sequestration. Carbon sequestration values need to be recognised for all long rotation plantations, irrespective of the level of site rainfall, the ownership structure and species type. This may be undertaken either through: ▪ substantially reforming the Carbon Farming Initiative to ensure the current bias against forestry is removed; or ▪ establishing a separate, internationally compliant carbon offset for forestry that is compatible with the international carbon accounting framework.
2	Carbon	The Australian government to provide upfront payments for carbon sequestration in planted long rotation forests. The value to the owner of trees would be offered as a lump sum, at a discounted rate compared to payments which accrue as the forest grows and sequesters carbon. The discounted rate would reflect the extent to which risk has been transferred from the landowner to the Australian government.
3	Carbon	The Australian government to recognise the carbon stored in wood products during product use and in landfill. The government may recognise the carbon stored in wood products while negotiating international carbon accounting methodologies that better reflects the amount of carbon retained. Any additional area planted with long rotation plantations would be 'additional' and flexibility may be introduced to recognise the permanence of carbon sequestration even where the plantation is not replanted.
4	Forest biomass for fuel and energy	Policy review to incorporate transport fuels into the carbon tax.
5	Forest biomass for fuel and energy	Subject to the findings of CSIRO research, develop a national blueprint/strategy for bioenergy to identify R&D requirements and opportunities.

Continued next page

5.1 Consolidated list of policy options (Continued)

	Value	*Strategy*
6A+ 6B+ 6C	Salinity including water quality improvements	Part A — an initial research and planning phase for catchments with valuable environmental assets/services that are salinity affected or at risk. These catchments must also have a reasonable prospect of being able to alleviate salinity through planting perennials, in a cost-effective manner. The research phase would identify projects that may deliver net public benefits and assist in the selection and design of the instrument/s. Part B — funding for CMAs that can demonstrate a project is likely to be cost-effective and technically efficient (see chapter 2). Part C — ongoing R&D funding to develop technologies and the capacity to address salinity.
7A	Mixed environmental values (excluding carbon)	Establish a revolving debt facility that enables the industry to have access to cheaper finance for establishing long rotation trees. The rate of capital would be offered at a flat, fixed rate once a project satisfies eligibility requirements. The design of the scheme may involve: a) A flat rate based on the average bundled environmental benefits from long rotation plantations. b) A flat rate determined by the expected minimum level of finance required to support long rotation plantation investment to a targeted level. The scheme would include mixed environmental benefits other than carbon, which would be addressed through items 1-3.
7B	Mixed environmental values	Alternatively, a grant to compensate for non-carbon values provided by plantations.
8A + 8B/ 8C	Public benefits from farm forestry	Part A — an economist to identify an appropriate average value of benefits from long rotation farm forestry for use by CMAs and state agencies in the estimation of public benefits from farm forestry. Part B — funding for direct incentives for farm forestry projects, where an independent committee is satisfied that the project constitutes a net public benefit. The direct incentives would be subject to competitive price determination to take in to account supply and demand parameters. Bundled benefits may either: a) Include carbon values. b) Exclude carbon values, with carbon values to be received through the amended CFI or an equivalent carbon offset mechanism for forestry. OR Part C — as an alternative to direct incentives, the Federal government could increase the tax deductibility (beyond 100 per cent) for eligible farm forestry expenditure, to recognise the mixed environmental and social benefits from farm forestry. The rate of tax deductibility would reflect the estimated average public benefit associated with the plantation.
9	Taxation reform to improve tax neutrality	Review of taxation rules affecting landholders investing in trees to ensure equivalent taxation outcomes, in particular, looking at income averaging provisions through Farm Management Deposits and Capital Gains Tax exemptions.
10	Productivity and market development	Industry to review the adequacy of research and development commitments to key areas, including by identifying the minimum threshold, maximum benefit and perceived allocation of benefits between the private and public sector. Potential target areas for R&D, to address barriers to obtaining values, include high quality hardwoods, products from low rainfall environments, metrics for biodiversity in private native forests, carbon stored in soil, salinity, landscape scale values from plantations (such as biodiversity networks), biochar, and second-generation energy and fuel.

Continued next page

5.1 Consolidated list of policy options (Continued)

	Value	Strategy
11	Future productive capacity and biodiversity in private native forests	Part A — an initial research phase to establish an appropriate metric for biodiversity associated with various management options for PNF. Part B — policy commitment from each State and Territory to review legislation and implement direct incentives, where public goods can be purchased cost-effectively. The review should focus on providing a low sovereign risk environment by safeguarding the future access of landholders to their resource.
12	Reduction of pricing distortions in international markets	The Federal government to continue to use bilateral or multilateral instruments/mechanisms to reduce the supply of forest products from high value forest assets including through incentives for the conservation of high value forests. This would include, but not be limited to, the provision of alternative income opportunities for those harvesting or with the rights to harvest high value forest assets
13	Domestic market transparency	Seed funding for industry to establish a Hardwood Pricing Index through an independent and trusted firm

A filter to assess the options

Chart 5.2 presents the options assessment framework used to assess the robustness of each of the proposed interventions, in terms of economic efficiency and potential effectiveness. The framework involves five key criteria that, where relevant, should be met satisfactorily.

1. The measure is likely to address an impediment to investment in long rotation forestry.

The first hurdle aims to ensure the target (impediment) and instrument is closely related. All options satisfy the first hurdle, due to the rigorous research phase undertaken prior to developing policy options to understand the impediments to investing in long rotation forestry.

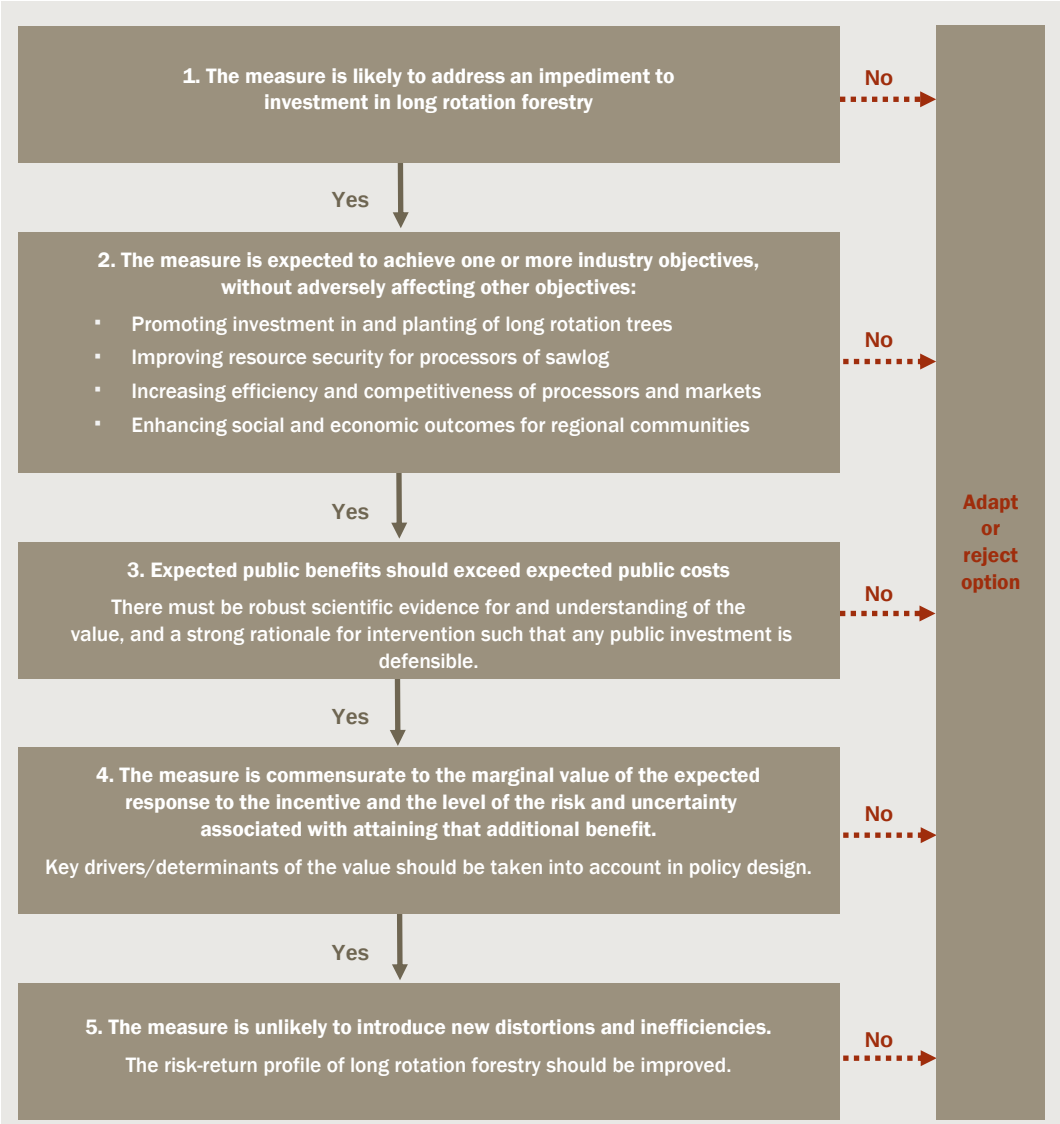
2. The measure is expected to achieve one or more industry objectives, without adversely affecting other objectives.

The second hurdle requires that the instrument make a tangible improvement to one or more industry objectives. The instrument may not be sufficient to achieve industry's objectives on its own. Many instruments may be required simultaneously to improve investment viability and, therefore, promote tree planting and the industry scale required to achieve resource security and competitiveness.

