Submission to Senate Standing Committee on Rural and Regional Affairs and Transport

Inquiry into Climate Change and the Australian Agricultural Sector

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

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The Secretary
Senate Standing Committee on Rural and Regional Affairs and Transport
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This submission addresses the following Terms of Reference

I. the scientific evidence available on the likely future climate of Australia's key agricultural production zones, and its implications for current farm enterprises and possible future industries;
II. the need for a national strategy to assist Australian agricultural industries to adapt to climate change; and
III. the adequacy of existing drought assistance and exceptional circumstances programs to cope with long-term climatic change

Sincerely

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Executive Summary

This submission outlines a strategy for effectively dealing with both climate change and rising input costs in the Australian agricultural sector.

With appropriate changes to land management, agricultural soils have the capacity to sequester large volumes of atmospheric carbon, significantly enhancing productivity, nutrient dynamics, plant and animal health, grain quality, water balance and biodiversity, while reducing the levels of carbon dioxide that impact on the greenhouse effect, global warming and climate change.

Rebuilding robust agricultural soils would enhance the resilience of the Australian landscape to withstand changes to climate, while also improving regional, national and international food security. Expenditure on fuel, fertiliser and chemical inputs would be significantly reduced.

Additionally, restoring soil function provides farmers and graziers with new financial opportunities, reducing or eliminating the need for drought assistance and exceptional circumstances programs.

As a bonus, sequestering carbon in soils represents a practical, permanent and productive solution to removing excess CO2 from the atmosphere. It would require only a 0.5% increase in soil carbon on 2% of Australia's agricultural land to sequester all greenhouse gas emissions.

That is, the annual emissions from all industrial, urban and transport sources could be sequestered in farmland soils if incentive was provided to landholders for this to happen.

A brief overview of the Australian Soil Carbon Accreditation Scheme (ASCAS) is included as an example of an initiative designed to provide proof of concept that: -

- innovative soil management practices exist for sequestering soil carbon
- improvements in soil carbon and soil health can be measured
- landholders can be financially rewarded for building soil carbon

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), by adopting regenerative soil-building practices.

RESPONSE TO TERMS OF REFERENCE

I. The scientific evidence available on the likely future climate of Australia's key agricultural production zones, and its implications for current farm enterprises and possible future industries

There has been a notable 'climate shift' in many of the arable regions of eastern, southern and western Australia. A trend to drier winter and spring seasons has increased production risks for annual cereal crops, while the greater incidence of episodic high intensity rainfall events in summer has heightened the vulnerability of bare fallows to erosion.

Below average rainfall experienced in many regions over the last 7-10 years has severely impacted on the financial viability of cropping and grazing enterprises and disrupted the social fabric of rural communities.

These events have highlighted a fundamental lack of resilience in current agricultural production systems.

In little over 200 years of European settlement, more than 70 percent of Australian agricultural land has become seriously degraded. Despite efforts to implement 'best practice' in soil conservation, the situation continues to deteriorate.

On average, 7 tonnes of topsoil is lost for every tonne of wheat produced. This ratio has most likely worsened in recent years due to an increased incidence of erosion on unprotected topsoils, coupled with declining yields.

Over the last 50 years, the organic carbon content of Australian agricultural soils has declined between 50% and 80% (Russell & Williams 1982; Dalal & Mayer 1986a; Watson et al. 2000; Dalal & Chan 2001; Dalal et al. 2004).

Soil carbon is the prime determinant of agricultural productivity, landscape function and water quality (Jones 2007). Carbon losses of this magnitude therefore have immeasurable economic and environmental implications.

Current 'best practice', that is, chemically-based zero-till broadacre cropping (Fig.1) does not provide a suitable environment for biological nitrogen fixing, active sequestration of humified soil carbon, or soil building.

Fig.1. *Current 'best practice'. Chemically based zero-till farming lacks essential requirements for the biological fixing of nitrogen, sequestration of humified soil carbon and building new topsoil.*

The most meaningful indicator for the health of the land, and the long-term wealth of a nation, is whether soil is being formed or lost. If soil is being lost, so too is the economic and ecological foundation on which production and conservation are based.

Discussions on adapting to climate change are irrelevant unless they focus on rebuilding healthy topsoil.

There is little information available for farmers as to how to increase the levels of air, water and organic materials in soil. This may explain why it is commonly believed that new topsoil cannot be formed.

