

**REPORT ON THE PROCEEDINGS FROM THE CARBON MANAGEMENT FORUM
HELD ON 19 OCTOBER 2010**



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Executive Summary

Almost daily we are told that Australia and the world is running out of time to address climate change and a related series of challenges, that include to our water and food security, land degradation, future energy options, our globe's increasingly unsustainable population and resource demands and the need to double our food production. Carbon is seen to be at the heart and cause of many of these problems, it is also their solution. Carbon as the fundamental building block of life, must also be a key element in fostering the stable climate and bio-systems upon which our wellbeing and survival depends.

Although debate on many levels continues, the science is clear. CO₂ levels have risen recently. Further, our land continues to degrade, fundamentally altering the hydrology of our soils and landscape and contributing to the increasing warming our climate. Thus it is vital that the carbon is put back into our soils to restore their hydrology, bio-productivity, resilience and facilitate carbon sequestration. This would:

- Reduce CO₂ levels to below 350 parts per million (ppm) to secure a safe climate;
- Restore the capacity of our soils and landscapes to retain and supply the water we need and support healthy vegetation essential for the photosynthetic draw down of atmospheric carbon; and
- Secure the future of our water and food supplies and therefore the stability of the increasing populations that will be dependent on them.

Currently Australia emits some 160 million tonnes of carbon annually (160 mil tC/an). This is only 1.6% of the global net carbon deficit of 10 bil tC/an but Australia has further responsibilities:

- Our advanced affluent society has one of the highest per capita emission rates globally.
- Our indirect emissions through exporting of over 300 mil t/an of coal as well as gas is a factor.
- Planned doubling of these coal and gas exports in the near future will further exacerbate the problem.
- Australia's extensive and relatively undeveloped land areas available for the bio-sequestration of carbon could provide a major offset.
- Our advanced technological capabilities could help address this global imperative.

To meet our international responsibilities Australia should aim to bio-sequester at least 1 billion tonnes of carbon annually (1 bil tC/an). The best option to achieve this is to emulate nature as much as possible by regenerating the photosynthetic capacity of our often degraded bio-systems. Australia has some 770 million ha of land and over 500 million ha of this has been farmed at various intensities, with around half of the farmed land being variably degraded. Consequently, by regenerating even 20% of this farmed land at the conservative rate of 10 tC/ha/an, Australia could potentially bio-sequester 1 bil tC/an to

meet our sequestration target. Regenerating these degraded soils could substantially contribute to the global carbon draw down target, while also helping to secure essential water, food and social stability.

Practical examples of land management changes that have realised improved soil health through the increased sequestration of carbon, water use efficiency, resilience and profitability through the recent drought conditions, are evident in Australia. They are not well acknowledged but were presented and discussed during the forum. The importance of documenting, demonstrating and promoting these innovations will be fundamental to realising the adoption of these leading practises more widely across Australia.

A number of impediments to adopting these practises were also highlighted, ranging from a complex regulatory environment, the current education approaches, limited research and development (R&D) capacities, through to competing commercial interests. These impediments will need to be considered carefully and the targeted use of incentives introduced to provide the essential catalyst for change.

A price on carbon is considered to have great potential. A preferred model for structuring and implementing such an effective incentive scheme that directly links those seeking CO2 offsets with those providing credits through their land management activities was discussed in detail. The Net Emissions Reduction Scheme, based on a forward price signal on an escalating schedule, leaves responsibility with the CO2 emitters, has the capacity to drawdown legacy emissions, whilst allowing the Australian Government to play its role in delivering nationally funded R&D programs to the wider benefit of Australia.

The challenges we face in dealing with a changing climate, land degradation, food and water security and the needs of increasing global populations are unprecedented. The good news is that solutions do exist in Australia now. We need to support the land management innovators with sound policy, research and incentives to ensure that Australia can play its leading role in providing these solutions both regionally and globally.