This hurdle is also intended to prevent the attainment of one objective at the expense of another. The industry cautions the planting of trees without a greater strategic plan of how these trees might contribute to resource security for processors. In turn, strategic planning is required to ensure that wood values can be attained (through having processing facilities and a market) such that a satisfactory return is achieved for regional communities. Industry and government must jointly consider how instrument design and its implementation affect the social outcomes for communities. That is, the change in

incentives promoted by the instrument choice and design features must be consistent with core industry and social objectives.

5.2 Options assessment framework



Data source: CIE.

3. Expected public benefits should exceed expected public costs.

The third hurdle requires that expected public benefits to exceed the expected public costs associated with the intervention. The presence of public benefits and expected level of benefit should be properly supported through scientific or other evidence. While industry will be focused on the level of incentives necessary to achieve its objectives, it is the role of government to support only those projects expected to have a positive return to the community. A key consideration is the expected level of uptake of the incentives, which affects the level of public benefit. As such, the impact of incentives on the private sector is also a relevant consideration (see chapter 2).

4. The measure is commensurate to the marginal value of the expected response to the incentive and the level of the risk and uncertainty associated with attaining that additional benefit.

The fourth hurdle is closely associated with the third. It aims to ensure that the public would be purchasing public goods in an economically sensible manner. In theory, public goods should be purchased at least cost and to the point that the marginal value of a dollar invested is at least zero. In practice, this may be very difficult to achieve particularly where instruments are blunt and prices are not determined through a market. If the incentive is not sufficient to promote the scale of uptake required for generating public goods, then the intervention is unlikely to be cost-effective.

In assessing a proposed intervention against hurdle four, the potential impact of private and public risk on payoffs must also be considered. If private risk is not considered during the appraisal of policy options, it is possible to overstate the expected response (benefit level) to the proposed intervention or understate the costs associated with a given level of adoption. Therefore, evidence of the key drivers and determinants of uptake should be taken into account when considering the choice of instrument and instrument design.

5. The measure is unlikely to introduce new distortions and inefficiencies.

The final hurdle is intended to highlight any risks and uncertainties associated with the instrument. These relate to the way in which investors, companies, landholders/farmers and the broader community may respond to the intervention. Where these issues cannot be satisfactorily addressed within the design of the intervention, they may reduce the attractiveness of the option.

Analysis of options

Table 5.3 applies the assessment filter to each of the policy options. It shows the assessment of the extent to which each policy option passes the 5 criteria set out above.

- A cross (X) indicates that there is significant uncertainty regarding the potential of the instrument to meet the criteria.
- One tick (√) indicates that the objective could be met but that some risk is likely to be incurred by the implementing agency or, alternatively, that the option will only go some of the way to achieving the objective.
- Two ticks (√√) indicate that the attainment of the objective/hurdle is associated with an acceptable degree of risk.
- Three ticks (√√√) indicate that there is low risk in meeting the objective/hurdle.

Where an asterisk is used (*) this means that the assessment is conditional on there being an acceptable framework in place to manage identified risks/uncertainties. Where the scoring is left blank, it is because the hurdle is not applicable to the option and/or it is too early or difficult to assess.

5.3 Assessment of options against criteria

Option	Instrument	Scoring against criteria				
		1 (Removes an impediment)	2 (Meets objectives)	3 (Public net benefit)	4 (Adequate policy design)	5 (No new distortions)
1	Carbon offset mechanism	√√√	√√√	√√√	√√√	√√√
2	Upfront grants for carbon sequestration	√√	√√	√*	√*	√√
3	Adoption of carbon accounting for wood products	√√	√√	√√	√√	√√
4	Policy review to incorporate transport fuels in to the Carbon Tax	√√	√	√√	√√	√√
5	National blueprint for bioenergy and second generation fuels					*
6A+6B+6C	Salinity mitigation research phase, project funding and ongoing R&D	√√	√√	√√*	√√	√√
7B	Revolving debt facility for mixed environmental benefits excluding carbon sequestration	√	√√*	X	X	X
7B	Grant for mixed environmental benefits excluding carbon sequestration	√	√	√*	√	√
8A+8B	Review to establish appropriate rate of grant, plus direct incentives for the public benefits from farm forestry and native vegetation improvement	√√	√√*	√√*	√√*	√√
8A+8C	Review to establish appropriate rate of tax deductibility, introduction of tax deductibility for the public benefits from farm forestry and native vegetation improvement	√√	√√*	√√*	√√*	√√
9	Taxation reform to promote neutrality for landholders	√√	√√	√√	√√	√√√
10	Review of research and development funding amount and allocation (Mixed public and private benefits)	√√	√√√	√√		√√
11A+11B	Future productive capacity and biodiversity - Legislative reform, research to establish metric and direct incentives (as appropriate)	√√	√√	√√*	√√*	√√*
12	Seed funding for a Hardwood Pricing Index	√√	√	√√	√√	√√
13	Pricing distortions in international markets - Range of instruments	√√√	√√			√√

Source: CIE.

Carbon

Policy options 1 to 5 address several elements of the regulatory environment for carbon. The first three are concerned with the abatement of carbon in trees and in the life cycle of wood products. Options four and five are associated with the avoidance of emissions through using low emissions fuel and energy sources, including through forest biomass.

Carbon offset mechanism

Option 1 would establish a defined market (and property right) for carbon sequestered by long rotation plantations, by recognising that all new acreage of long rotation plantations would qualify as 'additional' under international agreements and be eligible for recognition as a legitimate offset. This could be achieved by reforming existing legislation or through the creation of a new offset arrangement for forestry. A new offset scheme for forestry could provide greater flexibility to establish an appropriate scheme for the industry. However, the same outcomes could be achieved through reforming the Carbon Farming Initiative.

- **Option 1 meets all five of economic assessment criteria with low public risk and a high probability of meeting industry needs. The intervention could be adopted immediately (see table 5.4).**

5.4 Carbon offset mechanism

Criteria	Elements of the analysis
Target	Internationally compliant carbon sequestered in plantations (which are currently not recognised in the Australian carbon framework)
Instrument	Reform of existing regulation around the CFI, or the introduction of new regulation to establish an offset mechanism for all carbon sequestered in new acreage of long rotation plantations
Nature of changed incentives	All studies indicate that the creation of a price on carbon could significantly improve the viability of long rotation plantations, in particular, the investment in softwood species. A property right would be created for the carbon stored in the plantation for a fixed period (currently, it is recognised as 100 years) such that the removal of a plantation would have a cost equal to the loss of carbon at the international price in that year.
Risks	In this option, the risks are incurred by the investors, companies and/or landholders depending on the investment structure (who owns the plantation and associated property rights). This risk is unlikely to be transferred to the public even in the event of bankruptcy, because the property right would be attached to the land title. In addition, financial and insurance markets are expected to develop products for investors to reduce their exposure to risk.
Benefits	The benefits include significant improvement in the viability of the industry, particularly for long rotation softwood operations. Still, viability is only likely where the plantation exceeds the expected level of performance such as through lower cost of land, higher growth rates or access to payments for other ecological services.
Costs	Large-scale land use change is unlikely. Thus, socio-economic costs are unlikely to be substantial. A special ABARES report (Burns et al, 2011) suggests that if a carbon price were substantial (above $55 t CO2-e in 2011 dollars) uptake of hardwood plantations would still be mostly confined to South Australia and Tasmania. The uptake of softwood plantations may be more extensive.

Source: CIE.

Upfront grants for carbon sequestration

In addition to option 1, rather than as an alternative, a mechanism could be introduced which establishes a role for government in mitigating the private risk for companies and landholders in participating in carbon markets. The government would provide a fixed payment for carbon sequestration in the first rotation. The liability remains with the government for any loss of carbon sequestration resulting from companies or landholders deciding not to replant. At the end of the rotation, if the landholder or company decide

not to replant then the government would have to pay the market rate to replace the quantity of carbon released. By then, the price of carbon (offsets) may have increased significantly[13].

The carbon payment would be discounted to reflect the transfer of risk from the private entity to the government. Two key variables would determine the appropriate discount rate to use:

- the rate of conversion of land from forestry to other land uses after the first rotation; and
- the price trajectory over the initial and second rotation.

The appropriate discount rate for a given property may range from zero, where the plantation is replanted in the second and subsequent rotation, to in excess of 400 per cent (where no benefit should be offered for carbon).

- Discounting will significantly erode the carbon value to the extent that plantation investment is still unviable. The function of the government's involvement in the market would then be minimal.
- Due to the impact of discounting on plantation viability, political pressures may be introduced to increase the price (reduce the rate of discount) to encourage planting. This would increase the risk that the third hurdle (there are net public benefits) will not be achieved.

The CIE has calculated the appropriate discount rate under three different carbon price trajectories, assuming different rates of replanting. Table 5.5 shows the discount rate that should be applied so that the public is no worse off if it provides carbon grants, with no liability if replanting does not occur, than if a carbon price were paid where liability is assumed by the investor.

It should be noted that no expenses to administer the program have been incorporated. Given that low rates of participation are expected, these costs could add substantially to the marginal cost of each project and the risk that criteria 3 (net public benefits) will not be met.

Table 5.5 shows that, in order for the net public benefit test to be satisfied, the discount rate must reflect the rate of land use change after the first rotation. To satisfy the net public benefit test, the conversion of land after the first rotation cannot exceed 70 per cent under a low carbon price trajectory, 34 per cent under the medium price trajectory and 17 per cent under the high carbon price trajectory. If 85 per cent of plantations were expected to be replanted (just 15 per cent land use change after the first rotation), a discount factor of between 21 per cent and 87 per cent would be required.

