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Agriculture, forestry and emissions trading: how do we participate?

issues paper

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Agriculture, forestry and emissions trading: how do we participate?

Executive summary

Climate and climate change impact directly on Australia's agriculture and forestry industries. These industries, in turn, play a key role in Australia's profile of greenhouse gas emissions: agriculture is the nation's second largest emitter; forestry provides a significant carbon sink; and much of Australia's emissions abatement so far has come from significant reduction of land clearing from agricultural areas.

While agriculture has not been included in any emissions trading system developed yet, its emissions profile in Australia could make it a candidate for inclusion in any newly developed national emissions trading system which seeks to reduce national emissions in a cost-effective manner. Agriculture has the potential to help the mitigation of greenhouse gas emissions by the sequestration of carbon into soils and vegetation. Terrestrial vegetation and soils absorb approximately 40% of global carbon dioxide emissions from human activities and changes in agriculture and forestry could increase sequestration of carbon.

Forestry is already active in some existing trading systems, and should be part of any new emissions trading system in Australia. There is an opportunity to broaden the opportunity for forestry by inclusion of carbon stored in wood products.

Agriculture and forestry have unique features which must be taken into account if they are to play a comprehensive role in emissions trading. These include the widely distributed nature of agriculture and forestry, the difficulty of measuring small changes in annual fluxes over wide areas, permanence, and the lack of knowledge about best management practices for greenhouse gas abatement in agriculture or the costs of such abatement.

The exploration of a phased approach to incorporating agriculture fully into a national emissions trading system highlights the need for research to identify low-cost mitigation options for Australian agriculture, the development of industry standards for mitigation and offsets, the verification of methodologies, and the accreditation of management practices. This will require industry, government and the research community working together.

Introduction

There is broad scientific consensus globally of the need to make deep cuts in greenhouse gas emissions.

In its Third Assessment Report, *Climate Change 2001*, and the sections so far finalised of its Fourth Assessment Report, *Climate Change 2007*, the Intergovernmental Panel on Climate Change details impacts of current atmospheric greenhouse gas concentrations and projects significant impacts as concentrations rise.[1]

Both science and economics suggest a need to reduce emissions by 50 to 60 per cent or more by the middle of this century. In his report, *The Economics of Climate Change*, Sir Nicholas Stern found that stabilising atmospheric concentrations of greenhouse gases at or below 450 parts per million carbon dioxide equivalent would involve global emissions peaking within the next decade and then falling at more than 5 per cent per year, reaching 70 per cent below current levels by 2050. Even stabilising greenhouse gas concentrations at 550 parts per million of carbon dioxide equivalents would mean global emissions peaking in the next 10 to 20 years, and then falling at a rate of at least 1 to 3 per cent per year.[2]

As Australia and the world work to reduce impacts of climate change, a carbon constrained future is inevitable. While Australia does not yet have a target for emissions reduction (beyond the *Kyoto Protocol* target of average annual emissions in 2008-2012 being no more than 108 per cent of 1990 emissions), Britain has drafted a bill to require 60 per cent reductions in emissions by 2050, the 27 national governments across the European Union have agreed to cut greenhouse gas emissions by 20 per cent by 2020, and intense international diplomatic efforts are underway to reach global agreement on ways to reduce emissions after expiration of the first commitment period of the *Kyoto Protocol* in 2012.

The role of agriculture and forestry

Through both the planting of new forests and dramatic reductions in land clearing, agriculture and forestry have already done more than any other sector to reduce Australia's net greenhouse gas emissions. As fluxes of greenhouse gases to and from the land are significant, deep cuts to greenhouse gas emissions from Australia will necessarily further involve agriculture and forestry. Agriculture was responsible for 16.5 per cent of Australia's greenhouse gas emissions in 2004, making it the nation's second largest emitter. New forests are estimated to have removed 17.8 million tonnes of carbon dioxide from the atmosphere in 2004, a sink equivalent to

[1] Intergovernmental Panel on Climate Change http://www.ipcc.ch/
[2] *Stern Review on the Economics of Climate Change*, UK Treasury and Cabinet Office, 2006 http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm

more than 3 per cent of Australia's net emissions that year.[3] This is in addition to the growing carbon reservoir in wood products both in service and in landfill.[4]

Investment decisions and management practices in agriculture and forestry can impact on the size of fluxes of greenhouse gases – both sources and sinks – in any year. Both the extent to which agriculture and forestry are included in any emissions trading scheme and the price of carbon could affect such investment decisions, the take-up of best management practices, and therefore the fluxes of greenhouse gases.