Carbon Management Forum
Media Room, Department of Agriculture Forestry and Fisheries
18 Marcus Clarke St Canberra 2601
19 October 2010

Agenda

9:00-9:30	Registration and Welcome	
9:30-9:50	1. Our carbon management imperative	MajGen (ret) Michael Jeffery, Chairman OutComes Australia (OA)
9:50-11:00	2. Realizing this challenge and targets <ul style="list-style-type: none"> • Underpinning the functioning of the biosystem. • Australia’s land availability and needs • Working with nature at ‘Lana’ • The practical verification of soil carbon increments • Incentives to achieve the 1 bTC/an draw down target • Proactive carbon farming in a variable climate • Key customers and demands driving such changes • Communicating a strategic blueprint and benefits 	Simon Gould, OA <ul style="list-style-type: none"> • Walter Jehne, Microbiologist, Healthy Soils Australia (HSA) • Tom Nicholas, Farmer HSA • Tim Wright, Farmer • Rob Gourlay • Walter Jehne • Dianne Haggerty, Farmer • John White • Jennie Cameron, OA
11:00-11:30	Morning Tea	
11:30-12:45	3. Q & A analysis of key issues and options	Bill Hurditch, Consultant, Fifth Estate
12:45-13:30	Lunch	
13:30-14:00	4. Action priorities for catalysing the needed change	MajGen (ret) John Hartley, Executive Director Future Directions International
14:00-14:30	5. Next step actions in key areas.	Simon Gould
14:30-15:00	6. Meeting our carbon management objectives	Michael Jeffery

Welcome and Introduction

Simon Gould acknowledged the Ngunnawal people, the traditional owners and welcomed all attendees to the forum, particularly noting those participants who had travelled from regional and remote areas of Australia.

1. Our Carbon Management Imperative – General (ret) Michael Jeffery

Mr Gould introduced Major General (ret) Michael Jeffery to address Forum participants.

General Michael Jeffery welcomed all attendees to Outcomes Australia's second national strategic forum and noted in particular those participants who had travelled from Western Australia, Queensland and Tasmania.

General Jeffery commented that an earlier forum discussed the issue of water management and in particular how to prevent the wasteful and needless evaporation of some 50% of our annual rainfall, amounting to around 25 times the quantity of water held in all our dams, and caused in the main through inappropriate landscape management practices. The forum promoted the need to substantially reduce evaporation by improving soil health and structure. Water infiltration, increased plant biodiversity and the natural cooling of the landscape were all seen as the direct result of healthy soils. This retention of water in soil protected by year round ground cover would also impact positively on climate change.

He suggested that a key to healthy soils - including water management – is in the proper management of its carbon content, and this subject including its implications for climate change was the focus of the day's discussion.

He asked: 'So what are the challenges we face, how can we better understand them and can this provide more effective response options to allow us to move beyond our relative inertia in this area?'

He said that almost daily we are told that Australia and the world is running out of time to address climate change and a related series of challenges, including to our water and food security, land degradation, future energy options, our globe's increasingly unsustainable population and resource demands and the need to double our food production.

General Jeffery stated that although carbon is seen to be at the heart and cause of many of these problems, it is also their solution. Certainly carbon as the fundamental building block of life, must also be a key element in fostering the stable climate and bio-systems upon which our wellbeing and survival depends.

Our challenge from Climate changes

General Jeffery said that for fifty years we have watched atmospheric levels of carbon dioxide (CO₂) accelerate and we are now at 390 ppm, 35% higher than the pre-industrialization levels of 280 ppm. Attendees noted that based on advice from the

Intergovernmental Panel on Climate Change, the IPCC, these increased CO₂ levels now risk inducing serious greenhouse warming and climate changes within decades.

General Jeffery stressed that as leading climate scientists such as James Hansen from NASA highlighted, rather than just slowing down or reducing future emissions by 5% or even 40%, we must reduce global CO₂ levels from their current 390 ppm to below 350 ppm urgently to secure a safe climate. He added that Australia is faced with earlier and more serious impacts from global warming than most other nations.

Attendees were informed that since the 1970s, south-western Western Australia, and now much of southern Australia is becoming more arid and, despite the recent rains, this process still threatens the viability of much of our landscape and the bio-systems, agriculture and food supplies that we, and our 60 million global export customers, depend on. Similar aridity is also impacting other regions, crops and communities in China, India, Africa, the US and even Russia, seriously threatening global food security and the natural link to social stability.