Certain requirements could be applied to reduce the risk of land use change after the first rotation, by increasing the private cost of land use change. For example, the landholder or company could be required to repay the amount received for the carbon at the initial price, rather than the current market value. This would reduce the incentive for land use

[13] Note that this assumes the standard accounting approach that carbon is released on harvest, so that a liability is incurred without replanting. This consideration would not be relevant if carbon stored in wood products is appropriately recognised.

change, and public cost associated with that change, whilst also eliminating the price risk for landholders.

5.5 Discount factor required to satisfy public net benefit test

	Carbon price discount factor		
Rate of land use change after rotation 1	Low carbon price trajectory[a]	Medium carbon price trajectory [b]	High carbon price trajectory [c]
Zero	0	0	0
5 per cent	7 per cent	14 per cent	29 per cent
10 per cent	14 per cent	29 per cent	58 per cent
15 per cent	21 per cent	43 per cent	87 per cent
20 per cent	29 per cent	58 per cent	>100 per cent
35 per cent	50 per cent	>100 per cent	>100 per cent
50 per cent	72 per cent	>100 per cent	>100 per cent
70 per cent	100 per cent	>100 per cent	>100 per cent

[a] A starting carbon price of $20 t CO2-e which increases by 1 per cent each year in real terms. [b] A starting price of $20 t CO2-e which increases at 3 per cent each year in real terms. [c] The high carbon price growth trajectory is where the carbon price starts at $20 t CO2-e, increasing at a rate of 5 per cent in real terms each year.

Note: The analysis assumes carbon sequestration in wood products is not recognised.

Source: CIE.

A further issue is whether the government would be crowding out the private sector. Banks and other private institutions (such as insurance companies) could perform the same function. They would have greater capacity to differentiate risk levels between projects in both a technical capacity and due to their detachment from the political process. In the case of the government, an average discount rate would have to be utilised.

Adoption of carbon accounting for wood products

Countries are still negotiating how to manage carbon accounting of wood products throughout their life cycle, including with respect to the attribution of carbon offsets between those that supply sawlog and make wood products and those that use it. Were the government to recognise the carbon stored in wood products, this would not yet be counted as an internationally compliant offset in national accounting. The additional abatement in wood products would impose a cost on the Australian government, while the positive externalities would be received by the world rather than Australia specifically. While Australia would be effectively subsidising global environmental benefits, it is expected to be very small as plantation investment is unlikely to be stimulated significantly at the current price of carbon. In time, it is expected that the international community will resolve lingering issues associated with carbon accounting for wood products. Given the expected cost for this option is low, it is a sensible option to pursue from both a public and private perspective.

The potential effectiveness of carbon accounting for wood products depends on the assumed rate of decomposition for long rotation products. Recent work in Australia shows that the rate of decomposition for long rotation products may be significantly lower than is set out in existing international guidelines for voluntary reporting.

5.6 Upfront payment for carbon, with credits withheld by Australian Government

Criteria	Elements of the analysis
Target	Price risk associated with carbon liability
Instrument	An upfront payment for carbon (a grant) is offered, with the Australian government retaining the property right. Either the grant could be provided for one planting cycle, or it could assume replanting (for at least 100 years) with a nominated fixed liability for failing to replant. The scheme would be offered only for a fixed period (such as five years) with the view to provide sufficient time for the international carbon price to stabilise.
Nature of changed incentives	This would result in the transfer of price risk in carbon markets from the investor/landowner to the Australian government, with an associated reduction in returns.
Uncertainty	The rate of replanting and the carbon price trajectory which could increase public costs above the benefits of sequestration. Certain provisions may lower the rate of non-replanting.
Risks	The Australian government would be accepting liability for the reduction in carbon sequestration from trees that are not replanted after one period. At the appropriate carbon price discount, where public benefits> public costs, the carbon price may be insufficient to promote sound plantation investment. The government may be crowding out the private sector which can perform such risk mitigation functions.
Benefits	Benefits may be limited due to the level of discounting required to account for the transfer of risks associated with the carbon price.
Costs	Future liabilities could impose high costs/risks. The scheme would also need to be administered. However, where the discount rate is likely to be high participation may be low – meaning high administration costs per hectare planted.

5.7 Recognition of carbon stored in wood products

Criteria	Elements of the analysis
Target	Lack of international (and therefore) domestic recognition of carbon stored in wood products due to methodological issues rather than scientific uncertainty. Scientific evidence suggests conventional (guideline) rates for the decomposition of wood products in use and in landfill are higher than actual.
Instrument	The Australian Government would recognise the value of carbon sequestered in wood products, irrespective of whether the carbon stored in wood has been adopted into the international accounting framework
Nature of changed incentives	This would incrementally improve the returns to investing in long rotation plantations. The effectiveness would depend on assumptions around the rate of decay of wood products and rate of decomposition for products in landfill. It represents a transfer from the Australian government to industry, as the government would not be able to incorporate carbon sequestration values as an offset against carbon emissions. Given the benefit would accrue globally; this is essentially a form of subsidising global environmental benefits.
Risks	No substantial risks have been identified.
Benefits	It would cause an improvement to the internal rate of return of up to half a per cent under conservative accounting assumptions and one per cent under more 'realistic' assumptions. If sequestration in wood products in landfill are recognised, there may be some basis for the relaxing of the requirements for replanting and associated liabilities from not replanting.
Costs	The Australian government would incur the cost associated with new acreage of long rotation plantations prior to an agreement on international accounting rules. However, uptake is expected to be low and therefore total costs low, due to the lack of viability of long rotation plantation investment at current carbon prices.

The industry and government should consider ways to align policy with the latest science and consider opportunities to provide carbon credits without the liability for maintaining continuous rotations over 100 years.

Policy review to incorporate transport fuels in to the carbon price

The coverage of the carbon pricing framework should be broadened over time to provide a more neutral framework for alternative energy and fuel sources and enable them to compete on the basis of environmental attributes. Australia has excluded certain transport fuels, including fuel utilised by general motorists and the agriculture and forestry sectors from the carbon pricing framework. This should be reviewed in time, to enable a level playing field for all types of abatement options.

There is a range of technological barriers to extracting energy and fuel from biomass. A wide range of factors related to the perceived payoffs from investing in technological development may drive investment decisions, including the assessment of the potential size of the market.

Salinity and water quality improvement

The interventions proposed to capture salinity mitigation and associated water quality improvements involve three distinct components. Each component is required in order to satisfy the five hurdles and optimise public investment in salinity abatement. They include:

- A research phase for CMAs with significant assets at risk from salinity and the potential to implement integrated tree planting solutions. The CMAs would be equipped to undertake rigorous quantitative analysis to test the economic viability of various interventions. This step is required to ensure projects meet the net public benefit test (hurdle 3).
  - Due to the size of the salinity problem, this is a relatively low cost investment in salinity abatement even if no viable projects can be identified.
  - Funding would be targeted to specific catchments with dryland salinity issues that may be able to use forestry to address these issues. It is expected that around five catchments may be identified and each may require around $0.75 million over approximately five years to invest in technology and technical capacity.
- Upon demonstration of the positive net benefits to both the private and public sector, direct incentives and extension would be made available to the extent necessary to implement the required works. To ensure the policy design is appropriate to the expected level of public benefit and risk (hurdle 4) the nature of private and public costs and benefits need to have been quantified and are well understood, including by examining the expected private response to incentives.
- Meanwhile, investment in ongoing R&D and technological improvement would be required to support the viability of salinity abatement in the future such as through increasing tree productivity and identifying new markets.

The package of options is expected to ensure that all hurdles are met (see table 5.8).

5.8 Catchment scale modelling, direct incentives and ongoing research — salinity

Criteria	Elements of the analysis
Target	Market fragmentation for salinity benefits provided by trees by addressing the start-stop nature to investing in salinity mitigation and ensuring robust investment of public money
Instrument	Several key catchments with dryland salinity issues to invest in technical/quantitative assessment capability in relation to the assessment of salinity abatement options. Upon demonstration of viable options from both a public and private investor perspective, the Commonwealth and/or State governments would make funds available to support investment in salinity mitigation, where possible, through competitive bidding.
Nature of changed incentives	A salinity payment of $87.50 per hectare each year in real terms could increase the after-tax IRR by 0.5 per cent. However, the incentives for long rotation plantation investment are unlikely to be changed significantly without a carbon price.
Risks	The potential for failure in the assessment of economic viability of proposed salinity projects, including the inaccurate assessment of private responses to incentives. There is a risk of political pressure influencing the decision of which (if any) projects proceed, and that public funding will not be sustained or sufficient to achieve the scale of planting required.
Benefits	The CIE expects that only a handful of catchments would participate in the scheme and only a small number of projects would meet the investment criteria. Commercial plantations will require carbon offsets in order to invest in plantation development in salinity-affected regions to reach a commercially acceptable IRR – particularly with downside risks with planting in lower-rainfall environments.
Costs	It is estimated that the initial investment in the research phase would cost at least $3.75 million for approximately five CMAs to invest in quantitative analysis of salinity options over a five year period.

Source: CIE

Mixed environmental benefit

Stage 1 identified a range of environmental benefits, other than carbon, that are generated by trees. As such, the potential for a general (bundled) value for environmental externalities provided by plantations has been considered. Industry representatives agree that carbon should be valued through a separate mechanism such that the value of the benefit from this intervention reflects only non-carbon environmental externalities. Two options have been proposed. Firstly, a revolving debt facility could provide a lower rate of finance than available in the market (see table 5.9). Alternatively, the industry could receive an upfront grant or equivalent taxation incentive for planting new acreage of long rotation trees (table 5.10).