In addition, rainfall patterns, river flows, evaporation rates, fire regimes, temperatures, solar radiation qualities and atmospheric carbon dioxide concentrations affect growth rates of plants, agricultural and forestry decision-making, and consequently greenhouse gas fluxes. Climate change is affecting and will continue to affect agriculture and forestry in Australia. Despite this, understanding of the extent of impact – and even some of the mechanisms of impact on plant growth – is still emerging and requires further research.

Agriculture can contribute to carbon sequestration through production of biofuels and bioenergy. Some biofuel/bionergy production systems only provide minimum carbon savings relative to fossil fuel systems. Research is required to assess carbon life cycles of different biofuel/bioenergy production systems so that any trading scheme including biofuels delivers real greenhouse outcomes.

While agriculture and forestry will necessarily be involved in any successful program to make deep cuts in Australia's greenhouse gas emissions, the sector has unique features which must be taken into account if it is to play a comprehensive role in emissions trading:

- emissions and sinks from agriculture and forestry are widely distributed, in varied ownership and control;
- while annual fluxes through land-based activity are significant at the national scale, at site or enterprise scale annual fluxes are frequently small and expensive to measure (though over time fluxes at even the site or enterprise scale can be significant);
- while planting decisions and management practices affect fluxes, climatic variations can turn an anticipated sink into a source of emissions;
- at the site or enterprise scale, permanence of individual sinks cannot be guaranteed;
- while forestry has some experience with emissions trading, little is known about the best management practices to reduce agricultural emissions, the costs of such practices, or the extent of their impact;

[3] *National Greenhouse Gas Inventory 2004*, Australian Greenhouse Office, 2006, http://www.greenhouse.gov.au/inventory/2004/pubs/inventory2004.pdf

[4] Australia's *National Inventory Report 2004 (revised)*, Australian Greenhouse Office http://www.greenhouse.gov.au/inventory/2004/national-report.html ; *Forests, Wood and Australia's Carbon Balance*, Forest and Wood Products Research and Development Corporation and Cooperative Research Centre for Greenhouse Accounting, 2006

- changing climate will affect the emissions profile from agriculture and forestry;
- full involvement of agriculture and forestry in an emissions trading scheme could underpin changes in management practices and permanent changes in land use that have positive impacts for biodiversity and sustainability as well Australia's greenhouse gas emissions.

A sustainable future

The reduction of greenhouse gas emissions while protecting Australia's competitive advantages is critical to the sustainability of agriculture and forestry. Because of their significant role in Australia's emissions profile, the full involvement of agriculture and forestry in any emissions trading system could assist access to lowest-cost abatement solutions and deliver deep cuts in emissions.

Barriers to entering an emissions trading scheme

Forestry is already involved in emissions trading through generating abatement certificates for the NSW Greenhouse Gas Abatement Scheme and in other schemes around the world. Forestry in Australia has developed methodologies and protocols that would allow it to participate immediately in any national or wider emissions trading scheme. There are, however, some barriers which would delay agriculture's capacity to participate fully in a trading scheme.

Measuring & monitoring emissions

In any emissions trading scheme, a major question would be whether agriculture was to be regulated under a cap-and-trade system or some other mechanism. Under cap-and-trade, the agriculture sector could be given an overall emissions limit, which would then be divided into tradeable allowances among sector participants. Cap-and-trade is emerging as the most accepted model for scheme design globally and has been proposed for Australia by the state- and territory-based National Emissions Trading Taskforce (NETT).

However, monitoring emissions from agriculture is difficult and costly. In the NETT proposal, as in other markets such as the European Union Emissions Trading Scheme and the United States Regional Greenhouse Gas Initiative, only energy producers are regulated. Agricultural emissions are not currently regulated in any existing emissions trading scheme. A primary reason for this is the impracticality of accurately measuring on-farm emissions or sequestration to soil, and subsequently monitoring changes over time. This complicates reporting on whether the sector is meeting its cap, as well as the sector's ability to allocate tradeable allowances to regulated entities.