General Jeffery highlighted the importance of understanding, responding and adapting to these risks and new realities urgently. Given that climate change is already impacting via such drying of the landscape, our climate and water challenges may need to be seen as one. He asked: can carbon contribute in its common solution?

He noted that, more than ever, water must be respected not only as our vital natural and national strategic asset, but also as our key priority in minimizing the impacts of climate changes and securing our future, adding that as rainfalls decline, it is critical that we conserve and more effectively use every drop.

The attendees were advised that during discussions at Outcomes Australia's Water Management Forum in March 2010 it was agreed that this can only be done by using carbon intelligently to rebuild our soil health and its 'in-soil reservoir' capacities.

General Jeffery asked participants to note that for every 100 raindrops that fall on Australia, 98 of those drops fall on soils, adding that 50% of rain wastefully evaporates due to inadequate land management practices.

Attendees noted that most rain was retained in well-structured soils due to their high organic matter contents. These soil structures and 'in-soil reservoirs' were critical in:

- Buffering against extremely high evaporation losses.
- Sustaining the unique bio-productivity and resilience of our animal and plant life.
- Slowly and continuously recharging our billabongs and streams from underground; and
- Ensuring greater resilience in our landscape.

General Jeffery said that by severely degrading soil structures and organic matter levels over the past 200 years of agriculture we have greatly impaired the 'in soil reservoir' and the

robustness of our natural hydrology and landscape, therefore greatly increasing our flood runoffs, sheet and gully erosion and accentuated the increasing aridity of our landscape. He noted that we have not and will not solve this degradation, nor our water crisis, using the many billions of taxpayer dollars used to buyback 'entitlements' to virtual water from dry dams at the end of pipe. He emphasised that the issue can only be solved by regenerating our soil structures, 'in-soil reservoirs' and landscapes so that farmers, the landscape, end of pipe users and our rivers again have access to the 50 out of 100 raindrops that are currently lost to evaporation due to our past soil degradation. He added that this can be done by restoring the former natural organic matter levels in our soils which govern their structure, water holding capacity and much of our natural hydrology.

Forum participants noted that every extra gram of carbon that can be drawn down from the atmosphere back into the stable soil organic matter sinks can potentially hold up to 8 grams of extra water.

He asserted that how well we do this over the next decade right across the Australian landscape will largely govern the health and viability, not just of our soils and landscape, but also our communities and national economy.

General Jeffery commented that the science is clear. CO₂ levels have risen recently. Further, our land continues to degrade, fundamentally altering the hydrology of our soils and landscape, contributing to the increasing warming our climate. He stressed that it was vital that the carbon is put back into our soils to restore their hydrology, bio-productivity, resilience and facilitate carbon sequestration. This would:

- Reduce CO₂ levels to below 350 ppm to secure a safe climate;
- Restore the capacity of our soils and landscapes to retain and supply the water we need and support healthy vegetation essential for the photosynthetic draw down of atmospheric carbon; and
- Secure the future of our water and food supplies and therefore the stability of the increasing populations that will be dependent on them.

Carbon Management Forum objectives

General Jeffery stated that the objective of the carbon management forum was to identify and refine the practical actions on how to draw down this carbon to address the joint climate and water challenge.

He said that globally over the past 10,000 years, but more specifically over the past 200 years, humans have cleared some 75% or 6.3 billion hectares (ha) of the earth's former primary forests. We have then degraded many of these soils significantly reducing their often high original soil carbon levels, resulting in the release of over 20,000 billion tonnes of carbon (btC) into the atmosphere and oceans. General Jeffery added that in comparison, we have emitted 360 btC by burning fossil fuel, most of this in the past 50 years.

It was noted that, while these emissions have raised atmospheric CO₂ levels, by clearing forests and degrading soils, we have also radically impaired the natural photosynthetic and carbon draw down capacity of these regions, fundamentally altering their natural hydrology. General Jeffery stressed that unless we urgently regenerate the hydrology, bio-productivity and thus carbon draw down capacity of our degraded bio-systems, we cannot address climate change, nor our directly related water security imperative.