The proposed instruments are blunt, as they do not recognise the range of environmental values that may be achieved at different sites and locations. The average marginal benefit from non-carbon externalities generated by plantations is expected to be relatively small, given that benefits are determined by the location of the site with respect to remnant vegetation, wildlife corridors, endangered species and the scale and location of plantations with respect to the water table. Apart from carbon, which would be excluded from the scheme, the environmental services from plantations vary widely.
There is considerable risk that the average marginal environmental benefit will be less than the benefit required to stimulate investment. That is, a subsidy would need to be provided. The social and environmental benefits from plantation forestry for a given

hectare (when not targeted) are expected to be less than farm forestry. This is due to the willingness to pay for farm forestry, which is significantly greater than commercial forestry. The public good aspects of farm forestry have been estimated to range from $6 to $115 per hectare each year (Paul et al, 2011a). If hurdles 1 and 2 are satisfied (industry objectives are met) by making the payment high enough to make a difference to industry viability, hurdles 3 to 5 which relate to economic efficiency may need to be compromised.

A revolving debt facility would also carry higher risk than the provision of a grant or tax incentive, as well as higher management costs. The scheme may also introduce a new conflict of interest for the government, as it seeks to keep all companies afloat to avoid losing money. This may introduce a form of industry dependency on the government.

The extent of the subsidy required for investment in long rotation plantations to be viable would be significantly different under an environment where carbon offsets are available. Thus, the level of risk associated with meeting hurdles 1 to 5 is less in the event that a carbon offset is established for forestry *and* the price of carbon were to increase substantially in terms of the starting price and/or growth rate.

- At the highest benefit for farm forestry of $115 per hectare each year, a long rotation softwood plantation would also require a starting price of $30 t CO2-e and a real growth rate for of 5 per cent each year.
- The proposed interventions to recognise mixed environmental benefits should not be introduced in the absence of a carbon price.

The proposal for a revolving debt scheme or tax incentive would need to be undertaken on a national basis, but a targeted catchment scale approach to recognising environmental benefits from plantations is expected to generate greater public benefit. A grant administered at the catchment level will have greater capacity to encourage investment in plantations that support regional biodiversity objectives. Such a grant could enable plantations to become viable earlier and could be utilised as a part of a regional development program.

- **However, the risks associated with the proposal to introduce a revolving debt facility for non-carbon environmental benefits cannot be overlooked (see table 5.9).**
- **A grant to recognise non-carbon environmental benefits could only be considered where a carbon price is in place but a small additional incentive is required for the investment to proceed. This may be approximately $30 t CO2-e for softwood and approximately $50 t CO2-e for hardwood (see table 5.10).**

5.9 Revolving debt facility — mixed environmental benefit

Criteria	Elements of the analysis
Target	To recognise the mixed environmental benefits provided by plantations, other than carbon.
Instrument	A revolving debt facility that provides access to finance at a rate less than what is offered in the market. The instrument would not change the incentives with respect to environmental management – the instrument is blunt.
Nature of changed incentives	The access to cheaper finance would improve the IRR of forestry.
Risks/Uncertainties	Significant public risk from lending to commercial institutions. The government's role as a lender would be a conflict of interest to decision making. The purchase of public benefits in this way is unlikely to be cost-effective due to the exclusion of carbon and the blunt nature of instruments.
Benefits	The benefit would depend on whether the intervention was introduced with or without a carbon price and the potential trajectory of the carbon price. In the absence of a carbon price, no investment in long rotation plantations would be feasible without significantly infringing the net public benefit test and introducing new market distortions.
Costs	In addition to the opportunity cost of lending money at a reduced rate, the government would incur the risk (cost) associated with companies that fail to meet interest payments.

5.10 Grant — mixed environmental benefit

Criteria	Elements of the analysis
Target	To recognise the mixed environmental benefits provided by plantations, other than carbon.
Instrument	A direct incentive administered at the regional/catchment level to recognise the average benefit of non-carbon environmental externalities.
Nature of changed incentives	The grant would improve the viability of long rotation plantation, but without the carbon price, the incentives would not be sufficient to make long rotation investment viable. A carbon price of at least $30 t CO2-e for softwood and $50 t CO2-e for hardwood would be required.
Risks/Uncertainties	The purchase of public benefits in this way is unlikely to be cost-effective from the public's perspective, given the untargeted nature of the instrument.
Benefits	Under a carbon price scenario, a grant could get long rotation commercial plantation investment over the line. The incentive would need to be in excess of the value of farm forestry social and economic benefits unless carbon prices rise to more than $30 t CO2-e and experience significant year-on-year growth.
Costs	Due to the blunt nature of the instrument, environmental benefits are expected to be low. Unless other social values can be identified, the intervention may represent a small subsidy.

Farm forestry

A two-pronged approach is proposed to create a price for social and environmental values associated with farm forestry. Research by Paul et al (2012) indicates that whilst a relatively high level of financial incentives would be required to make commercial long rotation plantation investment viable, farm forestry may be viable under a lower level of additional incentive. The study by Paul et al (2012) concluded that 'if carbon offset investment targets marginal land (i.e. areas of farms of lowest productivity), carbon prices required for economic viability are less than $18 t CO_2-e, even at a relatively high discount rate of 8 per cent'. Therefore, it is expected that farm forestry would be

stimulated for less money than a commercial plantation. Farm forestry has the potential to be a very cost effective way to purchase public goods. An annualised payment of $100 per hectare could increase the internal rate of return by around 1.5 per cent, which represents a more significant improvement than if the same payment were made to a commercial plantation.

After an initial research period for an economist to identify an appropriate raw average benefit from long rotation farm forestry, either direct incentives for farm forestry projects or a higher rate of tax deductibility for expenditure could be used to stimulate tree planting. The direct incentive would be paid to the landholder whilst the tax deduction would be accrued by the entity incurring the costs of replanting — this may be the landholder or a commercial entity.

Each project must satisfy an independent committee that it will deliver a net public benefit. The price for each project should be determined through the market rather than the average level of benefit identified by the economist. The average rate of benefit paid should not exceed the estimated average benefit. It is envisaged that the value of public benefits from farm forestry, and key drivers of benefit, would be reviewed periodically.

Previous analysis on the discount rates that must be applied for upfront carbon payments suggests that bundling carbon into an upfront payment would significantly erode the value of the carbon payment. However, a carbon payment could be incorporated for a fixed period (at a heavily discounted rate) such as for plantations established within five years. The carbon payment could be associated with certain provisions that discourage a landholder from not replanting after harvest. The landholder would be ineligible to harvest trees and enter the carbon market.

A separate price would be determined for the expected benefits from any additional works proposed to rehabilitate and manage remnant native vegetation. Integrating native vegetation management and rehabilitation into a farm forestry enterprise is expected to derive both public and benefits to the landholder. A value for native vegetation restoration works would also be researched in the initial research period, prior to the implementation of competitive grants.

The key difference between the use of competitive grants and the use of the taxation system for valuing social and environmental benefits from farm forestry is the price determination mechanism. The taxation system would pay a flat benefit across all projects, not taking into account meaningful differences between projects and locations. A separate rate could, however, be applied for activities related to the rehabilitation of native vegetation.

Given the existing research which supports the existence of social and economic values from farm forestry, there is a robust basis to introduce an incentive for farm forestry. The main risk of this option is that it stimulates farm forestry development in regions that would not be able to support viable wood production. In this instance, the social and private benefits from farm forestry would decrease significantly if there were no harvesting facilities or market for products.

Involvement of commercial investors may reduce the risk that landholders plant inappropriate species and neglect or mismanage silvicultural regimes required to establish

a valuable resource. These risks need to be managed through stringent eligibility requirements to ensure the success of the scheme. These are best managed outside of the Australian Taxation Office.

5.11 Incentives for mixed social and environmental benefits - farm forestry and native vegetation management

Criteria	Elements of the analysis
Target	Introduce a mechanism to value the mixed social and environmental benefits provided by farm forestry, including through integrated farm forestry and native vegetation management.
Instrument	A review would examine the most appropriate rate of benefit for direct incentives applied to farm forestry. The instrument may include a taxation incentive (greater than 100 per cent tax deductibility), an upfront grant, or payments throughout the investment cycle. The specific instrument may be determined either at the Federal level such as through for a tax incentive or at the catchment scale such as through a competitive grant.
Nature of changed incentives	The incentive would promote planting through reducing financial impediments to investing in trees. The extent to which regional environmental values are maximised depends on how regional information is incorporated into the incentive framework.
Risks/Uncertainties	The location of the trees with respect to harvesting facilities and markets, if not considered may significantly reduce the social and private benefits from farm forestry.
Benefits	The incentives will be used to increase the level of social and environmental benefits. Landholders are expected to receive net benefits from the scheme if implemented according to guidelines.
Costs	The net public benefit should exceed public costs. The level of benefit is expected to range from $6 to $115 per hectare each year.

Taxation reform

There are several elements to the industry's reform agenda for taxation. The proposed reforms aim to provide a more neutral taxation environment for landholders such that taxation does not encourage or discourage planting trees relative to other crops. There are several unique characteristics of forestry such that in order to receive equal treatment, some rules must be tailored specifically to forestry. In particular, the lumpy nature of returns to forestry exposes the asset to high marginal tax rates relative to the annual return on investment. A range of reforms have been proposed including changes to rules around Farm Management Deposits (FMD) and Capital Gains Tax (CGT) exemptions for small business, enabling plantations to be transferred into superannuation portfolios (with zero transaction cost) and indexing costs/losses to the year in which income is derived.