Healthy groundcover, active root growth and high levels of microbial association, are fundamental to the success of any endeavour to build new topsoil. Fortunately, highly effective land management practices such as pasture cropping, a technique in which annual grain or fodder crops are direct-drilled into perennial groundcover, have become available to Australian farmers over recent years (Fig.2).

Fig.2. *The 'new face of agriculture'. Annual grain crops direct-drilled without herbicide into perennial groundcover enhance plant-microbial associations, vastly improve rates of biological N fixation, facilitate rapid sequestration of highly stable, humified soil carbon and stimulate the formation of new topsoil.*

The essential first step to rebuilding topsoil is to maximise photosynthetic capacity. A permanent cover of perennial plants provides an ongoing source of soluble carbon for the soil ecosystem, buffers soil temperatures, reduces weeds, prevents erosion, improves porosity, enhances aggregate stability and water infiltration, slows evaporation and 'conditions' the soil for the production of healthy, high quality, over-sown annual crops.

The soluble carbon exuded into the rhizosphere by perennial groundcover plants and/or transported deep into soil by mycorrhizal fungi, provides energy for the vast array of microbes and soil invertebrates that produce sticky substances enabling soil particles to be glued together into lumps (aggregates). When soil is well aggregated, the spaces (pores) between the aggregates allow the soil to breathe, as well as absorb moisture quickly when it rains. A healthy topsoil should be 'more space than stuff', that is, less than 50% solid materials and more than 50% spaces.

Friable, porous topsoils make it easier for plant roots to grow and for small soil invertebrates to move around. Well-structured soils retain the moisture necessary for microbial activity, nutrient cycling and vigorous plant growth and are less prone to erosion. Soil structure is very fragile and soil aggregates are continually being broken down. An ongoing supply of energy in the form of carbon from the rhizosphere exudates of actively growing plants and, to a lesser extent, decomposing organic materials, enables soil organisms to flourish and produce adequate amounts of the sticky secretions required to maintain soil structure and function.

Healthy, chemical-free soils also create appropriate conditions for humification (conversion of soluble carbon to humus), a process which does not occur in most conventionally managed agricultural soils.

Further, the carbon and water cycles are inextricably linked. Humus holds approximately four times its own weight in water (Morris 2004). The most beneficial adaptation strategy for climate change would therefore be one that focuses on increasing the levels of both carbon and water in soils.

Fig. 3*. Modern machinery is well suited to sowing annual grain crops into perennial groundcover, a technique known as 'pasture cropping'*

There is no valid reason for the Australian agricultural sector to be a net emitter of CO_2.

Cropping into a perennial groundcover base is a one-pass operation that markedly reduces fuel costs and largely eliminates the need for fossil-fuel based herbicides, fungicides and pesticides. "Biology friendly' fertilisers are highly recommended, further reducing the carbon footprint.

By adopting regenerative soil-building practices, it is practical, possible and profitable for broadacre cropping and grazing enterprises to record <u>net sequestration</u> of carbon in the order of 25 tonnes of CO_2 per tonne of product sold (after emissions accounted for).

II. The need for a national strategy to assist Australian agricultural industries to adapt to climate change

There is an urgent need for a national strategy to assist Australian agricultural industries to adapt to climate change. To be effective, this strategy will require a radical departure from 'business as usual'.

Fundamental redesign of agricultural production systems would enable the sequestration of more carbon and nitrogen than is being emitted, restoring richness to farmed soils and assisting the agricultural sector to deal confidently with a changing climate.

'Redesign' will require effective methodologies for the long-term sequestration of large volumes of atmospheric carbon dioxide as humified soil carbon.

Over the last decade the key people working to develop soil building strategies have been declined funding from major R&D corporations due to 'expert scientific advice' stating that it is not possible to build stable soil carbon. This inaccurate belief is based on data collected from research stations where 'depletion type' agricultural practices such as chemically-based zero-till cropping are undertaken (as depicted in Fig.1).

Australian Soil Carbon Accreditation Scheme (ASCAS)

To overcome continuing blocks to progress, Dr Christine Jones launched the Australian Soil Carbon Accreditation Scheme (ASCAS) in March 2007. ASCAS is a stand-alone incentive scheme with voluntary involvement, which encourages the adoption of innovative soil building practices. Widespread implementation of techniques developed by leading-edge landholders (as depicted in Figs.2 and 3) will transform the agricultural sector. Adoption of these processes needs to be fast-tracked.