He noted that we can only do this adequately and quickly by drawing down carbon into our soils, thus regenerating our landscape.

Setting targets

Attendees were advised that Australia currently emits some 160 million tonnes of carbon annually. Although this is only 1.6% of the global net carbon deficit of 10 btC/an, General Jeffery highlighted that Australia has further responsibilities:

- Our advanced affluent society has one of the highest per capita emission rates globally.
- Our indirect emissions through exporting of over 300 m t/an of coal as well as gas is a factor.
- Planned doubling of these coal and gas exports in the near future will further exacerbate the problem.
- Australia's extensive and relatively undeveloped land areas available for the bio-sequestration of carbon could provide a major offset.
- Our advanced technological capabilities could help address this global imperative.

General Jeffery noted that, to meet our international responsibilities Australia must bio-sequester at least 1 billion tonnes of carbon annually (1 btC/an).

He said that despite reservations about geological carbon capture and storage, we only have one realistic option – to emulate nature as much as possible by regenerating the photosynthetic capacity of our often degraded bio-systems.

Forum participants noted that the early explorers consistently recorded the very spongy organic nature of Australia's soils, indicating the soils high carbon contents. This was confirmed by Strzelecki as early as 1842 and is further evidenced by Australia's vast, deep but young brown coal deposits.

General Jeffery commented that the potential of our forests and soils to serve as carbon sinks is also evidenced by our old growth eucalypt forests, whose biomass and soils can contain over 1200 tC/ha. He added that, whilst modest by comparison, innovative farmers have confirmed they can bio-sequester carbon at rates of up to 20 tC/ha/an. The audience noted that at even half this rate, this may be orders of magnitude greater than the 0.14-0.3 tC/ha/an that CSIRO believes may be the maximum possible under conventional farming

practices. He urged CSIRO to urgently examine and confirm these high level sequestration success stories Australia wide.

General Jeffery said Australia has some 770 million ha of land. Over 500 million ha of this has been farmed at various intensities, with around half of the farmed land being variably degraded. Consequently, by regenerating even 20% of this farmed land at the conservative rate of 10 tC/ha/an, Australia could potentially bio-sequester 1 btC/an to meet our sequestration target. He stated that regenerating these degraded soils could substantially contribute to the global carbon draw down target, while also helping to secure essential water, food and social stability despite increasing food demands.

General Jeffery stated that clearly this country has the obligation, the land, natural bio-systems, most of the science, including the capability to measure, the practical skills plus the additional CO₂ with which to achieve our 1 btC/an draw down target.

He concluded by noting the task of the forum was to define the actions, and what we must do to realize this imperative and target.

2. Realizing our carbon challenge and targets - Simon Gould

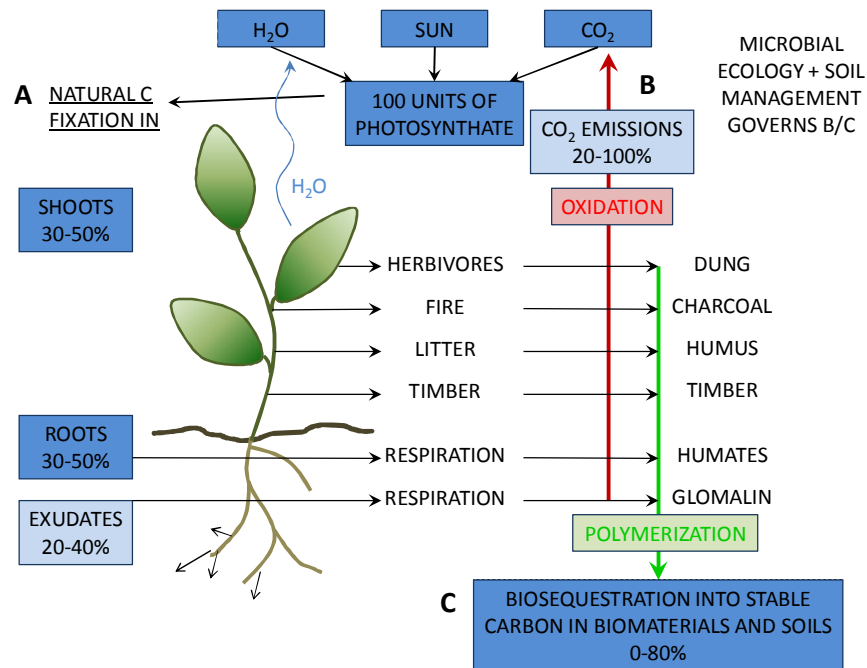
Mr Gould emphasised that our challenge is to define how to do it, how to get there, in time and with minimal casualties. He said it was important to recognise the impediments, and to successfully coordinate the under-resourced but committed skills, knowledge bases and resources to secure our target.

