Submission to Garnaut Climate Change Review

Issues Paper 1
Climate Change: Land use – Agriculture and Forestry

With particular reference to the Australian Soil Carbon Accreditation Scheme (ASCAS)

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Background

In March 2007, Dr Christine Jones launched the Australian Soil Carbon Accreditation Scheme (ASCAS), the first incentive payments scheme for soil carbon in the Southern Hemisphere, placing Australia among world leaders in the recognition of soil as a verifiable carbon sink.

The ASCAS project provides financial reward for landholders adopting innovative broadacre cropping and grazing practices that result in measured increases in levels of soil carbon.

The amount of humified carbon in soil is directly related to nutrient bio-availability, soil structural stability, soil water-holding capacity, agricultural productivity and landscape function.

Improvements in carbon content increase the resilience of soils to climatic extremes as well as reducing the atmospheric concentrations of carbon dioxide and water vapour, the major greenhouse gases contributing to global warming and climate change.

Comments on Issues Paper 1 Appear in blue under relevant sections

Issues Paper 1
Climate Change: Land use - Agriculture and Forestry

This paper includes a summary of climate change issues relating to the agriculture and forestry sectors raised at the Garnaut Review Public Forum on August 17 2007. It does not represent a position held by Professor Garnaut or the Review Secretariat, but seeks to raise relevant questions and invite feedback from interested members of the community.

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As a significant contributor of greenhouse gas emissions, it is desirable for agriculture to play a part in the mitigation effort. Agriculture contributed 16.8 % of Australia's greenhouse gas emissions in 2005, making it the second largest emitting sector behind stationary energy (see Box 2.1).

There is no valid reason for the Australian agricultural sector to be a net emitter of CO2.

Under regenerative agricultural regimes it is practical, possible and profitable for broadacre cropping and grazing enterprises to record net sequestration of carbon in the order of 25 tonnes of CO2 per tonne of product sold (after emissions accounted for).

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Australian and New Zealand farmers, with their greater reliance on grass feeding and all-year round outdoor husbandry, would gain considerably in competition with emissions intensive agriculture in Europe, North America, Japan and Korea if there were a comprehensive global carbon pricing regime. Mitigation efforts, such as the use of farmland for bio-energy are likely to result in an increase in global prices, notably for grains and oilseeds, and livestock products using them as inputs.

Agree. Australia is well situated to gain marketing and carbon trading advantages by changing to carbon positive agriculture (rather than carbon negative).

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Finally, the land use, land use change and forestry (LULUCF) sector has the potential to be a net sink of greenhouse gases as it was in 2005. Reductions in land clearing and the planting of new forests are largely responsible for Australia being 'broadly on track' to meet its Kyoto target of 108 % on 1990 levels by 2012 (PMTG, 2007). Between 1990 and 2005, emissions from agriculture, forestry and fishing declined by 41.7%, largely as a result of reduced forest clearing. Against this decline, direct emissions have increased in all other sectors, particularly in the electricity, gas and water sector and mining, which increased by 46.9% and 44.8% respectively (AGO, 2007b). In addition, modified farm management practices (e.g. reduced tillage) can lead to agricultural land being an important carbon sink.

Australia's rangelands (tropical savannas, temperate woodlands, shrublands and grasslands used for extensive grazing) are estimated to comprise approximately 288 M ha. Areas devoted to more intensive agricultural production (the eastern draining catchments, Murray-Darling Basin, Tasmania and the south-west of Western Australia) comprise approximately 167 M ha (NLWRA).

A modest change of 0.5% carbon in the 0-30 cm profile of 288 M ha of rangeland and 1% carbon in the 0-30 cm profile of 167 M ha of more intensively managed land would result in the sequestration - or emission - depending on whether the change was positive or negative - of 48 Gt CO_2[1]

The net sequestration – or emission – resulting from changes of a similar magnitude in the 0-110 cm soil profile, would be 176 Gt CO2.

There has been a loss of over 50% of the organic carbon content of surface soils since the introduction of deleterious land management practices attendant on European settlement (Russell & Williams 1982; Dalal & Mayer 1986a; Watson et al. 2000; Dalal & Chan 2001; Dalal et al. 2004).