Each proposal has been assessed individually to ensure it meets the five key hurdles. The CIE presents a package of reforms which are deemed to pass all five criteria. They include:

- in relation to Farm Management Deposits, increasing the maximum limit of deposit funds at any one time and redefining the withdrawal threshold in relation to death or retirement; and
- a range of improvements to the accessibility to CGT exemptions.

Reforms to be adopted – Farm Management Deposits

There is a strong case for increasing the maximum limit of funds held in deposits at any one time from $400 000 to at least $500 000 of annual farm turnover. The average scale of a farm forestry enterprise in Australia may be less than 5 hectares. However, private holdings of farm forestry could be in excess of 25 hectares, which is common in the United States and several European countries (Harrison et al, 2002). Approximately $30 000 per hectare may be received at harvest, which is equivalent to just $1000 per hectare each year. Earned in one lump sum, however, this may amount to approximately $150 000 if we assume a small operation of approximately 5 hectares or $750 000 if we assume a larger operation of 25 hectares. If the income were accumulated each year, between $5000 and $25 000 would be deposited for operations between five to 25 hectares.

The implication is that the revenue at the time of harvest may be taxed at the highest marginal tax rate, rather than the appropriate tax rate if income was averaged over the period. This may hinder investment in forestry and effectively amounts to treating forestry and crops differently through the taxation system.

In addition, there are solid grounds for changing the withdrawal threshold in relation to death or retirement from primary production. Currently, the ceasing of primary production from retirement or death triggers a period of only 120 days when all income placed in a FMD must be withdrawn. Given that long rotation forestry requires between 30 and 35 years to reach maturity, the time of harvest is likely to occur on or around retirement. As income is derived upon harvest, at the end of the plantation life, the landholder does not have the opportunity to average income over the previous years.

It is therefore sensible to allow a period of at least three years after harvest for the income from forestry to be spent. This is important given that the income derived is a significant form of superannuation, which only attracts a 15 per cent rate of tax if contributed through other mechanisms, and the transaction costs associated with shifting existing forest assets into a superannuation portfolio.

The current restrictions, and hence the proposed reform, may have significant implications for the viability of farm forestry. Introducing a three-year period for landholders to withdraw deposits from harvest returns could reduce the marginal tax rate:

- from the highest bracket (46.5 per cent) to the second highest bracket (37.5 per cent) for plantations between 8 and 18 hectares;
- from the highest bracket to the third bracket (34 per cent) for plantations between 4 and 8 hectares; and
- for plantations under 4 hectares in size, from 38.5 per cent to 20.5 per cent. This is still higher than the tax rate of 15 per cent which is applied to superannuation contributions up to $25 000 per year.

Together, these two reforms would improve the neutrality of the tax environment (thereby addressing hurdles 3, 4 and 5) and could significantly change the viability of farm forestry (addressing hurdles 1 and 2). Table 5.12 illustrates this point by showing the internal rate of return for a farm forestry enterprise under different rates of taxation, both

with and without a carbon price. Given the significant variation of farm forestry enterprises in terms of site quality, management regime and planting geometries, which causes significant variation in economic viability, these results should be treated as illustrative only.

5.12 Illustration of impact of taxation rate on viability of farm forestry

	IRR, by tax rate (%)				
Tax rate (%)	0	20.5	34	38.5	46.5
Softwood sawlog, no carbon price	6.9	6.5	6.2	6.0	5.6
Softwood sawlog, with a carbon price of 20t CO2-e [a]	11.3	10.6	10.0	9.8	9.2
Hardwood sawlog, no carbon price	6.5	6.1	5.6	5.5	5.1
Hardwood sawlog, with a carbon price of 20t CO2-e [a]	11.5	10.7	9.9	9.6	8.9

[a] Assuming no real carbon price change over the period in which carbon offsets are generated.

Source: CIE.

Reforms to be adopted — Capital Gains Tax exemptions

All reforms proposed in relation to amending the rules around the CGT exemptions for landholders participating in farm forestry have economic merit. The proposed reforms will improve the liquidity of properties and businesses that have a forestry enterprise. In particular, the following reforms should be considered:

- amending the 'active asset' condition of the small business CGT concessions to either allow that a farm would still qualify as an active asset when leased[14] or delete the requirement for the retiring taxpayer to have an active asset at the time of sale or transfer of the property. This is expected to prevent landholders that are receiving rent for their land for forestry activities from being penalised when selling their property, and therefore support the involvement of landholders in farm forestry.
- removing or raising the arbitrary asset value threshold in relation to private forests to account for the appreciating nature of the asset. This would spare landholders from being effectively taxed through both the capital gains taxation stream and the income tax stream over the life of the asset.

In addition, the following issues should be considered:

- the lingering uncertainty around profit a prendre or landholder interest (AFG, 2010).
  - Profit a prendre/forest rights are 'not as tradable as they should be because the tax rules suffer from uncertainty and have an anomaly that could result in double taxation' (Qld Treasury, 2005). This could be resolved through adhering to the Ralph recommendation (1998) by shifting profit a prendre into the income tax stream and out of the capital gains tax system.
- the need to hold trees for four years to enable an investor to claim a tax deduction on planted trees.

14 Certain CGT assets cannot be active assets even if used or held ready for use in the course of carrying on a business, for example, assets whose main use is to derive rent, unless where the asset was rented to an affiliate or connected entity for use in their business.

– This is according to Jones (HOR SC, 2011) 'impeding the ability for people to transition from planting the tree to institutional ownership. It is an impediment which does not achieve anything'.

5.13 Reform of taxation arrangements affecting farmers

Criteria	Elements of the analysis
Target	Taxation arrangements which do not achieve tax neutrality for landholders that invest in farm forestry compared to alternative crops and enterprises
Instrument	Taxation reform which would, at the least, review: ▪ the Farm Management Deposits in relation to the maximum limit of deposits and the withdrawal requirements associated with death and retirement; and ▪ rules pertaining to Capital Gains Tax exemptions for landholders participating in farm forestry.
Nature of changed incentives	The reforms aim to reduce tax disadvantages for forestry, enabling landholders to receive a fair after-tax internal rate of return. The marginal tax rate has a significant impact on the after-tax return from forestry. The reforms may increase the after-tax IRR by between 0.5 to 1.5 per cent. The reforms are also expected to increase flexibility and the liquidity of farm forestry assets. With commercial return the most significant barrier to landholders investing in farm forestry, the reforms may increase the adoption of farm forestry. However, tree planting is not expected to result in large-scale land use change and planting may occur on marginal or underutilised land.
Risks/Uncertainty	The proposed reforms target landholders and not the public, such that the proposed reforms are unlikely to cause distortionary asset structures and decision making. However, it is important to ensure landholders are appropriately informed on the commercial suitability of proposed developments and any associated risks.
Benefits	Farm forestry has been widely attributed with environmental and social benefits. Private net benefits may be acceptable if industry/market requirements can be met. However, a further incentive such as a payment for mixed environmental/social benefits or carbon would be required to generate a positive NPV at an 8 per cent discount rate.
Costs	The removal of taxation impediments to investing in farm forestry is not expected to impact taxation revenue. Land planted to forestry may be underutilised or under crops that have full access to benefits via FMDs and the CGT exemptions for small businesses.

Research and development

To determine the potential net benefits of changing the composition of or aggregate level of investment in key R&D areas requires a comprehensive analysis of current R&D investment. The study would be a low cost investment and has minimal risks to the public. The study would be undertaken through the FWPA (the forest sector RDC), which is funded by an industry levy and matching Commonwealth funds. The analysis may be independently commissioned or undertaken by the RDC, and may result in recommendations to increase public funding.

5.14 Review of research and development funding level and allocation

Criteria	Elements of the analysis
Target	Areas of R&D which may be underfunded or overfunded
Instrument	Review to identify the minimum threshold, maximum benefit and perceived allocation of benefits between the private and public sector – for key areas of R&D.
Nature of changed incentives	n.a.
Risks/Uncertainty	It is challenging to estimate the appropriate share and total amount of funding. The actual effectiveness of the allocation may only be observed after-the-fact and after a considerable time lag.
Benefits	Medium to long term improvement in the viability of plantations such as through increased tree productivity and resilience, viable new markets including for environmental services etc.
Costs	The study may cost up to $0.2 million in consultancy fees or in-kind resources from FWPA. Additional costs may be incurred if the study results in higher funding levels for R&D

Future productive capacity and biodiversity in native forests

The future productive capacity of native forests is under threat. The current operating environment, created by state legislation and the lack of financial incentives for public goods, discourage investment in silvicultural improvement/practices that supports long term forest vitality. This is a significant issue, given that private native forests represent a significant resource, equivalent to around 22 times the area of plantations in 2007. The key issue associated with PNF regulation is to what extent it provides regulatory certainty over the access of the landholder to their forests for harvesting in the long term. This proposal involves three integrated measures, including:

- Legislative reform — the extent to which reform is required varies by state. Tasmania and Queensland are generally viewed as having greater security around harvesting rights than other states.
- Research to establish an appropriate metric for biodiversity (based on inputs, outputs or outcomes) — the need to overcome a number of deficiencies in the capacity to value PNF management options needs to be balanced with the need for early intervention to promote long term sustainable management outcomes for private native forests.
- Direct incentives for biodiversity values to recognise habitat value, conservation networks and important species conservation.

