Section 5

Group Outcomes

Cropping Systems

Grazing Systems—Pastures and Rangelands

Forests

Cropping Systems Group Outcomes

Co-Chairs: Craig Pearson, Volker Aeuckens

Rapporter: Holly Ainslie

The group was asked to decide whether to take a "broad land categories" or "activities based" approach to soil carbon accounting. For each approach, it was necessary to identify the risks, problems and implications associated with that approach.

BROAD CROPPING SYSTEM CATEGORIES

The group agreed that Australia could be described by 7 main cropping systems:

- Horticulture
- Sugarcane
- Rice
- Cotton
- Northern Summer Cropping
- South East Winter Cropping
- South West Winter Cropping

The boundary between northern and south eastern cropping is the line Sydney-Wellington-Dubbo, where summer and winter rainfall are about the same.

NARROW ACTIVITIES

The group defined 5 main activities in cropping production systems that may modify soil carbon sequestration.

- Intensification or change in cropping frequency (a move towards continuous cropping as opposed to the incorporation of leys or fallow periods).
- Water use and irrigation
- Residue retention/reduced tillage
- Fallowing
- Introduction of perennials, either herbaceous e.g. lucerne, or woody perennials e.g. alley cropping , agroforestry.

(Subsequently, "cropping frequency" was seen to include fallowing.)

Of the above activities, it was agreed that residue retention/reduced tillage would be most likely to result in a positive trend for carbon sequestration if a net/net accounting approach was adopted.

The introduction of perennials (woody and herbaceous) was another activity considered to have potential for increased carbon sequestration.

The "broad land-based categories" definition was considered to be problematic with some positive outcomes in terms of carbon accumulation but with concomitant increases in other greenhouse gases. In addition, measurement and subsequent verification would be difficult and/or complicated using this approach.

It was agreed there is a need for quality modelling including remote sensing. For each land-based agricultural category, we may model changes in soil carbon using the following variables:

- Climate (specifically temperature and moisture)
- Inputs (quality and quantity)
- Fallowing
- Initial soil carbon levels and pool structure
- Soil texture (specifically clay mineralogy and content)
- Tillage

TIME TRENDS IN SOIL CARBON

- Crop system changes will occur only if there are perceived economic benefits, driven by markets or incentives.
- There were concerns that increases in production efficiencies may encourage an extension of cropping into more marginal areas. These areas will also have high risks of carbon losses.
- This may have implications for not only carbon losses but also increased emissions of other greenhouse gases (e.g. Nitrogen) through the use of fertilisers.
- On the other hand, intensification and increased inputs will occur with the shift, at least in relatively small areas, towards high-value horticulture and viticulture.
- There was consensus that in marginal cropping regions and high rainfall zones, a shift towards perennial pastures/crops and forestry (and other woody perennials) would be needed to improve soil carbon status.
- The shifts toward intensification/extensification will be localised.
- Need 4 t/ha of above-ground biomass to increase soil carbon. The low occurrence of these yields suggests there is little likelihood of increasing soil carbon under extensive cropping.

- It was noted that currently approximately 150,000 tC is applied annually to Australian soils in the form of lime. This contribution was not considered to be significant and was not discussed further.

OUTCOMES – MEASUREMENT AND VERIFICATION

- Monitoring of soil carbon to 30 cm depth was considered reasonable. Measurement of carbon at greater depths was considered unnecessary due to long residence and turnover times. There are also difficulties associated with measuring at depths greater than 30 cm.
- It was agreed that soil carbon levels are highly variable, even on a paddock scale, due to soil heterogeneity.
- Soil bulk density must be taken into consideration when measuring time-trends in soil carbon.
- Care must be taken when using early carbon data particularly where > 2 mm fraction has been discarded.
- It was agreed that in order to model carbon sources and fluxes we must establish a 1990 base line value. The data for this may be obtained from soil measurement of established trials. Where data are insufficient or incomplete, or where long term trials are inappropriate or absent, it was agreed that new experimental trials would have to be established and measured as soon as possible (to establish a baseline). These trials would then be remeasured in 2012 to obtain an "endpoint". It was agreed that due to field and climatic variabilities, carbon differences (if any) could only be estimated by drawing a trend line between the base line value (1990) and the endpoint (2012).
- It was agreed that verification would be easiest if measurements were based on the "narrow activities" approach rather than the "broad land-based categories" approach.