Prior to the relatively recent decades of increased industrial capacity, losses of soil carbon were the greatest contributor to Australia's greenhouse gas inventory.

Soil, historically the largest terrestrial sink for CO2, has become one of Australia's - and the world's - largest carbon sources.

The agricultural sector has only just begun when it comes to transforming previous carbon sources to carbon sinks

Some landholders have increased stable soil carbon levels by more than 2% within a few years of adopting regenerative soil management regimes. Large and rapid improvements to soil carbon across the continent are therefore well within the realms of possibility.

One of the main aims of the ASCAS project is to collect data that will enable accurate quantification of these changes.

[1] Bulk density of soil in the 0-30cm profile is generally in the range 1.2 - 1.8 g/cm^3, with the most commonly observed value being 1.4 g/cm^3. A bulk density of 1.4 g/cm^3 has been assumed for these calculations.

The ASCAS project will also encourage improvements to soil carbon levels by providing financial incentive for landholders to move away from 'business as usual' (which is creating carbon loss) and by providing knowledge on effective methods for building soil carbon.

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The extent of economic and social impacts of climate change on the agriculture and forestry sectors will be dependent on the biophysical impacts resulting from climate change, the design of policy mechanisms to encourage adaptation and mitigation, and the effective management of the opportunities presented by climate change

If Australian agricultural policies were to focus on 'sequestration' rather than 'adaptation and mitigation' we would move forward at a much faster pace. Achieving net soil carbon sequestration on 455 M ha of agricultural land would not only markedly improve the outcomes for adaptation and mitigation - but place Australia on the positive side of the international carbon ledger.

Irrespective of climate change, it is would be of enormous economic benefit to the Australian nation to provide incentive to the agricultural sector to rebuild soils by implementing practices that increase levels of humified soil carbon.

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3 The issues

3.1 Adaptation in the agriculture and forestry sectors

Opportunities for adaptation

Adaptation is "adjustment in natural or human systems in response to actual or expected climatic changes or their effects, which moderates harm or exploits beneficial opportunities" (Pittock, 2003).

There exists substantial debate as to which aspects of climate change are natural and which are human-induced.

Major factors that are undisputedly human induced are:

i) continued land degradation/ desertification/ loss of soil integrity
ii) loss of photosynthetic capacity
iii) loss of soil moisture-holding capacity
iv) dramatic changes to the way water moves in the landscape

In the face of dwindling supplies of fresh water and deteriorating nutritional status of soils the planet will struggle to support a burgeoning human population.

Humus holds approximately four times its own weight in water (Morris 2004). Irrespective of climatic variation, improving the functionality of soils will have wide-ranging benefits in terms of enabling continued productivity in a drying, warming environment.

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There are a range of adaptation options available to agriculture and forestry, many of which are extensions or enhancements of current measures aimed at managing variability in the existing climate (see Box 3.1).

Research has shown that the uptake of adaptation measures can considerably reduce the projected economic impacts of climate change (Gunasekera *et al*, 2007). However, these are not costless. Most involve an initial investment while the benefits may be realised over a longer period of time.

Complexity and natural variation are integral to biological systems and provide resilience in the face of adverse conditions, such as those precipitated by climate change.

Widespread adoption of agricultural practices that are highly productive, while also providing net sinks for atmospheric carbon, will have a restorative effect on the natural resource base and a net financial benefit to individuals and communities in rural and regional Australia – and the nation as a whole.

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3.2 Mitigation options for agriculture and forestry

Mitigation is a reduction in net greenhouse gas emissions.

The mitigation challenge

The agriculture sector is a significant emitter of greenhouse gases. It is important that ways be found to encourage a reduction in the greenhouse gas emissions intensity of agricultural production in order to help meet the cuts in global emissions required to reach stabilisation of greenhouse gases in the atmosphere at a level that avoids the worst impacts of climate change.

In addition to contributing to reductions in direct emissions, the agriculture and forestry sectors can play a significant part in meeting overall emissions reduction targets in both the short and long term due to the fact that both sectors can provide significant capacity as carbon sinks.