He said the mission could be defined thus:

- Sequester at least 1 billion tonnes of carbon annually into stable soil sinks.
- Help return CO₂ levels to below 350ppm.
- Regenerate the hydrology, bio-productivity and resilience of our landscape.
- Help secure the essential water, food and bio-system needs of Australia, and
- Assist in transitioning Australia's industrial ecology to a sustainable, just and low carbon future.

To achieve this mission, he highlighted the need to be clear about the system and science governing the capacity to the draw down 1 btC/an we need to identify the processes.

Walter Jehne stated that the answers are relatively, simple, absolute and un-disputed scientifically. He explained that, for the past 3.5 billion years, and 450 million years on land, life and our bio-sphere has depended fundamentally on photosynthesis -the process by which plants use solar energy to combine CO₂ and water into sugars.



In referring to the diagram, he explained what happens to each of these 100 units of sugar governs our bio-sphere and future.

- Typically 30-50% of them are used by the plant to produce the shoots we see that are essential to the plant to produce even more sugars.
- Some 30-50% are invested in roots to enable the plant to access water and nutrients to support that photosynthetic activity, and
- Often not appreciated, some 20-40% is exuded from the roots to support microbial ecologies critical in forming healthy soils, accessing and cycling nutrients and ensuring the health of that plant.

However it is what happens to each of these carbon sinks that is critical to our future.

Clearly plant shoots are eaten by herbivores, burnt by fires or return to the soil as litter. Woody tissues are similarly consumed by fungi or termites, burnt or preserved as timber. The roots and root exudates typically are bio-decomposed by micro-organisms.

Effectively, for the past 3.5 billion years, all carbon that has ever been fixed on earth has either;

- Been oxidised through microbial activity or by fire and returned to the air as CO₂, or
- Been polymerized primarily by certain fungi into stable soil carbon sinks.

It is this stable soil carbon that has created and largely governs the bio-productivity of our soils and landscapes, their hydrology and the health and survival of animals who depend on it for food. It is these soil humates¹ and glomalins² that, over geological time, formed the fossil fuels we rely on. It is

¹Humates are key components of the stable carbon in soils (60-80%) and are produced by the microbial conversion of cellulose and lignin from organic matter.

this biological draw down of CO₂ into these stable biomass and soil carbon sinks that has reduced CO₂ levels from some 95% to as low as 0.02% over the past 4 billion years to help create our climate. And it is this carbon and these processes that have been degraded by our:

- Deforestation;
- Soil degradation and erosion;
- Burning of fossil fuels, and particularly
- The oxidation of former high soil organic matter levels as a result of our extensive soil cultivation, fertilization and use of biocides.

Consequently, it is these natural processes that must be reversed and regenerated if we are to:

- Draw down atmospheric CO₂ to manageable levels.
- Restore healthy soils and thus the hydrology, bio-productivity and resilience of landscapes.
- Restore the earth's natural bio-sequestration balance and capacity to secure our future.

Humans, having taken command of and degraded these natural processes and balances, now have the inescapable responsibility and choice to either;

- Continue their oxidation and collapse of the carbon sinks and bio-systems we rely on, or
- Regenerate healthy landscapes by restoring the essential microbial processes involved.