ASSESSMENT OF LIKELY TRENDS IN LAND BASED CATEGORIES

Horticulture: The 1990 total area sown to grapes, fruit and vegetables were 202,652 ha. In 1996, total area sown was 244,556 ha (ABS, 1990/91 & 1997/98). These figures do not include most fruit trees such as pomes, citrus, stone, and nuts as these are reported as numbers of trees and yield per tree rather than hectares sown. According to the group, few changes are expected in the area sown. It was believed that there would be a small increase in carbon sequestration.

Sugarcane: In 1990, sugarcane was grown on approximately 397,000 ha compared to, approximately 415,000 (ABS, 1990/91 & 1997/98) ha in 1996. Lateral expansion of the industry is not expected to be great given current sugar prices. A slight increase in carbon sequestration is expected along with an increase in other green house gases.

Rice: A relatively small area sown which has increased from 105,000 ha in 1990 to 147,000 ha in 1996 (ABS, 1990/91 & 1997/98). A decline in the area sown is expected due to competition for water. A small increase in carbon sequestration is expected along with an increase in other greenhouse gases.

Cotton: The area sown has increased from 240,000 ha in 1990 to 381,000 ha in 1996 (ABS, 1990/91 & 1997/98). Expect a decline or no change in the area sown. Carbon sequestration is not expected to occur and an increase in other greenhouse gases is expected.

SW Cereal, SE/Winter Cropping, N/Summer Cropping: The total area sown to cropping in Australia in 1990 was nearly 17 million ha and had risen to 21.5 million ha by 1996. A small increase in carbon sequestration is expected. The southwest cereal region of Western Australia (incorporating mainly wheat) occupies

Ranking of Research Priorities

Activity	Rank Data Needs	Questions	Time Scale
Residue retention/ reduced tillage	1	Is residue retention practiced? Amount of residue?	T: district agronomists etc. S: satellite monitoring
Herbaceous perennials Agroforestry	2	Area sown? Below ground biomass?	T: area statistics and district agronomists /forestry S: below ground C, modelling
Cropping frequency/ fallowing	3	Area sown to different crops? What are the impacts on soil carbon	T: district agronomists etc. S: impacts on soil carbon.
Salinity management/ salinisation Water use and irrigation	4 Not ranked	Impact on carbon?	Long term

T: < 6 months, S: strategic or longer term

approximately 12.7 million hectares of cleared land. Of this, approximately 6.4 million ha are cropped and the remainder remains as pasture. The area dedicated to annual agriculture is expected to decline slightly (to 10Mha) in the next ten years. The northern summer cropping region stretches from Dubbo in northern NSW to Clermont in central Queensland. The total cropping area of the region is estimated to be 6 million hectares although not all of this is cropped every year. The southeast winter cropping region incorporates South Australia, Victoria, southern New South Wales and northern Tasmania. The total area dedicated to annual crop production (cereals and lupins for grains, oilseeds) is approximately 6.8 M ha (ABARE, 1999). This value excludes rice in Victoria. There is a trend toward more intensive cropping at the expense of pastures.

It was agreed that predicting carbon sequestration was extremely difficult as there was a great deal of uncertainty and insufficient data.