Far more than a 'reduction in emissions' is required to tackle climate change.

As previously stated, there is no reason for agricultural sector to continue as a net emitter of greenhouse gases. Even if emissions from industrial and other sectors can be substantially reduced, they will continue at some level.

There is also a large 'legacy load' of CO_2 which cannot be reduced by either adaptation or mitigation, but can be substantially reduced by effective sequestration

The most beneficial mitigation strategy for climate change would therefore be one that focuses on sequestration.

Until recently, effective methodologies for the sequestration of large volumes of carbon dioxide were not known.
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However, these sectors have some unique characteristics, summarised below, which make mitigation difficult:

_ **Diffuse sources and sinks:** While significant at the national scale, agriculture and forestry emissions sources and sinks are often small, diffuse and difficult to measure and verify at the individual entity level. Sources and sinks are frequently small relative to the measurement effort required.

Do not agree that potential carbon sinks in the agricultural sector are small or difficult to measure.

The implementation of biologically-based broadacre cropping practices such as Pasture Cropping and/or the use of compost teas and microbial stimulants in place of fossil-fuel based fertilisers, can lower input costs markedly and increase net carbon sequestration rates by orders of magnitude.

With soil biology friendly farming, there even exists the potential for achieving levels of soil carbon higher than those recorded under remnant native vegetation.

For example, in 2007, soil carbon stocks of 516 t C/ha were recorded on a broadacre cropping ASCAS site north of Clermont in central Queensland, compared with 149 t C/ha in nearby native vegetation. The concentration of carbon in the 0-110 cm profile of the biologically farmed soil ranged from 3 to 4%, while the soil carbon content under native vegetation was in the order of 1%.

Similarly, on extensive grazing lands, managed grazing can markedly improve soil carbon content in comparison to the Australian 'default' option of set-stocking, which has resulted in land degradation and soil carbon loss on a massive scale since European settlement.

In 2007, a soil carbon content of 5.86% was measured in the topsoil of an intensively grazed (high density short duration) ASCAS site south of Biloela, Queensland, after 7 years of below average rainfall. The highest recorded value available for native vegetation on a similar soil type was 4.9% under native vine scrub.
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A significant challenge for both governments and industries is to develop policies and approaches that promote the uptake and adoption of mitigation measures on-farm. Even win-win agricultural mitigation practices will often require an initial upfront investment which may discourage uptake in the absence of any direct financial incentives, government regulations or industry-wide standards.

Questions for consideration

What potential is there for mitigation in the agriculture sector in the short term? What practical options for mitigation are likely to become commercially viable in the near future?

As indicated elsewhere in this submission there exists a large potential for soil carbon sequestration which simultaneously deals with both adaptation and mitigation.

Data presented in the previous section indicate that levels of soil carbon sequestration may be higher than previously assumed. Adaptation and mitigation strategies based on the implementation of practices designed to sequester soil carbon would not only be costless, but of positive economic benefit.

These practices will have short, medium and long term benefit
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What incentives, policy innovations and/or market-based mechanisms would guarantee an optimal contribution to the national mitigation effort?

The ASCAS project is an innovative market-based mechanism that guarantees optimal contribution to the national effort by encouraging maximum sequestration and retention of carbon.

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3.3 Practical considerations for including agriculture and forestry in an emissions trading scheme

There are a number of potential practical difficulties to the inclusion of agriculture and forestry in an emissions trading scheme. A summary of the potential advantages and practical difficulties of including forestry and agriculture in an emissions trading scheme is provided in Table 1. Some key design elements are discussed further below.

Table 1 Summary of the potential advantages and practical difficulties for the inclusion of agriculture and forestry in an emissions trading scheme

Efficiency

Inclusion of all sectors in a domestic ETS would enable the pursuit of greenhouse gas reductions at a lower overall cost.

Inclusion of agriculture in both domestic and international emissions trading schemes would enable practitioners of regenerative agriculture to gain additional farm income from soil carbon sequestration. The adoption of innovative farm practices would have net financial benefit to the nation.