Mr Jehne then handed back to Mr Gould who stated that to achieve the mission a range of key partners needed to be engaged and factors considered including:

- The support of over 20,000 leading innovative farmers throughout Australia.
- The information and commercial strategies to help them implement relevant management changes over a required element of Australia's farmed land area.
- The support of a wide network of innovative community agencies and individual supply chains committed to these climate, land regeneration and social transition objectives.
- The support of key strategic policy and corporate stakeholders who recognize the imperatives we face and the relevance of our mission in catalysing the needed changes, and
- Access to leading scientific innovation and technical support to aid this transition.

He emphasised that achieving this mission will also need to involve fostering both innovation and change and a successful outcome may be at risk from a wide range of conflicting interests. The development of constructive relations in key areas would be covered in the session immediately following the lunch break.

² **Glomalin** are also key components of stable carbon fractions in soils (20-40%) and are produced by the microbial conversion of chitin from fungal hyphae and insect exoskeletons. It permeates organic matter, binding it to silt, sand, and clay particles. These add structure to soil, and keep other stored soil carbon from escaping.

Mr Gould said that while there will always be more to know, we know enough from practical farmers that the target is attainable and should also be able to draw on the 30,000 'person years' of public research and extension in exploring aspects of these systems. He added that in view of these uncertainties and the innovative nature of the changes required, attention needs to be given to the management of risks so that we can learn from and adapt actions in accordance with the experiences and progression of this mission – a process of constant evolution.

Mr Gould said that although the following blueprint and proposed changes are innovative and may require continual refinement, it is clear from the state of our current landscape that the conventional land management practices that created the problem and our extensive past investment in its solution have been ineffective.

He commented that Australia must be prepared to critically assess the potential of such innovations rather than continuing to marginalize them, through lack of resourcing, priority and commitment to real change from the status quo.

Australia's availability of suitable land and human resources - Tom Nicholas, Healthy Soils Australia

Mr Nicholas outlined that Australia comprises 770 m ha of land, over 500 m ha of which is farmed. He said the majority of this farmed and grazed land has been variably degraded with soil organic matter levels often under 1-2%, significantly below the levels at the start of farming, adding that most of this land therefore has the capacity to hold more carbon.

Mr Nicholas commented that these lands are currently held as grazing leases, crown reserves, indigenous land, national parks and as freehold. He highlighted that most responsible managers would be interested in its regeneration to improve its soil health, bio-productivity and resilience, depending on this being done practically and viably.

Forum participants noted that over 5,000 lead innovators from Australia's 140,000 farmers have already invested in various land regeneration activities that build carbon, and the majority of the others could be expected to participate once current impediments and inertia can be addressed through relevant incentives and education.

Mr Nicholas said that the bush largely understands the status quo is untenable and that major change is needed urgently. He added that what they need is the leadership, the vision, the catalysts and the practical economic blueprints to engender change at strategic and regional levels. He said that if such encouragement were available there would be no shortage of land nor interested farmers to achieve the targeted draw down of 1 bTC/an throughout Australia. He was certain that a realistic price on carbon was an essential ingredient in the land regeneration mix.

Mr Nicholas emphasised that farmers see themselves as the custodians of the land and it was vital that the successful farmers were not ignored.

Attendees thanked Mr Nicholas for his presentation.

Working with Nature at 'Lana' - Tim Wright, Mixed farming

Mr Gould introduced Mr Tim Wright to the audience to explain his successful holistic management and controlled grazing methods.

[PowerPoint display highlights at Enclosure 1]

Mr Wright outlined his experience on his property 'Lana' in New England NSW and provided a PowerPoint display to demonstrate the change in thinking and management on his property since 1990. He highlighted that the change was motivated by two key considerations:

- Costs of inputs, particularly reduction in wages; and
- Efficiencies in grazing management to achieve, resilience and sustainability.

He presented data that demonstrated a marked improvement in the carrying capacity of his land over time, despite significant reductions in rainfall. He pointed out that the key lessons that he had learnt were that:

- Highest return on capital had been from education, not regulation;
- The biggest breakthrough had been the ability to plan ahead through feed budgeting;
- Managing the whole system with Holistic Management and Planned Grazing has proven more rewarding than high input systems and sown pastures;
- He is able to improve his triple bottom line – environmental, economic and social; and
- In the future, he plans to develop ways to monitor soil biota and convince others of the benefits.