RESEARCH STRATEGIES: INITIATION AND FUNDING

A number of strategies were identified that could be undertaken in the short and longer term to help the CRC achieve its objectives. These included:

- The knowledge of soil carbon was considered to be incomplete. Much of the data is fragmented and often difficult to obtain. An important role of the CRC would be to locate and retrieve currently existing soil carbon data and place it on a centralised database.
- Locate and test soil carbon accounting tools, programs etc. Ascertain whether they are appropriate, or can be adapted, for Australia conditions. Identify whether overseas data can be extrapolated to simulate Australian conditions.
- Research into below-ground carbon inputs and carbon flux in saline soils was considered a research priority.
- Locate existing long-term experimental trials and ascertain their suitability for carbon measurement (1990 and 2012). This was seen as urgent as many long-term trials have ceased or will cease to be funded in the very near future. Ascertain whether the CRC can get permission to use suitable sites.
- These research needs would require lobbying of various agricultural bodies such as SRDC, GRDC, growers bodies etc. for funding. Where research is required, the CRC should also be responsible for identifying appropriate collaborators.

Grazing Systems—Pastures and Rangelands Group Outcomes

Co-Chairs: Ian Noble, Tracie Hogan
Rapporteur: Michael Hill

The group was asked to consider activities that might potentially be included under Article 3.4 of the Protocol.

NARROW SPECIFIC ACTIVITIES

1. Non-N fertilisation of pastures

Advantages

Optimal fertiliser regimes (e.g. 28 kg P/ha would add 10t C/ha)

Problems

- Increased livestock
- Increased emissions
- Difficulty in obtaining increase above 1990 levels
- Costs to monitor—fertiliser sales unreliable
- Likelihood of implementation is low
- Difficult to measure and high cost

2. Browse Trees for Managed Grazing

Example: *Leucaena* introduced into existing cleared country

Currently 60,000 ha

Could be increased to 1 M ha

Potential sequestration 5 t/ha.

Advantages

- Acts as a "live" feedlot
- Should help to reduce stocking rates on surrounding lands
- Has enhancement effect on associated grasses
- 1 M t sequestered

Example: Saltbush for reclamation of degraded rangelands—chenopod shrublands

1. Rabbit reduction as part of rangeland management—calici virus can reduce rabbit numbers which improves rangeland condition.

Advantages

- Readily measurable

Problems

- Most of the benefit may already be obtained

2. Decision not to clear woody weeds

Is a human-induced change—a positive human intervention, so should count.

Which article would it be under?

Has to be under article 3.4 for a decision not to clear to count.

Comment: just count it as a reduction in clearing under articles 3.3 or 3.7.

Strategy

- Clearing is based on a permit system
- Growth is documented
- So stop clearing and give a C credit for the action
- Acts as a virtual sink as it would have been cleared anyway.

Which scenario is best:

Count under 3.3 as reduced deforestation

Count under 3.4 as human induced action not to clear since it would have been cleared otherwise.

Comment: Specific measures (e.g. calici virus) may be aggregated together in context of broad classes such as rangeland management.

BROAD ACTIVITY STRUCTURE

Example structure

Level 1	Rangeland management
Level 2	Artificial planting
	Grazing management (domestic, feral, native animals)

1. Rangeland Management

Major Uncertainty

- Soils buffer climatic variability but change is the measure so large changes in AGB could be negative between 2008 and 2012.

Managed rangeland—400 M ha

Strategy

- Fire reduction and control
- Stocking reduction or removal
- Conserved land – like CRP
- Feral animal control
- Control of woody weed ingress
- Maintain uncleared areas i.e. make sure stocking rates have not increased on certain areas
- Get benefit from vegetation sink
- Methane will go into agricultural emissions.

2. Fire Management

Issues

- Difficult to get fire management included under Article 3.4
- There is an ecological need for fire. Increased tree cover results in less pasture. Therefore there is a need for planned burning to increase pasture.
- Fire suppression agenda might be offset by fire promotion for other reasons.

Strategy

- Under Article 3.4—educed fire from 1990 to 2010
- Use a long term trend line (to remove climate noise)
- Some promotion, some suppression
- Area northern pasture? lands
- 11 M ha on averaged reduced to 6 M ha
- Reduced burn permits for measurement
- Problem with illegal "permit system" in non permit fires
- Gearing loads? to intensity of management reduces fire potential.