The agriculture sector is also dynamic, both geographically and temporally; farmers change crops and practices based on commodity prices, economic trends, climate conditions and other factors. These changes do not

necessarily align with financial-year time-scales in which emissions are typically reported and traded. For example, increases in soil carbon are small, variable across landscapes and accumulate gradually. Small increases in soil carbon over wide areas can have significant impact on net national fluxes. However, while there has been limited research which has identified practices which increased soil carbon over time in specific places, there is no practical way to experimentally determine in the short term if particular management practices in a specific location will increase soil carbon in the long term.

It is likely the transaction costs associated with regulating agricultural emissions via cap-and-trade would be so high that trading allowances would not be economic, thereby reducing the efficiency of including agriculture in the scheme. A likely result of including agriculture in a trading scheme from the start could be farmers changing to management practices that are expected to have lower emissions profiles, but retaining any allowances earned to hedge against future land-use changes or unanticipated future rises in greenhouse gas emissions. It would be difficult for government to determine whether changed management practices actually achieve regulated emission reductions, and the result would be more like an imposed management practice than a liquid market.

Trade exposure

Agriculture, which competes in global markets, has little capacity to pass increases in costs on to its customers. The markets in which it operates are highly elastic; any increase in price will lead to falls in demand, as customers source their produce from overseas suppliers not carrying internalised environmental costs.

Stationary energy, on the other hand, operates in a relatively inelastic market. Most customers will still buy much the same amount of electricity (in the short term, at least) regardless of increases in prices passed on because of the costs of reducing emissions from generation and emissions trading. While some of its larger energy-intensive customers (such as aluminium refining) compete on world markets, Australian generators of electricity compete only with other Australian generators of electricity.

Any immediate cost burden of involvement in an emissions trading system would therefore have to be carried by farmers unless such emissions trading was truly global in scope (in which case the cost of food would rise globally). This contrasts with the stationary energy industry, where the costs could simply be passed on to consumers (with, possibly, some protection for large consumers competing in global markets), with the hope that price increases may over time drive energy efficiencies.

Energy has been targeted in early trading schemes because of its high emissions profile (stationary energy represents 50 per cent of Australia's net emissions[5]) and because its emissions can be easily monitored from the point

[5] *National Greenhouse Gas Inventory 2006*, Australian Greenhouse Office, 2006 http://www.greenhouse.gov.au/inventory/2004/pubs/inventory2004.pdf

sources where they are generated. Additionally, these sources are already subject to government regulations and operate in markets where daily trading occurs, meaning these fundamentals of emissions trading are already familiar to market players.

Though trade exposure limits the extent to which agriculture can pass on increases in costs, the fact that its emissions are second only to the stationary energy sector suggests that it cannot be ignored in developing an emissions trading system to achieve least-cost abatement of greenhouse gas emissions.

Marginal costs of abatement

The extent to which emissions from agriculture can be reduced with economic efficiency is unclear. While there may be low-cost abatement options in some segments (for example, burning methane from piggery effluent, which is being done in Victoria to create carbon credits for the NSW Greenhouse Gas Abatement Scheme), the costs of reducing emissions in other segments may be much higher relative to options in other economic sectors.

In many cases the marginal costs of abatement from agriculture are unknown in the Australian context or need to be studied more holistically to inform decision-making. Work by the United States Environment Protection Agency[6] identified that the marginal costs of reducing emissions associated with cropping activities are far less expensive than reducing emissions from livestock. The research also indicated that many activities in the agriculture sector can provide abatement at costs comparable with current carbon commodities in an emissions trading scheme (about US$10 to 15/t$CO_2$e). This data was globally aggregated across a range of activities, with no definition of cost curves for Australia, where abatement may be more difficult. For instance, studies indicate that the potential to increase soil carbon in cropping systems in Australia may be generally much more modest than in the United States or Europe. [7]

The benefit of an emissions trading scheme is to target abatement action to areas where abatement can be achieved at lowest cost. If costs of most abatement in agriculture are relatively high compared to other sectors, then including agriculture in an emissions trading system would not be likely to result in an overall economically efficient national response to emissions reduction.

Currently, there is too little information available to consider the benefits of including agriculture in a mandatory emissions trading scheme. A program of research will have to be developed and implemented to fill the information gap before agriculture will be able to participate fully and effectively.

[6] See http://www.epa.gov/nonco2/econ-inv/international.html
[7] *Agriculture and greenhouse*, CRC for Greenhouse Accounting, 2004. http://www.greenhouse.crc.org.au/publications/brochures/brochure_cropping.cfm

Scheme access

A central point for the agriculture sector in considering an emissions trading scheme will be the ability for small landowners to access benefits and be protected from prohibitive costs. Farmers have increasing opportunities to earn revenue from providing environmental services such as stewardship payments, and carbon sequestration offers a further opportunity for this. While larger landowners will always enjoy efficiencies and economies of scale, widespread adoption by small landowners could be an objective of an emissions trading scheme.