He went on to say that as outlined previously the journals of early explorers and scientific analyses of soils by Strzelecki as early as 1842 make it clear that most Australian soils pre European farming were soft and well structured due to their very high levels of soil organic matter levels of up to 37%.

This soil structure and these organic matter levels were fundamental to their capacity to permit infiltration to retain vast quantities of water from our irregular rainfall, to sustain the high productivity and resilience of the Australian landscape; despite its weathered old soils and extreme climate.

Over 200 years of agriculture these organic matter levels have declined significantly where there has been over stocking with hard hoofed animals, extensive and intensive cultivation, chemical fertilization causing oxidation of these soils, the application of biocides and our continued 'extraction' and exportation of nutrient in grains, meat, milk and timber.

As a result, even surface organic matter levels are now often below 1-2% resulting in further serious structural declines, acidification, salinization, sodicity and resultant productivity losses.

Enormous areas of topsoil have been eroded leaving farmers to cultivate subsoils while over 1 million kilometres of streams have also been gullied and seriously incised.

Consequently we have an almost unlimited capacity, indeed necessity, to restore the organic matter content and structure of Australia's soils; using a range of practical methods to draw down carbon.

However, as CSIRO has demonstrated, this cannot be achieved under the high input oxidative soil practices that were largely responsible for degrading these soils. In contrast innovative farmers in both grazing and cropping systems have been effective in bio-sequestering carbon as stable biomass and in soil at rates of up to 20 tC/ha/an. This is consistent with the potential and evidence of carbon sequestration capacity of natural bio-systems.

However to be conservative, even at sustained rates of 10 tC/ha/an, if practical proven soil carbon farming practices were integrated over just 20% or 100 m ha of Australia's farmland this could readily and beneficially bio-sequester or draw down our target of 1 btC/an.

This potential draw down of 1 btC/an from the atmosphere into stable soil carbon sinks is 6 times Australia's current direct emissions of some 160m tC/an and could also offset our responsibility for the indirect emissions from our current 300 mt/an and projected 600m t/an of coal exports.

By returning most of the carbon that is drawn down into soils as long lived soil humates and glomalin it is also at minimal risk of oxidation in periodic wildfires, in contrast to biomass above ground.

Consequently Australia could readily and beneficially achieve its 1 btC/an draw down target; provided policies and incentives enabled this potential to be realized rather than impeded as a present through the subsidised protection of carbon emissions and lack of innovation support.

The practical verification of changes in stable soil carbon levels - Rob Gourlay

Mr Gould introduced Rob Gourlay to attendees to present his PowerPoint slides on remote sensing and the ability to measure soil carbon levels.

[PowerPoint display highlights at Enclosure 2]

Mr Gourlay said it is critical for farmers to get a return on their investment by accurately measuring and verifying changes in stable soil carbon levels. He said methods within the industry were currently available to accurately measure such changes in different carbon fractions in our soils but these traditional methods relied upon replicated soil samples and a range of wet chemical analyses that are often very laborious, expensive and of variable accuracy and relevance to the data needed to measure soil sequestration. He added that this is particularly the case when data is needed to verify changes in stable soil carbon levels in variable field sites and in response to management changes over time to meet carbon trading requirements.

Mr Gourlay said that the extreme variability of carbon levels in soils and fluctuations in response to various treatments, may make the cost of verifying such changes using traditional methods greater than the carbon credit produced. Attendees agreed that there was a need to validate other methods. He added that it was often also difficult to differentiate different carbon fractions in soils with different natural longevities via these chemical methods.

Mr Gourlay noted that to enable soil carbon to be included in Australia's national carbon accounts better methods are needed to measure and verify increments in stable carbon levels in soils and biomass. These methods need to be:

- Simple, quick, cheap and accurate;
- Able to differentiate stable from various labile soil carbon fractions;
- Able to accurately measure changes at biome³ and landscape scale over time
- Able to measure changes in such stable soil carbon increments retrospectively to 1990, and
- Not impaired by the high cost, extreme variability and inaccuracy of soil sampling.