The first two measures can be adopted immediately. Legislation should be reviewed to recognise landholder's future access to their resource or, alternatively, the requirement for compensation from restricting access. The amendments could also establish the commitment to provide incentives for biodiversity values, where an appropriate mechanism has been identified. The incentives provided for private native forestry could be integrated into sustainable markets for biodiversity offsets related to native vegetation management. A long term commitment to forest health and vitality (and associated

biodiversity outcomes) from more sustainable PNF management should be signalled to landholders.

Due to a range of issues associated with linking PNF management to biodiversity outcomes, it would not be appropriate to implement a metric for biodiversity prior to further research. However, the need for greater certainty around biodiversity values should be balanced with the requirement to change incentives around the management of private native forests. The two risks, which must be balanced, include:

- that biodiversity values associated with PNF management would be overstated and investment in public goods associated with the environment would be better spent elsewhere; and
- that Private Native Forests will remain in a degraded state, resulting in the depletion of the genetic and commercial potential of many of these forests as well as associated risks to habitat quality (and therefore, biodiversity).

The research phase would need to examine private cost structures and potential responses to various incentives to ensure the market facilitates the attainment of public goods at least cost.

5.15 Future productive capacity and biodiversity in native forests

Criteria	Elements of the analysis
Target	Current unsustainable forest management practices associated with private native forestry, by changing the incentives for landholders from legislative framework and lack of incentives
Instrument	Regulatory reform to ensure that landholders have security to harvest their forest in the future. In addition, a research phase would be required to identify an appropriate metric for biodiversity associated with various PNF management options and (where appropriate) direct incentives would follow.
Nature of changed incentives	Landholders would take a longer term view of their forest (lower their discount rate) such that investment in silvicultural treatments and training associated with sustainable forest management may have an acceptable payoff over the long term.
Risks/Uncertainties	In terms of applying a direct incentive, there is the risk from early implementation that direct incentives are excessive or inappropriately designed. There may also be a risk from delaying implementation of an incentive, from the lack of investment in addressing the degradation of PNF resources.
Benefits	Investment in silvicultural treatment and changed practices should increase the quality and volume of wood which can be processed over the long term. Improvements to forest sustainability are expected to result in biodiversity benefits. At this stage, there is insufficient information to determine the marginal benefit ($/ha) cannot be estimated. However, benefits are expected to be substantial when accumulated over around 38.1 million hectares (URS, 2007).
Costs	Legislative reform may have significant impacts, at a relatively low cost. However, further incentives are likely to be needed to encourage optimal management. Private responses to various incentive structures would need to be ascertained over the research phase to determine the potential costs.

Domestic price transparency

This option represents a low cost initiative, which (if successful) would remove a significant impediment to the involvement of landholders in farm forestry as identified in stage 1 of this project. It would complement the introduction of a carbon price and payments for additional environmental and social benefits, as well as taxation reform to improve equity in the treatment of forest products. It relies on the participation of industry. As such, it is advised that industry commitment to the index should be established prior to public investment. There is considerable uncertainty as to whether meaningful indices can be established utilising data from related markets to represent new/thin markets for hardwood products. An obvious alternative would be for industry to advertise the prices they are willing to pay in existing or future markets.

International recognition of forest values

An important impediment to an efficient market for forestry is the widespread distortions in international markets. There is a strong rationale for using bilateral and multilateral forums to reduce the pressures on deforestation, where there are strong ecological values associated with the forest. This will include a range of instruments, from providing bilateral support for institutional building as well as providing direct incentives to pay for the environmental services of standing forests. Over time, this may reduce the subsidisation of forests, whereby the value of harvested wood products is less than the full replacement cost of the forest and thereby support the improvement in prices for forest products. This will require ongoing effort and considerable resources; however, the potential global environmental benefits (and flow on benefits to the Australian plantation industry) may be substantial. They cannot be quantified in the scope of this study.

5.16 Seed funding for Hardwood Pricing Index

Criteria	Elements of the analysis
Target	Lack of price transparency in the market for sawlogs, which represents a significant impediment to landholders investing in long rotation plantations
Instrument	Seed funding for industry to establish a Hardwood Pricing Index through an independent and trusted firm – which is aimed to reduce the reluctance of stakeholders to provide data to construct this index
Nature of changed incentives	By understanding the local and regional markets for wood products, landholders will be able to appraise potential investments in tree crops relative to alternatives. The price index may assist in improving transparency and confidence of smallholders in selling products into monopolised markets.
Risks/Uncertainties	The option relies on relevant stakeholders participating through providing various forms of data. It relies on the ongoing provision of data and the willingness of industry (industry bodies) to absorb the ongoing expenses of maintaining the index. It also relies on the ability to construct an index that is a meaningful indicator of prices.
Benefits	Increased transparency would result in indirect benefits for the industry over time, by increasing the supply of wood from farm forestry.
Costs	The establishment of the index and management of data through an independent facility would be relatively low cost. It may, for instance, require approximately $250 000 over three years before it would be expected to be funded by industry.

6 Timing and sequencing of options

To date, the analysis presented here has not explicitly considered the timing of the various policy options analysed. This chapter briefly considers the timing of policy options.

Chart 6.1 presents an overall summary of one approach to timing. In some senses the policy proposals could be considered as a sequence of options (although in other cases the policy options are variants, rather than part of a sequence).

A number of the options could be implemented immediately: particularly those related to a carbon price (sequestration). Indeed, the policy framework for sequestration is really a crucial foundation for the other policy options — as noted several times in this report, non-carbon values alone are unlikely to change the fundamental economics of long rotation forestry. Recognition of sequestration is therefore a necessary first step.

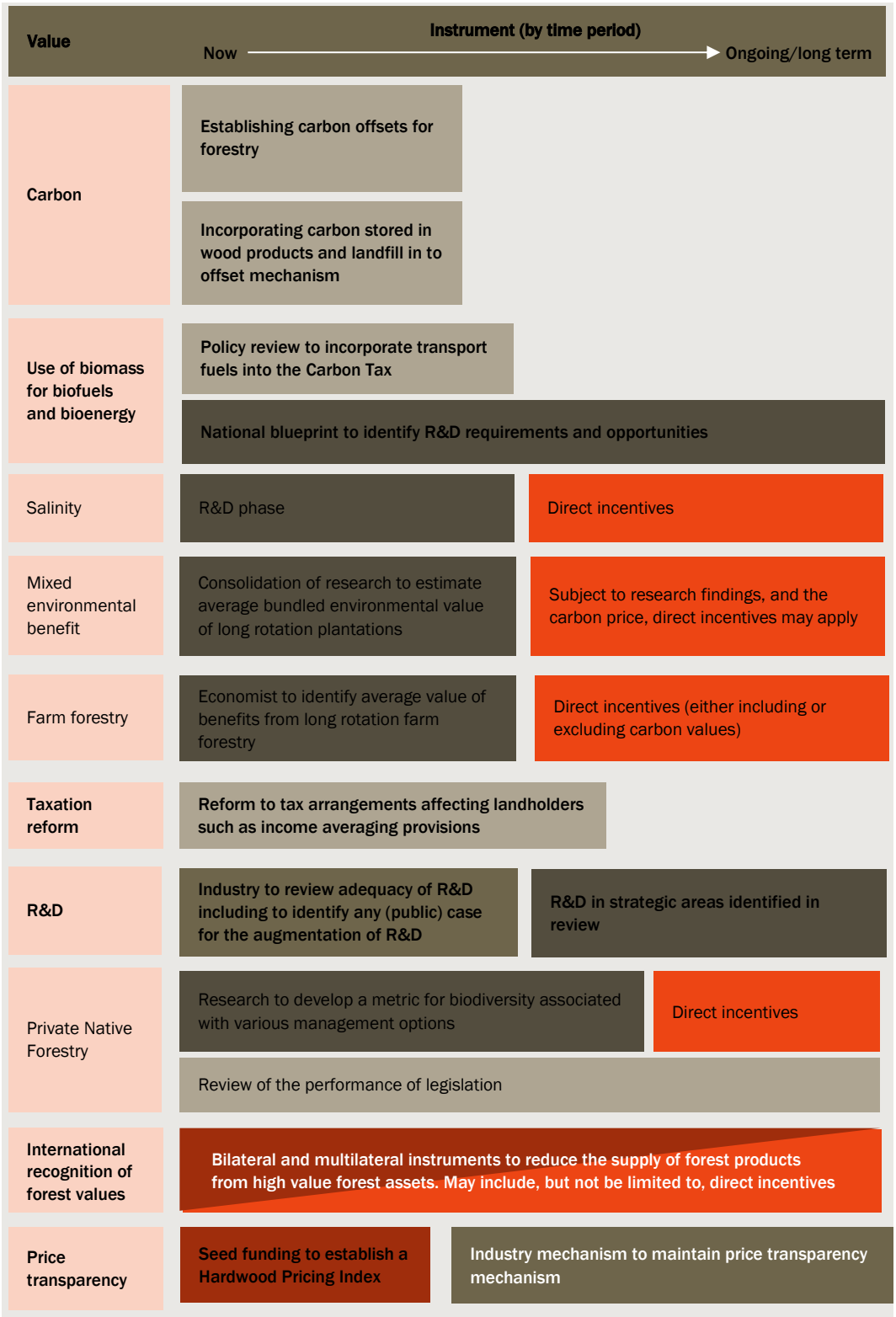
Importantly, a number of options require an initial research phase before the policy could be implemented in practice. This is the case for salinity, payments for mixed environmental benefits and farm forestry.

While many initiatives require a component of R&D, there must be a policy commitment to support the implementation of subsequent interventions (such as direct incentives) upon the demonstration of positive net public benefit.