Farmers are innovative and adaptable, and they rely on their ability to understand their land, the climate and international markets that impact their products. Emissions trading in many ways sits at the nexus of these interests. If a national emissions trading scheme is implemented, farmers would be interested in participating if it offers more options for managing the land; landowners would factor in the price of emissions – either as a cost of production or as a potential source of revenue from carbon commodities.

A staged approach

The barriers that make full participation of agriculture in an emissions trading scheme difficult in the first instance suggest the need for a staged approach to regulating reductions from non-point sources, drawing on a parallel program of research and development to inform the implementation of later stages.

Full and effective involvement of agriculture could come through a long-term plan with perhaps a 20-year transition to full participation by agricultural industries. Stage 1 of such a scheme would involve building industry understanding related to international rule sets, economic implications, benefits to first movers and design options. Stage 2 would look to a baseline and credit approach, whereby landowners were encouraged to adopt best management practices that provide a "win-win," in which productivity is increased or costs are reduced as emissions are reduced. Over time, farmers who have achieved best practice could create tradeable carbon commodities through offsets enabling fully participation in an emissions trading scheme. Stage 3 would involve full scheme participation by agriculture and forestry.

Currently, the lack of knowledge regarding the costs and benefits of on-farm abatement make it difficult to consider whether inclusion in a cap-and-trade framework makes economic sense. Research in Stage 1 and experience from Stage 2 would reveal whether the sector can be a low-cost source of abatement options in a domestic, globally linked emissions trading scheme.

Stage 1: Industry understanding & consistency

The agriculture and forestry industry comprises a diverse group of landowners that are necessarily segmented by on-farm activities and other factors, such as location and size. Emissions trading is likely to affect groups differently, although there are common interests and issues that affect the sector as a whole. The first stage of involving the agriculture sector in emissions trading

could focus on identifying those points of commonality and building industry understanding, particularly in terms of internationally consistent frameworks, marginal costs of abatement, and economic impacts from rising energy prices.

International Consistency

A first-order issue is defining the rules that frame how the agriculture sector may be able to participate in emissions trading, and how this would be consistent with internationally negotiated frameworks. Given that the international community, including Australia, has been negotiating carbon market rules for 10 years under the *Kyoto Protocol* (and longer under the United Nations Framework Convention on Climate Change), it is likely that this rule-set will remain fundamental. Kyoto rules are ultimately negotiable, particularly in the context of the second commitment period. Australia can therefore use these rules as a basis, while arguing for amendments or deviations that enable Australia to develop a feasible national scheme that allows for agriculture's participation, is still recognised internationally and can potentially link to Kyoto markets.

Land-use, land-use-change and forestry activities have been heavily debated throughout the Kyoto process. Agreement was reached via Article 3.3, which defines eligible forestry sequestration activities, namely afforestation/reforestation after 1990 on land that was clear before 1990. The NSW Greenhouse Gas Abatement Scheme has adopted Article 3.3 of the *Kyoto Protocol* and Australia's interpretation of corresponding definitions (i.e. specifications for defining a "forest").

Article 3.4 of the *Kyoto Protocol* includes a wider suite of land-based activities, including improved forest management, crop management and grazing-land management. In the first commitment period, countries have been able to choose whether to include these activities in their national accounting inventories, and Australia has opted not to include them. This decision has limited the incentive for the development of methodologies for these activities, which would have otherwise probably been considered eligible in the NSW scheme. Other countries that have adopted Article 3.4 are developing methodologies, as are projects under the Clean Development Mechanism of the Kyoto Protocol. These could be used in the future in Australia.

Australia could choose to adopt Article 3.4 in the second Kyoto commitment period (post-2012), with some possible benefits. Regardless, a national scheme that sits outside the Kyoto framework could still be developed to encompass all the activities addressed in Articles 3.3 and 3.4 and include the 1990 baseline. This would ensure that work that has already begun for the NSW scheme, Kyoto inventories and voluntary carbon products that have adopted Kyoto rules could be streamlined into the national scheme. The NETT is proposing to base offset-project eligibility on activities addressed under the articles.