ASCAS is 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.

Incentive payments for annual measured increases in soil carbon above baseline levels have been sourced from a private donation by Rhonda Willson, Executive Chairman, John While Springs (S) Pte Ltd, Singapore. 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).

Annual payments to landholders based on measured soil parameters provide incentive for maximising soil carbon sequestration and maintaining permanency of sinks. The ASCAS project has attracted financial support from highly regarded industry benefactors keen to see improvements in soil carbon rewarded through the inclusion of agriculture in national and international emissions trading schemes.

Monitoring costs are partially offset by participating NRM groups (the cost of monitoring is balanced by catchment benefits including improved soil health, agricultural productivity, water quality and landscape function). NATA accredited Environmental Analysis Laboratories, Southern Cross University, Lismore, NSW and CSBP, Perth, WA, undertake laboratory analyses. Participating state agencies include WA Department of Food and Agriculture, NSW Department of Primary Industries and Queensland Department of Primary Industries and Fisheries.

Expansion of ASCAS

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

ASCAS team leaders are well versed in the management techniques required to facilitate soil carbon sequestration via the humification of soluble carbon. Additional demonstration farms where annual broadacre crops are being grown successfully in a perennial base, combined with workshop tours involving leading edge innovators, will facilitate extension and further adoption. These activities will be backed by rigorous scientific evaluation of soil carbon, water, nutrients and crop yield under regenerative regimes.

III. The adequacy of existing drought assistance and exceptional circumstances programs to cope with long-term climatic change

Ongoing handouts to farmers struggling to maintain business as usual do little for either the national balance sheet or landholder self-esteem.

It is possible that global warming could accelerate even more rapidly than observed to date, increasing the financial burden on government for drought assistance.

Improved resilience of the resource base would overcome much of the requirement for drought assistance and exceptional circumstances payments.

Rather than increase costs, mitigation of climate change via the adoption of regenerative soil building practices would bring net financial benefits to landholders and rural communities (the sectors hardest hit by climate change)

A change to farming in a perennial base has many advantages, including

- same or better yield than chemical fallow or cultivation-style farming
- fewer inputs, resulting in higher gross margins per hectare
- less reliance on fossil fuel-based fertilisers and farm chemicals
- enhancement of natural soil building processes
- ‘reverse’ carbon footprint - more carbon sequestered than emitted
- ‘reverse’ nitrogen footprint - more nitrogen fixed then emitted
- increased water use efficiency due to lower evaporative demand
- improved soil water balance due to hydraulic lift and hydraulic redistribution
- no bare soil for weeds to grow - paddocks virtually weed-free
- reduced financial risk - no expenditure if a crop is not sown
- additional income stream from harvest and sale of perennial grass seed
- more time for family - no need for cultivation or herbicide application
- higher biodiversity of plants and animals (eg bettongs returning on some farms)
- incentive for all members of the farm family, including children, to become involved

Improved agricultural productivity and profitability would translate to reduced requirements for government assistance. Furthermore, farming in a perennial base would enhance the resilience of the agricultural landscape to a wide range of climatic extremes, some of which may not even have been encountered to date.

The development of an appropriate incentives framework for regenerative agricultural activities would reverse the farm sector's carbon and nitrogen footprints (more C and N sequestered than emitted) and improve food security in a warming, drying environment.

An overview of the Australian Soil Carbon Accreditation Scheme has been provided as an example of an incentive-based (rather than regulatory) approach.

The ASCAS project supports soil restoration by providing financial incentive for landholders to move away from 'business as usual' (that is, carbon depleting activities) and by improving community knowledge on effective methods for building soil carbon.

Widespread adoption of productive and resilient agricultural practices that enhance net sinks for atmospheric carbon would have a revitalising effect on the natural resource base and provide a financial benefit to government, individuals and rural and regional communities.

Irrespective of climate change, it would be of enormous economic benefit to the Federal Government to encourage the agricultural sector to rebuild soils by implementing practices that increase levels of humified soil carbon and reduce reliance on fossil fuels.

In 1937, Franklin Roosevelt noted *"The nation that destroys its soil destroys itself"*

The future of Australia depends on the future of our soil.

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