Some initiatives may not have an early payback period and would require ongoing investment. These include the investment in R&D requirements, including an integrated strategy for biofuels and bioenergy, the promotion of domestic price transparency, and bilateral and multilateral instruments to reduce the international supply of forest products from high value forest assets.

All options put forward in this paper will require the intervention of the government either through the provision of resources or through regulatory/policy reform. However, there is a significant requirement for industry contribution to ensure the target objective/s are attained without compromising other objectives, and that policy design reduces the risk of unintended consequences.

6.1 Indicative time trajectory for the implementation of instruments



Reform; R&D/technology adopt; Direct incentives; Other non-competitive instruments; Industry-only initiative

Source: CIE.

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PART A

Appendix

A Incentives for ecological services: other countries

Europe

In Europe, according to EUROFOR (2011), 'there are currently few possibilities for payments for ecosystem services'. The implementation of markets for ecosystem services is still at the pilot stage. In particular, there are currently no developed mechanisms to link national carbon targets with carbon sequestration achievements. The forestry sector does not have a common policy at the EU level, albeit the institutional capability to make payments for ecological services is developing.

Ecosystem services will be integrated through a number of separate EU policies. These include:

- the European Agricultural Fund for Rural Development (EAFRD) is the key funding instrument for Ecosystem Service Projects available for the period 2007-2013 (see table 1). The Rural Development Regulation, which underpins the EAFDD, contains a directive for State Aid for activities that are 'directly contributing to maintaining or restoring ecological, protective and recreational functions for forests, biodiversity and healthy forest ecosystems' (EUSTAFOR and Patterson, 2011).
  - According to EUSTAFOR and Patterson, amendments to this Regulation and any associated Implementing Regulations could (be required to) provide more direct support to ecosystem services.
  - The Birds Directive and Habitats Directive also promote biodiversity and habitat conservation through establishing a requirement for compensation in the event of damage or destruction to valuable habitats. It represents a potential for future markets for biodiversity banking or offsets to meet compliance arrangements (EUSTAFOR and Patterson, 2011).
- the Environmental Liability Directive also requires those responsible for contaminating land, harming protected species or habitats, or breaching water management legislation to pay the costs of restoration. The Directive therefore 'provides a starting point for setting up future habitat and species banking'.
  - However, the implementation of the Directive would only be applied to strictly protected sites within the NATURA network (a limited number of sites that are subject to the Directive). The extent of habitat and biodiversity banking is, therefore, limited and the market potential in EU member states is currently low.
- Currently, the main funding opportunities for biodiversity and habitat projects are in the LIFE+ program. EUSTAFOR and Patterson (2011) suggest this may lead to funding for biodiversity offset actions that create corridors between NATURA 2000 sites.

- The Green Infrastructure program aims to reduce landscape fragmentation, such as through funding to create habitat corridors, increase ecosystem resilience and protect biodiversity.
- One of the key actions identified in the EU Forest Action plan to increase the competitiveness of forestry is to exchange and assess experiences on the valuation and marketing of non-wood forest goods and services. This is intended to quantify the total value of forests and their functions in order to introduce instruments to compensate for non-marketed goods and services.

A.1 EU Funding Instruments for Ecosystem Service Projects 2007–13

Service	Ecosystem services					Socio-economic
	Carbon/climate	Water quality	Forest biomass	Biodiversity	Protective services	Quality of life
Council Regulation 1698/2005 — support for rural development through EAFRD						
Provision of advisory services (< 80 per cent to maximum of 1500 Euros)	√	√	√	√	√	√
Funding to establish advisory services	√	√	√	√	√	√
Funding for cooperative R&D between forest land owners, processors, and other parties to develop new products, processes and technologies	√	√	√	√	√	
Costs related to infrastructure to improve access to forest land, land consolidation, energy supply and water management	√		√	√	√	√
Funding for afforestation projects on agricultural land (< 80 per cent)	√	√	√	√	√	√
Funding for afforestation projects on non-agricultural land (<80 per cent)	√	√	√	√	√	√
Funding for non-productive investments such as to enhance public recreational value of forest and wooded land	√	√		√	√	√
Encouragement of tourism activities such as through signage and marketing						√
LIFE+						
Funding for supporting environmental and nature conservation projects (50-75 per cent maximum limits)	√	√	√	√	√	
Regional policy funds						
Sustainable rural development to strengthen economic and social cohesion in the EU	√	√	√	√	√	√
Convergence of the least developed Member States via funding for reforestation, erosion control, nature conservation measures, climate change, tourism etc. (<85 per cent of eligible expenditure)	√	√	√	√	√	√

The EU Forest Action plan also aims to promote the use of forest biomass for energy generation, which is also underpinned by the 2005 Biomass Action Plan to reduce dependence on oil. Some European countries have a feed-in tariff. In the United

Kingdom, the feed-in tariff mechanism works alongside the Renewable Obligation certificates, which drive investment in co-firing of biomass including from pellets, wood chips and forestry and agricultural waste biomass. The German biomass power market is also driven by a feed-in tariff mechanism, which attracts companies to be involved in adding to existing renewable power capacity across the country (Business Insights, 2011). In Sweden, the majority of Sweden's biomass power plants generate a combination of heat and electricity, suggesting there are opportunities for CHP installation.

The Water Framework Directive also establishes the requirement for a good level of management of water quality and quantity by 2015. Market-based mechanisms are currently being identified.

In the past, grants have been a common measure to provide compensation to landholders for social and environmental values provided by new or improved woodlands.

- The Woodland Creation Grant Scheme in England provided grants of approximately 1800 pounds (AUD 2900) per hectare for the basic establishment cost of trees.
  - An additional 2000 pounds per hectare was available where applications met regional priorities.
  - Annual payments of up to 300 pounds per hectare were also provided each year to compensate for income forgone when creating woodland on agricultural land (de Fégely, 2011).
- In Scotland, forestry-specific grants have been provided under the Scotland Rural Development Contracts to promote rural priorities.
  - They are less associated with environmental values and more closely affiliated with regional development objectives. The rates vary from 1206.8 pounds (A$1946) per hectare to 2450.4 pounds (A$3852) per hectare depending on the proposed planting area. The grants are paid as a lump sum on the completion of planting. In addition, payments were made for annual maintenance costs for five years after planting, ranging from 101 pounds (A$163) to 229 pounds (A$369) per hectare (de Fégely, 2011).

In Finland, the Forest Biodiversity Programme for Southern Finland provides voluntary-based conservation agreements where protected areas are designated between the authorities and forest owners. The program aims to halt the ongoing decline in the biodiversity of forest habitats and species and establish stable favourable trends especially in Southern Finland's forest ecosystems. This example may constitute a relevant international example for the proposal to recognise conservation and restoration efforts for native vegetation within plantations/ farm forestry.

- A site selection criterion forms the basis for determining what kind of ecologically valuable habitats are to be protected. The criteria are based on the ecological structure of forests and on forest habitat types required for biodiversity and ecosystem services. Thus, it is based on the existing habitat or expected condition of improved habitat and knowledge of the biodiversity supported by the habitat type/condition.
- The forest sites that have been protected through voluntary measures generally have high ecological values. Sites preferred include those that are well preserved in their natural state or those that can be easily restored, where they host rare or endangered species, or where they are important for ecological connectivity.

- Importantly, the program also involves research to assess the program's long term ecological, economic and social impacts. The program allocates 2 million euros each year to support basic and applied research on forest biodiversity.

United States

The USDA Forest Service and partners (Mercer et al, 2011) estimated the potential level of payments for forest-based ecosystem services from government and non-government organisations and individuals from 2005 to 2007.

- Approximately one fifth of total funding was provided by governments.
- More than two fifths of total funding was driven by government-induced, compliance-driven markets including conservation and wetland mitigation banking.
- Less than two fifths were accounted for by voluntary payments associated with carbon offsets, conservation easements, hunting leases and fees, and wildlife viewing.

The Farm Bills contain a directive to compensate landowners for environmental services. The 1985 Farm Bill established the Wetlands Reserve Program, Forest Legacy Program and the Forest Stewardship Program. The 1990 Farm Bill also shifted the focus of incentive programs from timber production to forest stewardship, conservation and the production of ecosystem services to enhance public benefits from private forests. It included the Stewardship Incentives Program. The 2008 Farm Bill was amended to include forestry practices on *non-industrial* private forestlands, including through the Conservation Stewardship Program, the Farmland Protection and Grassland Reserve program, and the Environmental Quality Incentives program.

Most payments for ecological services in the United States have been for managing land to produce a *bundle* of ecosystem services, rather than compensation for a single ecological service. The largest bundled service program pertains to the protection of wetland services. There are currently no exclusive payments for carbon sequestration or offsets, and carbon offsets relate to voluntary markets.

On the other hand, water quality payments are well established. Enhanced watershed services provided by trees and forests have been taken up on numerous occasions to improve water quality. However, whilst water quality trading has been used to control nonpoint source pollution, these trades rarely involve trees or forests or participation by forestland owners. The market is also inhibited by the lack of sufficient market actors within a watershed to encourage robust trading.

Biodiversity payments are undertaken through public payments to a variety of conservation programs, voluntary private payments from hunting and wildlife viewing and from compliance-based payments associated with conservation banking transactions.

Almost all programs bundling payments for services provide a single payment to offset the cost of implementation. Property tax incentives for maintaining land in forests and states are also provided to *non-industrial* forest landowners to retain forestland uses, protect riparian areas and wetlands, enhance wildlife habitats, and conserve soil and water quality. Property tax reductions to landowners of forested land are also found in

other countries such as Ontario in Canada. Usually a managed forest plan for good forest stewardship, certified by a Managed Forest Plan Approver, is required.