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Difficulty in applying traditional regulation techniques

The cost and value of mitigation options varies considerably between individual entities, and is therefore difficult to apply traditional regulatory measures.

Appropriately managed farmlands would be carbon sinks rather than sources, thus regulatory measures would not be required if incentive options were used instead.

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Mitigation incentives

Market-based mechanisms provide incentives and flexibility for mitigation.

Agree. The ASCAS model is based on financial reward from the private sector, creating a collaborative and progressive market based instrument to help address a wide range of environmental issues, not the least of which is climate change. Receipt of Soil Carbon Incentive Payments (SCIPS) is similar to being paid 'on delivery' for livestock or grain, with the bonus being that sequestered carbon remains in soil, conferring multiple landscape health and productivity advantages. Soil Carbon Incentive Payments are calculated at one-hundredth the 100-year rate ($25/tonne CO2-e).

Over 400 landholders enquired about joining ASCAS within one week of the project launch in March 2007. The list of requests for inclusion grows weekly.

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Opportunities for landowners

Landowners could gain from participating in an ETS if it provides further opportunities for land management and access to the international carbon market.

Agree. The launch of the ASCAS project was the first step in a validation and verification process designed to enable access to both a domestic ETS and international markets.

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Economies of scale

The cost and complexity of determining emissions reductions from individual projects as required by existing voluntary offsets schemes may discourage involvement. The devlopment of verification and measurement rules as part of inclusion in an ETS could therefore increase overall mitigation.

Agree

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Knowledge gaps regarding mitigation capacity and cost
The costs of mitigation in agriculture are relatively unknown in an Australian context. If mitigation options are limited and costly, inclusion of agriculture and forestry in an ETS could increase the cost of mitigation for other sectors included in the scheme.

Rather than increase costs, mitigation via the adoption of regenerative soil building practices would bring net financial benefits (refer earlier comments)

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Capacity to administer
The ability of small individual landowners to meet requirements and actively participate in an ETS could be limited and/or administratively burdensome.

Agree. An Australian soil carbon aggregator is required (ASCAS?)

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International consistency
Land-use, land-use change and forestry emissions and their accounting have been widely debated during the Kyoto process. Rules inconsistent with international processes could confuse the market and limit international trading.

Confusion surrounding LULUCF soils discussions have arisen in part because the data used to develop models such as Roth C have been derived from dead and dying soils. The measurements taken on dysfunctional soils – and the models derived from them, show, as would be expected, that soil health is declining and that the agricultural sector is a net emitter of CO_2.

Carbon building utilises a different biological pathway than carbon loss. Hence models derived for soil carbon loss are inadequate for explaining soil carbon sequestration.

Data from the ASCAS project will enable models such as Roth C to be recalibrated.

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Liability for landowners
If agriculture and forestry are included in an ETS, landowners will then become liable for emissions and ensuring the permanency of carbon sinks.

Land management conducive to soil building and soil carbon sequestration will simultaneously reduce agricultural emissions –and create the soil environment required for permanency – and continual enhancement – of soil carbon sinks.

Building stable soil carbon is a four-step process that begins with photosynthesis and ends with humification (Jones 2007). The humification step is absent from most broadacre agricultural production systems.

Humification is a process whereby products of microbial activity interact with soil minerals to form humus, a complex, high molecular weight material that is inseparable from the soil matrix. Once carbon is sequestered as humus it has high resistance to microbial and oxidative decomposition.

Humified carbon differs physically, chemically and biologically from the labile pool of organic carbon that typically forms in agricultural soils. Labile organic carbon arises principally from biomass inputs (such as crop residues) which are readily decomposed. Conversely, most humified carbon derives from direct exudation or transfer of carbon from plant roots to mycorrhizal fungi and other symbiotic or associative microflora.

The biological soil environment required for humus formation is commonly found in Yearlong Green Farming systems (such as Pasture Cropping and/or the managed grazing of perennial grasses).

The soil conditions required for humification are diminished in the presence of herbicides, fungicides and phosphatic and nitrogenous fertilisers – and enhanced in the presence of humic substances such as humic and fulvic acid, microbial foods and biologically friendly products such as compost teas and microbial inoculants. It is possible for humification to occur in annual cropping systems provided soil is kept covered at all times and biologically-based fertilisers are used rather than products which have anti-microbial effects.