POTENTIAL CRC RESEARCH

1) Usefulness of shrub/trees in grazing landscapes

- Leucaena
- Oil mallee
- Tagasaste
- Saltbush

2) All appropriate accounting on post 1990 cleared land in Australia.

3) Emissions in grazing industries

- N2O
- CH4

4) Inserting trees into agricultural systems e.g. tree planting on dairy farms, shelter belts, riparian protection

5) Tree crops with animals underneath, e.g. nut trees.

AGRICULTURAL STATISTICS

	Total	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Pasture harvested 1990	30861	6992	6504	4822	3786	7724	865	148	28
Pasture harvested 1997	19039	4436	3945	3219	2214	4542	633	37	13

Table 1: Total area of sown pastures and grasses in 1990 and 1997 ('000 hectares).
Source: ABS Summary of Crops, 1991 and ABS Agriculture, 1998

Forests Group Outcomes

Co-Chairs: Graham Farquhar, Annette Cowie
Rapporteur: Adrian Bugg

AFFORESTATION AND REFORESTATION UNDER ARTICLE 3.3

1. Current area of afforestation/ reforestation since 1990

- That the area of commercial plantations established by larger growers is currently well documented through surveys conducted by the National Plantations Inventory.
- Knowledge of the area of commercial plantations established by smaller-scale forest growers and of environmental plantings is considerably less.

2. Area of afforestation/reforestation by 2008-2012

- That area of commercial plantations is expanding rapidly.
- Continuation of this rate of expansion will depend on a range of factors including tax policy, cultural + community acceptance, continued flow of investment funds from domestic and overseas sources, including the potential flow of funds for carbon offset projects.
- Inclusion of carbon sequestration associated with this estate will depend on the outcome of international rules regarding previous land use.
- In the absence of information on drivers of plantation establishment, projections could assume a range of plantation development scenarios.

3. Net annual change in carbon stocks per hectare

- Mean annual carbon sequestration rates for commercial plantations in Australia range from about 3 to 15 t C/ha/yr. This varies with species and site and with the stage of development of the plantation.
- Assuming that plantations established recently and in the future may be sequestering carbon at the same rate as those planted historically may be erroneous, because current and future plantings are occurring on different sites with a different species mix to the pre-1990 plantation estate. There is generally a shift toward the establishment of plantations on less productive sites, but there have also been improvements in genetic quality and silvicultural practices that may result in increases in growth rates.

4. Potential for greenhouse gas emission reduction or carbon sequestration by 2008-2012

- Estimates provided suggest that average carbon dioxide sequestration in commercial plantations between 2008-2012 might be between 2 and 20 Mt/yr.
- The rate of carbon sequestration will depend on a number of factors including:
  a. The rate of plantation establishment. The rate of establishment of new plantations that comply with the IPCC definition of reforestation (ie. plantations established on areas that have not recently been covered by forest) is about 51,500 ha/yr. The total post 1990 commercial estate in 1999 was 323,000 ha. With a continuation of this rate of planting the estate would reach 992,500 ha by 2012.
  b. Rotation lengths and management regimes. The bulk of plantations established in the last 5 years have been short rotation plantations that will be harvested during the first commitment period of the Kyoto Protocol. This will result in a significant reduction in carbon stocks. Sub-rules proposed in the IPCC Special Report may limit this reduction in stocks.
- To improve capacity to predict potential sequestration rates under different definitional scenarios, better information is required for previous land use, areas of plantations harvested and replanted, proposed management regimes.
- There is a need to consider emissions of other greenhouse gases (methane and nitrous oxide) that might be generated during plantation development.

5. Cost of applying the activity

- For commercial timber plantations this may be marginal if there are other returns from wood products, and largely related to the cost of measurement.
- Emissions associated with harvested would need to be accounted for.
- Costs of establishing non-commercial 'environmental plantings' or revegetation might range from $500 - $10,000 per hectare (not including land cost) depending on the nature of the regeneration activity and the number of stems planted per hectare.