Sequestration services through reforestation on non-forested lands are potentially the first area where farmers may benefit from carbon trading. Ensuring that rules under a national scheme reflect the market knowledge that

has been developed under Kyoto would facilitate adoption and be likely to reduce transaction costs. Developing new definitions and eligibility rules outside the framework would risk confusing the marketplace, slowing adoption and losing the ability to trade internationally. In the initial stages of a national emissions trading scheme, Article 3.3 activities could be eligible to create tradeable offsets consistent with the rules of the NSW Greenhouse Gas Abatement Scheme.

One point of possible differentiation is in dealing with the issue of permanence. Sequestration-based credits carry a retention liability that requires carbon to be permanently removed from the atmosphere. "Permanent" is defined differently in different markets: for example in the NSW scheme 100-year guarantees must be put in place; while some United States markets require permanent conservation easements to be placed over the land. The *Kyoto Protocol* has dealt with the issue differently, allowing sequestration projects to generate commodities that are recognized for a set period of time (generally 20 to 60 years). Buyers are required to purchase replacement commodities when the originals expire. These short-term commodities are expected to trade at a heavy discount to regular commodities, and this – along with other challenges – has resulted in few sequestration projects being developed under the Kyoto mechanisms.

The introduction of short-term commodities has confused the marketplace and avoided dealing with the challenge of permanence. The NSW scheme was the first carbon market in the world to trade forestry-based commodities, and its arrangements for permanence have been accepted by the marketplace, creating sequestration-based commodities that are equivalent to any other type of commodity.

Marginal cost of abatement

There has been some research relevant to determining the marginal costs of abatement, but much more is needed on the specific costs and implementation opportunities in Australia. Areas for research likely to have the largest impact include:

- ruminant animals - breeding, nutrition, dietary supplements and vaccines to reduce methane emissions;
- fertiliser - application rates, nitrogen inhibitors, organic production to reduce nitrous oxide emissions; and
- cropping – minimum-/no-till farming, rotational grazing, burning regimes to build carbon levels in soils.

A program of research to identify, develop and define cost-effective abatement practices will be required.

The marginal costs for sequestration activities in forestry are more widely understood, given their early entry into markets such as the NSW scheme and voluntary markets, and forestry operators can generally deliver commercial projects for a price of about $10 per tonne of carbon dioxide. The agriculture industry is not capable of being an early mover given the barriers discussed

above, so determining the marginal costs will help set policy direction regarding reducing costs or encouraging participation where costs are low.

Energy costs

Costs of production in the agriculture and forestry sector are likely to increase as a result of emissions regulation placed on the energy and, potentially, transportation sectors. Economic modelling of this relationship at an industry level would help the sector understand the contributions it will be making indirectly to emissions trading via this channel. As discussed previously, the elasticity of agriculture and forestry markets means agricultural and forestry enterprises will generally absorb these extra costs rather than pass them on to consumers. An industry understanding of the interplay between rising energy costs, potential future regulation on the sector and opportunities to reduce costs associated with a carbon price is required for landowners to innovate and continue producing competitively.

Stage 2: Baseline & credit

Building industry understanding and consistency through research and information, as discussed in Stage 1, would help define clearer options for participation by the sector. This could lead to Stage 2, in which landowners could be working toward certified activities that could generate offset commodities.

Opportunities for sequestration from forestry and revegetation should be included as offset options from any scheme's inception, but opportunities to involve emissions reductions from agriculture need to be clarified through the Stage 1 process first.

A potential source of agricultural emission reductions might be intensive farming, where emissions can be more accurately measured and monitored over time. In particular, most of the sector's emissions come from the digestive processes of ruminant animals (80 per cent), known as enteric fermentation. Targeting feedlots is an obvious first point of entry. There are several potential options for reducing enteric fermentation in feedlot animals, such as breeding, nutrition, dietary supplements and vaccines. Costs associated with these vary, and a carbon price may be the economic incentive required to encourage farmers to implement them. This could be clarified with research in Stage 1.

Fertiliser application in irrigation areas is another intensive practice that could provide offsets. There are many options for reducing fertiliser emissions both by reducing the volume of fertiliser used and by reducing the volume of emissions from fertiliser that is used, for example using nitrogen inhibitors. The first approach tends to be a "win-win", in that fertiliser costs are reduced but (to a point) productivity does not decline. The second approach tends to impose a cost on farmers, but the economics would shift with a carbon price signal.