Ensuring the permanency of carbon sinks simply equates to good land management.

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Sectoral diversity
The agriculture and forestry sectors cover a diverse range of production systems, entity size and location. Different groups will be impacted differently, which may add complexity to the design of an ETS.

The ASCAS project is coordinated by regional NRM groups, reducing much of the complexity inherent in attempting to develop a 'one-size-fits-all' approach. The processes for soil carbon sequestration are the same world-wide, but the methods for achieving the desired outcome will vary regionally.

The ASCAS protocols for site selection, soil sampling and soil testing ensure that soil carbon sequestration is measured, interpreted and financially rewarded in a uniform manner across the continent.
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Point of obligation

Determining the extent of coverage and the point of obligation in an ETS can have a significant impact on the cost and efficiency of the scheme. Due to the difficulties associated with monitoring at the farm level, the cost to an individual of trading a small number of permits may be higher than the benefit – it is unlikely that individual landowners would find it economic to trade. Having hundreds of small participants may also affect the overall efficiency of the market (DEFRA, 2006).

Potential design options include:

_ Involve groups of farmers, trade bodies or downstream wholesalers such as abattoirs or manufacturers;

_ Establish brokerage bodies that specialise in the purchase of permits from small operators – such as the 'Offset Aggregators' under the CCX (see Box 3.2); and

_ Make initial participation in the scheme (including liability for emissions) voluntary, encouraging involvement only from those that would benefit, or are willing to take the risk. This approach has been proposed by the New Zealand Government for land managers wishing to get credit for post-1989 afforestation (Appendix A).

Agree. An Australian soil carbon aggregator is required (ASCAS?)
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Box 3.2. Chicago Climate Exchange (CCX) - Offset Aggregators

Monitoring and verification of emissions and mitigation

As mentioned above, the costs of accurately monitoring and verifying emissions at entity level is likely to be high relative to the level of emissions. This increases transaction costs which reduces trade, and in turn reduces efficiency.

To reduce the costs of monitoring and verification, proxies can be developed that use readily observable and measurable inputs/outputs to the process that can be correlated with the level of emissions. Examples include the number of cattle on a farm or the amount of fertiliser applied.

DO NOT AGREE WITH THESE PROXIES!!

i) Number of cattle is NOT relevant. Whether land behaves as a source or a sink for carbon depends on how livestock are MANAGED, not on how many are present. Under appropriate grazing regimes, more carbon is sequestered in soil as humus than emitted to the atmosphere as methane. This calculation takes into account the significantly higher global warming potential of methane in comparison to carbon dioxide.
ii) The amount of fertiliser applied is NOT relevant. However, the TYPE of fertiliser used is of fundamental significance. Refer to last paragraph of response under section heading 'Liability for landowners' on previous page
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However, these indirect approaches may lead to errors in emissions calculations if the relationship between the proxy and emissions is uncertain; do not take into account the high level of variation that can occur within the chosen proxy – particularly where natural systems are involved; and may not provide incentives for the adoption of technology and/or practices that change the relationship between the proxies and emissions. This would reduce incentives for the adoption of new technologies or practices.

Agree
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Potential design options include:

_ Developing simple, standardised rules for issuing credits for agricultural and forestry emissions, such as those developed by the Chicago Climate Exchange (see Box 3.3).

Do not agree.

The CCX proxy system is based on 'lowest common denominator' formulas.

This approach acts as a disincentive to the maximisation of soil carbon sequestration.

Further, the CCX price for carbon is extremely low.

These factors make CCX neither attractive nor financially rewarding for participation by individual entities and would be unlikely to encourage innovation in the agricultural sector.

An analogy would be to say "the average wheat yield in NSW is 1 t/ha, therefore every producer will be paid for this yield irrespective of how much wheat they actually produce".

If we are serious about mitigating the causes and effects of climate change, landholders need to be rewarded for <u>every tonne</u> of CO_2 sequestered (and provided with appropriate information on how to achieve high sequestration rates) so that "trading in tonnes' of CO_2 will one day become an additional income stream.