6. Measurement capacity

- Methods for measurement and modelling of changes in carbon stocks in above-ground living biomass are relatively well established.
- More efficient methods and models are required to assess changes over large areas.
- More efficient methods are required for mixed species and environmental plantings.
- Generally a mixture of measurement and modelling will be the most efficient method of estimating changes in C stocks across the forest estate.
- Methods are required for efficient estimation of coarse and fine litter.
- Improved methods are required for below-ground carbon (roots and soil carbon).
- There may be issues related to confidentiality in obtaining estimates of plantation growth from private forest growers.

7. Measurement cost

- Measurement cost will largely depend on the level of precision required for the estimate of the carbon pool in question. This will depend on the scale of resolution of the carbon estimate (whether an estimate is simply required for the whole forest estate or for every stand) and the variability of the sampled unit.
- The required measurement precision is uncertain. It is likely to be different for project scale accounting for emissions trading purposes than for national level reporting.
- Costs from NSW State Forests studies were developed.

8. Emissions associated with the activity

- If land-based accounting is adopted, harvest losses and emissions from natural disturbances will need to be accounted for.
- Emissions related to fossil fuel use from plantation establishment and management will be accounted for in other parts of the greenhouse gas inventory.
- There may be emissions associated with loss of soil carbon during plantation establishment, particularly when converting from native forest to plantation, or from improved pasture to plantation.

9. Permanence

- At the estate or national scale there may be some periods where overall carbon stocks in commercial 'Kyoto compliant' plantations are declining if the estate has a skewed age class distribution and if planned rotation lengths are adhered to.
- There are some risks associated with losses due to fire or disease. In NSW plantations fire losses have been negligible. In Queensland fire has affected a total of about 7,000 ha out of 175,000 ha in the last 10 years.
- There may be some risks associated with conversion of 'Kyoto' forests to other uses if the market values of wood decline or market values for competing agricultural products increase.

10. Impacts on other production values

- There will be reductions in the output of agricultural commodities as land use changes from agriculture to forest. Some evidence from the US that the overall value of regional commodity production might increase when a proportion of land is converted to trees.
- There is some evidence to suggest that up to 20 percent of farms can be converted to trees with no loss in agricultural production, and in some cases incorporating trees into agricultural production may increase agricultural output.
- Large scale revegetation may impact on catchment water yields and the availability of water to irrigators.

11. Impacts on sustainability objectives

- If appropriately located, commercial plantations and other forms of revegetation may result in other natural resource management benefits such as improved water quality, reduced land degradation, salinity mitigation and riparian zone protection.
- Benefits for biodiversity conservation will depend on the plantation species and management regime and incorporation into the revegetation of structural features, habitat heterogeneity, native species and understorey development.
- There may be adverse community and social reaction to large scale revegetation in agricultural landscapes.

12. Capacity to separate human-induced from non-human-induced effects

- This will depend on the accepted definition of human-induced. A broad definition will incorporate a wide range of revegetation options, including direct seeding, assisted natural regeneration and protection from stock or wildlife browsing. A more restricted definition might only include planting.
- It will be impossible to separate additional growth as a result of potential indirect human-induced effects such as increased atmospheric CO2 concentrations, longer growing seasons or increased rainfall.

ADDITIONAL ACTIVITIES UNDER ARTICLE 3.4

- These include activities that may be undertaken in plantations established before 1990 or in existing native forests.
- They could include activities that result in increases in carbon stocks during an accounting period or activities that result in reduced emissions compared with a baseline of previous practice.
- As indicated in the IPCC Special Report, activities might be considered in broad classes, e.g. 'forest management', or 'cropland management' (which would involve assessment of greenhouse gas emissions across a complete managed forest or cropland estate), or more narrowly defined activities such as 'forest fertilisation' (that would involve accounting for greenhouse gas emissions on a specific area of land where that activity is nominated to occur).