In the intensive farming examples above and in other on-farm activities there are many examples of best management practices that increase productivity, reduce costs and/or reduce emissions. For example, improving soil carbon through minimum till farming is being adopted for its multiple benefits, but this is occurring in line solely with economic benefit, omitting the benefit of a carbon price (although it captures the productivity gains afforded from soil that is richer in soil carbon). The reasons all farmers do not immediately adopt best management practices include a lack of information, lack of technical capability or knowledge and, in some cases, prohibitive costs.

Thus, Stage 2 could see agriculture and forestry participating by:

- landowners who can verify they have adopted best practices becoming accredited during the first few years of a scheme;
- government-developed industry standard factors for carbon emission reductions or sequestration being applied to accredited practices to assist landowners in understanding the potential value of carbon commodities from their activities;
- landowners developing methodologies (or adopting approved methodologies, for example from the Clean Development Mechanism) to specify the volume of emission reductions or sequestration on their property and creating tradeable commodities.
- methodologies verified by third parties becoming accredited to generate commodities under the national scheme;
- commodities then being traded to regulated entities.

Such an approach could encourage participation by providing a clear path for early movers to work toward creating tradeable carbon commodities. Some costs, such as those for developing industry standard factors that indicate average emissions volumes per activity, might be absorbed by government to help jump-start the market. Examples might include the emission reduction per hectare achieved by applying nitrogen inhibitors to a certain fertiliser on a particular crop type or the emission reduction per head achieved through nutritional supplements in feedlot beef cattle. Land-owners would then bear the costs of developing methodologies and achieving third-party verification to generate and sell carbon commodities.

This baseline-and-credit approach is used in many schemes and can be combined with a cap-and-trade mechanism for regulated sectors. Such a hybrid approach is being pursued in both the United States Regional Greenhouse Gas Initiative and the European Union Emissions Trading System, in which regulated entities can trade allocated allowances as well as purchase project-based offsets to meet emission obligations.

Stage 3: Full scheme participation

The current barriers and economic factors make it difficult to envision agriculture being able to participate fully in an emissions trading scheme in the short term. Agriculture and forestry could engage fully with an emissions trading system over time, depending on the resolution of several key issues.

The linking of any Australian scheme with international trading schemes would provide access to the widest possible selection of low-cost abatement commodities if participants in the agriculture and forestry sector find that they need to purchase offsets for their emissions. It would also provide that widest possible buyer market for commodities created by the sector, bringing with it the efficiencies of more-liquid markets.

An internalised carbon price on Australian agricultural production will jeopardise their international competitiveness unless it reflects an internalised carbon price on farm production world-wide. NETT proposes a form of compensation for energy-intensive exporters.

Commercially available low-cost accredited mitigation options for farmers will be required. A clear carbon-price signal from an emissions trading scheme will naturally increase the attractiveness of some activities, such as sequestration, while making others more costly. There is a need for extensive research to identify low-cost mitigation options for Australian agriculture, and to develop industry standards for mitigation and offsets, verify methodologies, and accredit management practices. Just as governments in Australia are supporting industry efforts to develop clean-coal technologies, governments could choose to support efforts toward Australian leadership in providing commercial solutions for agricultural emissions abatement, such as through vaccines or low-emission fertilisers.

A major barrier for the sector is the costs associated with measuring small changes to emissions over large areas. A follow-on from developing industry standard factors in Stage 2 could be developing protocols for carbon pooling to facilitate multiple landowners aggregating carbon and reducing transaction costs.

Conclusions

Agriculture is the second largest emitter of greenhouse gases in Australia, second only to stationary energy. Australia's major achievement in slowing the growth of greenhouse gas emissions has come primarily from dramatic reductions in land clearing. Forestry provides significant carbon sequestration services. Any successful effort to make deep cuts in Australia's net greenhouse gas emissions must involve agriculture and forestry.

An emissions trading scheme would have major implications for agriculture and forestry in Australia. If they were left out of such a scheme, their costs would still rise through the increase in energy prices that would be expected from such a scheme. Only by their inclusion in any emissions trading scheme could their potential to deliver low-cost abatement be identified and maximised.

However, significant research and development of standards, methodologies, protocols, and management practices are needed before agriculture can engage fully with an emissions trading scheme. A phased approach which included the development and implementation of the necessary research program could allow agriculture and forestry to become full participants in an

emissions trading system over time to ensure the continued sustainability of agriculture and forestry in Australia. This will require business, government and the research community working together.