There is limited discrimination of payments between management regimes to reflect the variation in the quality or extent of the ecosystem services provided. The conservation reserve program, which targets marginal cropland and pasturelands to improve productivity utilises a ranking system based on the Environmental Benefits Index rating system based on expected long term benefits. Many require an approved management plan; however, it is unclear whether there is significant price discrimination based on the quality of ecological services provided (in the case of biodiversity).

According to the USDA Forest Service and partners, very few landowners participated in these programs. The largest program, the wetlands program, is not relevant to commercial producers. There also appear to be very few programs that target commercial plantations.

Table A.2 provides a summary of the major Federal programs providing payments to landowners for the provision of ecosystem services from forests.

New Zealand

New Zealand has several schemes to implement a value on carbon and compensation for carbon sequestered in forests established after 1989. The instruments vary by the type of forest targeted (their purpose), the onus of liability for carbon, and the timing of the compensation.

The Permanent Forest Sink Initiative promotes the establishment of permanent forest on cleared land. The initiative provides a guarantee of Assigned Amount Units (AAUs) for carbon sequestered since 1 January 2008 in Kyoto Protocol compliant forests. These are internationally compliant. There are no additional funds provided from the government (de Fégely, 2011).

The NZ Emissions Trading Scheme targets softwood plantations and, in accordance with international practice, it treats post-1989 and pre-1990 forests separately. Pre-1990 forests attract a carbon liability if they are not replanted following harvest. This caused a significant amount of clearing of forestland prior to the scheme coming in to effect. Post-1989 forests under the Kyoto Protocol are eligible to earn units for increases in carbon stocks from 1 January 2008. If the carbon in the forest decreases, then units must be surrendered. However, participation in the ETS for owners of post-1989 forestland is voluntary (de Fégely, 2011).

The Afforestation Grants Scheme was designed to encourage the establishment of new forests through providing an alternative to the ETS scheme. Landowners receive a grant for establishing new forests on Kyoto-compliant land, while the Crown retains the carbon credits (and liabilities) generated during the ten-year period of the grant agreement. This scheme is also intended to recognise other environmental benefits, including where a landholder is able to reduce erosion, nutrient leaching and flood peaks, and improve indigenous biodiversity. The funding is split in to two streams, with local governments applicable for one and the general public applicable for the other. In addition, 70 per cent

A.2 US Federal Programs providing PES for Bundled Services

Program	Assistance type	Incentives for	Targets
Conservation Reserve Program	Cost sharing of up to 50 per cent Land rental payments based on soil productivity	Reducing soil erosion Reducing sedimentation in streams/lakes Improving water quality Establishing wildlife habitat Restoring floodplains Enhancing forest and enhance forest and wetland resources	Marginal crop and pasture lands Selection based on ranking system using Environmental Benefits Index (long term expected net benefits)
Conservation Reserve Enhancement Program	Incentive payments, cost share assistance and rental payments	Long term conservation practices on eligible land. Specific environmental needs of individual states	Contracts for 10 to 15 years to remove certain lands from agricultural production. Those meeting eligibility criteria.
Forest Land Enhancement Program (Program has ceased)	Cost share	Implementation of practices for health and productivity of forest in terms of capacity for timber, habitat, soil, water and air quality, wetlands and riparian buffers.	Private non-industrial forest land owners
Forest Legacy Program	Acquisition via conservation easements	Support state efforts to protect 'working forests' - those providing ecological services and/or forest products and/or recreation benefits	Environmentally sensitive private forest lands at threat of conversion
Healthy Forests Reserve Program	Financial assistance and compensation for the reduction in property value due to easement via easement contracts — from 10 years to permanent easements (approx. $2600/ha in 2008/9 dollars)	Recovery of endangered species Improvement of biodiversity Enhancement of carbon sequestration opportunities	Private forest landowners
Environmental Quality Incentives Program	Incentive payments for up to three years and cost sharing (up to 45 per cent) via 1 to 10 year contracts	Conservation practices implemented through an approved plan Recovery of endangered species, biodiversity, and carbon sequestration	Individuals or entities
Wetlands Reserve Program	Cost share restoration agreements	Wetland conservation	Landholders with wetland areas.

Source: Mercer et al, 2011.

of the funding pool is allocated to species with high carbon sequestration rates whilst the remaining 30 per cent is allocated to species with lower sequestration rates including indigenous species (de Fégely, 2011).

China

Local and centralised government eco-compensation initiatives are commonplace in China. The focus of ecosystem compensation has been on water-related issues and the provision and protection of watershed ecosystem services. This includes water rights trading and water-based eco-compensation policies between municipalities, water rights trading between irrigation districts and industry and various cost share arrangements for watershed management between jurisdictions. However, ecological services from forests are incorporated via a range of programs including the Conversion of Cropland to Forests and Grassland Program and through the Forest Ecosystem Compensation Fund.

A number of forestry programs target a range of ecosystem services, including carbon sequestration, landscape amenities, timber, biodiversity, watershed ecosystem services and combating desertification (see table A.3). They aim to support at least 100 million hectares of forest, with the State Forest Administration a key driver of the market for ecosystem services over the past decade. The involvement of the private sector has been relatively limited as programs focus on payments to landowners for stewardship of ecosystem services on their land. However, Bennett (2009) suggests there is interest in engaging the private sector.

A.3 Payments for ecosystem services in China

Program	Assistance type	Incentives for	Targets
Conversion of cropland to forests and grassland program	Direct compensation (subsidies) for a maximum of between 5 and 8 years	Establishment of trees and grassland on cropland	Individual farmers Cropland and wasteland
Forest ecosystem compensation fund	Direct compensation	Farmers, communities or local governments to manage standing forest area deemed 'key public benefit forests. Emphasises watershed protection or soil-conservation	National-level key public benefit forests
Natural Forest Protection Program	Direct compensation (subsidies) for forest management costs of central agencies	Shift focus towards longer term ecological and economic sustainability (reduced harvest) and recovery of forest stock	State Forest Sector
"Three Norths" shelterbelt program	Tax breaks, low interest loans, payments for afforestation, agroforestry extension	Afforestation to reduce desertification in central China via creation of a large transitional forest zone. Operational until 2050.	Individuals, the community and the private sector Forest belt and transitional forest zone and household agricultural plots
Beijing-Tianjin Sandstorm source control program	Resettlement subsidies to move people away from fragile ecosystems, Eco-compensation mechanisms for works to address erosion and afforestation/forest management	Afforestation with trees and grasses to reduce sand storms Reducing erosion Forest management	
Forest vegetation restoration fee	Fee levied on developers that impact SFA forest area	Offset impact of development activities on ecosystems	Developers such as from mining, infrastructure and construction projects

Costa Rica

Costa Rica first legislated incentives for reforestation in 1979 (Malavasi and Kellenberg, 2002). In 1996, the Forestry Law No. 7575 provided recognition to four key environmental services and the legal and regulatory basis to issue contracts to privately owned forest ecosystems, and establishes a financing mechanism for this (Malavasi and Kellenberg, 2002). The Payments for Environmental Services Program (PESP) provides payments to small and medium sized farmers, and the extent to which commercial scale forestry has benefited is unclear. Most of the forest targeted is primary and secondary forest areas, rather than plantations.

Landholders are required to present a sustainable forest management plan, certified by a licensed forester. They are also required to undertake conservation or sustainable forest management activities, depending on the type of contract, throughout the life of the individual contracts. These commitments are registered with the deed to the property and therefore contractual obligations transfer a legal easement to subsequent owners for the life of the contract. The rights to their GHG emissions reductions are surrendered to the authority (FONAFIFO) to be sold in the international market. The program is funded from a tax on fuel sales, proceeds from the sale of Certified Tradable Offsets (or carbon bonds) and private sector payments for the conservation of critical watersheds (such as from renewable energy producers, and water blotters) (Malavasi and Kellenberg, 2002).

There are three different types of contracts, with the contracts varying in the duration of the contract and compensation. They vary according to whether the contract is for forest conservation, sustainable forest management or reforestation (for instance, on degraded and abandoned agricultural land). Forest conservation contracts are akin to the system of conservation easements utilised in the United States and European countries. Over the five year period to 2001, around 283 000 hectares of forest were incorporated with payments to landowners of approximately US$57 million (from 4461 contracts) (Malavasi and Kellenberg, 2002).

Chile

Chile has a long history of the provision of incentives for afforestation including through the 1931 Forestry Law and the 1974 Decree law 701. The 1931 Forest Law established incentives for afforestation on eroded lands and sand dune areas. The Decree Law 701 aimed to encourage the development of plantations on unused marginal and highly eroded land (de Fégely et al, 2011) and provided for incentive payments of 75 per cent of the costs of reforestation, paid upon demonstration of a 70 per cent rate of tree survival (de Fégely et al, 2011). In addition, exemptions on property and inheritance taxes were provided and land tenure was guaranteed once the land was planted (de Fégely et al, 2011).

In 1996, the Decree Law 701 was extended for a further 15 years. The law increased the subsidisation of establishment costs to 90 per cent, and 75 to 90 per cent of total costs for plantings in degraded areas. Sloped areas may be fully subsidised, although they are subject to harvesting restrictions. The scheme aimed to engage small landowners.

Uruguay

Uruguay also strongly promoted plantation development on vacant or unused areas of land. However, it is understood that the principle driver for government assistance was associated with economic development.