BROAD APPROACH

- Some evidence was presented from Queensland that carbon stocks across their managed forest estate are increasing.
- Measurement systems for assessing carbon stock gains or losses in plantations are fairly-well established.
- Given the age class structure of the Australian plantation estate, harvesting of mature stands (the bulk of which were planted in the 1960's and 70's) might result in a net decline in carbon stocks in the pre-1990 plantation estate over the next 10 years or so.
- Measurement of C stock gains or losses in many native forest estates may be difficult because data and measurement systems to assess carbon stock changes are not currently in place.
- Measurement costs associated with estimation of carbon stock changes in native forests may be high compared with the magnitude of the potential changes per unit area.
- Measurement may be undertaken more efficiently by combining forest inventory for a range of values, particularly those associated with criteria and indicators of sustainability.

Potential large losses under broad approach

- Future climate change impacts on forest (longer term)
- Major insect pest outbreaks e.g Asian gypsy moth
- Big wildfires (included under land based accounting)
- Cyclones, natural disasters.

GENERAL ISSUES

- As for afforestation and reforestation under 3.3, estimation of changes in carbon associated with additional activities will need to be accounted for through a combination of measurement and modelling.
- The baseline against which reductions in emissions or increases in carbon stocks resulting from changes in native forest or plantation management is uncertain. There are 3 broad options for including reductions in greenhouse gas emissions resulting from Article 3.4 activities toward country targets: (a) no baseline (similar to how gains in carbon stock from reforestation under Article 3.3 are counted); (b) a comparison with change in carbon stocks from the activity in 1990; or (c) assessing net emissions under previous practice and deducting this from emissions improved practice.

NARROW APPROACH

It was not possible to fully discuss all the proposed narrowly defined additional activities. Comments relating to those activities that were discussed are presented in the tables below.

SHORT TERM RESEARCH PRIORITIES

- Describe and classify the management systems being applied in Australian native forests and plantations in terms of their effects on carbon stocks.
- Identification of those components of management systems that might be changed to give increased carbon stocks or reduced emissions.
- Consider the potential capacity to change management in different systems and interaction that this might have on other values, including production.
- Review the potential for measurement of changes in forest carbon stocks as a result of the broad approach to inclusion of forest management practices undere Article 3.4.
- Analysis of the cost of monitoring compared with the benefits resulting from assessing carbon stock changes.

LONGER TERM RESEARCH PRIORITIES

- Ongoing development and application of forest information and analytical systems that allow analysis and quantification of alternative forest management and development options on carbon stocks.
- Improved forest inventory practices that incorporate measurement of all major carbon pools.
- Wider application of forest inventory and other remote sensing studies to quantify current forest structure, composition and condition (including all carbon pools) and to assess the effects of forest management on a range of forest values.

Table 1. Native forest based additional activities.

Activity	Issues/Comments
Forest fertilisation	Not likely for 98% of native forest. There may be some potential for application in intensively managed regrowth or private forest, particularly in association with thinning.
	Could provide some growth response but potential for increment is uncertain due to water limitation, and fertiliser losses.
	Cost of fertiliser and application is high.
	Emissions of nitrous oxide need to be accounted for.
	There area likely to be impacts on forest species composition and encouragement of exotic weeds.
	There are likely to be impacts on water quality and stream ecology with broad scale fertilisation.
Forest rehabilitation	This is not currently widely practiced
	area requiring rehabilitation not known
	Some forest areas may have been silviculturally degraded 22% (where did this come from??)
	Historical management or growth records are often not available to demonstrate improvement since 1990.
	Could include weed management programs, with weeds used as bioenergy.
Fire management	A range of fires occur in native forests: prescribed fuel reduction fires, slash burns for site preparation and wildfires.
	Wildfires are single events that can have a major effect on C stocks.
	It is uncertain whether fires are currently carbon neutral or whether fire activities could be manipulated to increase C. There can be increased productivity post fire that needs to be accounted for. Stock depends on regeneration.
	Reducing prescribed burns may increase carbon stocks in the short term but increase the risk and ability to control large wildfires in the longer term.
	There are likely to be consequences of reduced regeneration/fertility/soil structure
	Need further research on emissions associated with different types of fire.
	Do not have data on composition of slash, amount of charcoal produced.
Changing silviculture/reduced	Harvesting practices in Australia are generally of a high standard.
impact logging	There may be some scope for reduction in emissions associated with forest harvesting as codes of practices are introduced for private native forest.
	Other components of harvesting and management system that might be changed to reduce carbon emissions or increase stocks include: a. Retention of habitat trees and protection areas. b. Residue management c. Attention to regeneration.
	The capacity to alter silvicultural systems will vary greatly between forest types.
	Carbon benefits from changing management will take some time to achieve as the area of practice will be limited to the area harvested each year. This is generally a small proportion of the entire forest estate.
	Thinning the forest and putting the thinned stems into long term storage or use in bioenergy may result in effectively no net emissions and a stimulation in growth in the residual stand.
Grazing management	Not discussed.
Forest conservation	Not discussed