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_ Use an on-farm accounting model such as 'OVERSEER' (developed by the New Zealand Government) or 'FullCAM' (developed by the Australian Greenhouse Office). However, research has suggested that models such as these can be complex, technically demanding, time consuming and do not produce results accurate enough for trading purposes (Allen Consulting Group, 2006).

Agree that these models are complex and time consuming.

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_ Define a benchmark based on regional and sectoral 'best-practice' emissions intensity levels, which would be revised and updated as technology improved (Kerr, 2007).

This is a possibility, provided good regional databases for sequestration rates under regenerative regimes exist.

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_ For forestry, use a mixture of satellite imagery and self-reporting to initially quantify the area of planting or clearing. Planted areas could then be monitored to determine age/species and multiplied by a standard carbon stock value

For soil carbon sequestration, remote sensing via satellite imagery could assist with verification of agricultural land management regimes and quantification of areas involved.

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Questions for consideration

What 'proxies' would be appropriate for the estimation of emissions in the agriculture and forestry sub-sectors?
What systems are available that would allow for efficient and accurate monitoring of emissions at the operator level?
What are the implications if the stringency of monitoring, reporting and verification requirements vary between sectors and sub-sectors?

Suggest proxies are not appropriate.

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Questions for consideration

Phasing and timing

The potential advantages and difficulties described in Table 1 suggest that it may be difficult to include agriculture and forestry as full participants in a cap and trade ETS in the first phase of implementation.

Do not agree.

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An option could be a transitional approach in order to allow testing of a range of implementation solutions without impacting on the main ETS. This could involve the following stages (LWA, 2007, DEFRA, 2006, Keogh, 2007):

_ Stage 1: Initial period of research and development, while participating in an ETS through the provision of offset credits. The high transaction costs of one-off accreditation for offset creation could disadvantage smaller entities.

_ Stage 2: Development of a stand-alone, baseline-credit scheme, possibly with voluntary involvement to encourage adoption of best management practices. A stand-alone scheme would not necessarily require the same level of emissions accuracy as the main ETS.

The Australian Soil Carbon Accreditation Scheme (ASCAS) is a stand-alone, baseline credit scheme with voluntary involvement which encourages the adoption of innovative soil building practices.

Monitoring costs are partially offset by participating NRM groups (the cost of monitoring is outweighed by the catchment benefits of improved soil health, agricultural productivity, water quality and landscape function).

Annual payments to landholders based on measured soil parameters provide incentive for maximising soil carbon sequestration and maintaining permanency of sinks.

Experienced soil technicians within the Departments of Agriculture and Food (WA) and Primary Industries and Fisheries and Natural Resources and Water (Queensland) are involved in site selection and field collection of baseline soil samples. Laboratory analyses are undertaken by NATA accredited Environmental Analysis Laboratories, Southern Cross University, Lismore NSW.

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_ Stage 3: Full participation of agriculture and forestry in a cap-and-trade ETS, where the sectors will become liable for emissions as well as providing credits to the scheme, supported by research and experience gained in the earlier phases, and subject to comparable treatment by competitors in major markets for internationally tradeable farm products.

Agree

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Questions for consideration

If a domestic ETS excludes agriculture and forestry initially, but includes them at a later point in time:

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What are the advantages/disadvantages of involving these sectors in the scheme through the inclusion of offsets, or an 'opting in' baseline and credit trading scheme?

_ What sort of transitional arrangements should be incorporated in the initial design?

See comments above re ASCAS – the' transition' is already underway.

The ASCAS project will begin to take an international perspective during 2008, working with government and non-government agencies in South Africa, China, New Zealand, UK and USA.

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3.4 Recognition of carbon sinks and offsets

The agriculture and forestry industries have considerable potential to provide carbon sinks through changes in land management practices. The development of an appropriate framework to provide incentives for these activities will encourage greater overall mitigation and provide these sectors with new opportunities and an alternative source of revenue.

Agree 100% as far as the agricultural sector is concerned.

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