Table 2. Plantation management activities

Activity	Issues/Comments
Improved genetics	There are active genetic improvement programs in most Australian plantation species. There are general gains with each rotation in genetic improvement. These are generally well quantified, although gains measured in experimental plantings may not fully translate to the entire forest estate.
Changing species	Changing plantation species to one with a higher timber density or higher growth rate for that site may result in significant increases in rates of carbon sequestration and long-term carbon storage at the site level. These species changes may be occurring for other management or marketing reasons.
Fertilisation	May be some benefits from increased growth due to improved fertilisation Baseline, or measurements under previous practice will be required. Gains will be relatively limited, because fertilisation is now widely practiced.
Improved silviculture	Improvements in site cultivation and weed control may result in increased early growth and plantation site occupancy over previous rotations. This may result in higher early rates of carbon sequestration These gains will not generally result in greater long-term carbon storage. Measurement and verification will require historical records to compare growth in current versus previous rotations. Control plots using species and genetic material similar to the previous rotation will also be required because some differences in growth might be due to climatic variation. These measurements will not be available for all plantation species and regions.
Reduced emissions from harvesting and site preparation	Historical site preparation practices using fire often resulted in large losses of organic matter (and emissions of greenhouse gases) at the end of the rotation. Alternative practices have been introduced in many regions in the last 15 years that reduce organic matter losses and GG emissions. Knowledge of carbon stock changes due to harvesting and site preparation practices is relatively poor. Further research and survey analysis will be required to fully quantify these effects.

Table 3. Other forest related activities

Activity	Issues/Comments
Increased carbon storage in wood products	Carbon can be stored in wood products for a considerable period of time. Current IPCC default method of assuming all C in harvested wood is emitted at the time of harvest is not appropriate. There is generally good information available on the quantity of timber harvested in Australia, the products that this timber is for, and the C emissions associated with converting timber from log to product form. There is more uncertainty about the longevity of C storage in different wood products and the nature of mathematical functions for estimating decay of different wood products. Some analysis is suggesting that the amount of C in the wood products pool is increasing. Wood products will also have significantly better carbon storage and emission reduction benefits when compared with energy intensive building products such as aluminium, plastics or steel. The full greenhouse costs of these products should be factored into their production, and government policies should promote the use of timber in replacement for these products.
Use of forest residues for biomass energy	This was not extensively discussed. Replacement of fossil fuel based energy with bioenergy will be recognised in other parts of the inventory. There is a significant resource of unutilised residues from plantations and native forests that might be used for bioenergy. This needs to be better quantified. The national greenhouse gas inventory should appropriately incorporate bioenergy related use of wood.
Non-forest woody revegetation	There is some information available through an ABARE survey on areas of non commercial vegetation established on farms in different regions. This is now dated and should be repeated. National Farm Forest Inventory is aiming to capture information on the area, species and age class of plantations in small-scale plantations on private land. Good information available on areas planted for mallee eucalypts in WA and tea tree. There is still major uncertainty related to areas of non-commercial revegetation and landcare plantings established with assistance from a range of government programs.

Section 6

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