Attendees learned that such methods are available using remote sensing and the on-the-ground verification of satellite data. However they noted that detailed proof of process studies are needed to refine and optimize their applicability to measuring changes in stable soil carbon levels in Australian biomes and soil conditions.

Mr Gould thanked Mr Gourlay for his informative presentation.

³ IPCC definition : A naturally occurring community of flora and fauna (or the region occupied by such a community) adapted to the particular conditions in which they occur (eg tundra).

Incentives to sequester 1 billion tonnes of carbon annually - Walter Jehne

Mr Jehne reiterated that to draw down the 1 billion tonnes of carbon annually and secure our safe climate we have no option other than to regenerate the natural carbon draw down capacity of bio-systems. Consequently we need to catalyse the urgent widespread regeneration of our soils, our hydrology and the landscapes that govern the carbon draw down capacity of these bio-systems.

The audience agreed that to do that successfully we will need the support of a large number of Australia's 140,000 farmers so as to assist them in adopting land management improvements that can bio-sequester some 10 tC/ha/an over 100 m ha.

Mr Jehne said that while over 5000 innovative farmers have already self-selected and adopted such improvements, to realize our draw down target we need to extend their numbers, effectiveness and viability rapidly, adding that this extension will not happen by itself and direct catalytic support is required to overcome the impediments and distortions inherent in the status quo that are currently obstructing the essential innovation.

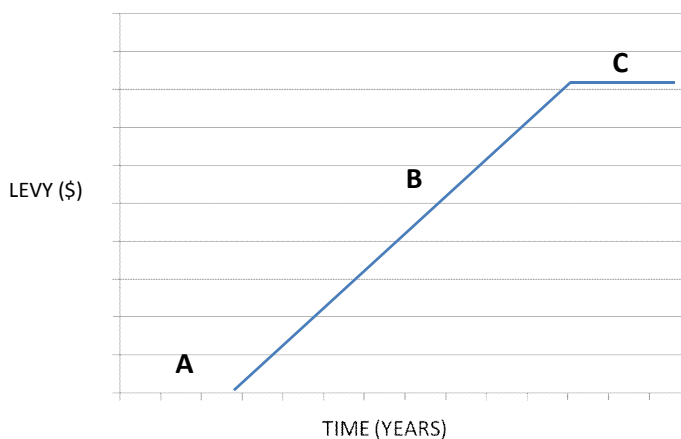
Mr Jehne noted that this support will be required to provide relevant information, demonstrations, evaluations, regional plans and mentoring but above all the commercial incentives and demand drivers to make the essential extension of our carbon draw down capacity viable for the farmer, region, industry and the nation. He added that to provide this incentive and drive commercial demand, we must remove the subsidies that hide the real cost of carbon emissions and distort markets.

He emphasised that to value our health and future we must start valuing, by pricing, the eco-systems we depend on, noting that a price on carbon was needed.

Attendees were advised that provided there was such a valid price signal, farmers would have the incentive and means to invest in bio-sequestration of additional stable carbon in their biomass and soils. Mr Jehne added that the carbon credits could then be traded via farmer cooperatives to major emitters to offset their carbon liabilities.

Mr Jehne said establishing such a price would simply require the government nationally to mandate a clear price signal on the externality costs of carbon emissions for a limited number of the larger emitters and fully justify this politically and economically as a Net Emissions Reduction Incentive (or NERI). He noted that such a forward price signal could ideally start from a nominated date, be modest initially but increase annually to progressively reflect the full externality cost of that impact to the community and market. Because of the forward notice there is no valid case for exemptions and subsidies.

The Net Emission Reduction Incentive (NERI)



- A** – FORWARD NOTICE OF NERI TO AID PLANNING AND AVOID THE NEED FOR EXEMPTIONS.
B – DEFINED PROGRESSIVE PRICE SIGNAL AND INCENTIVE FOR INNOVATION AND OFFSETS.
C – PLATEAU AT GLOBAL CARBON PRICE PARITY

Attendees noted that individual farmers and emitters would remain free to choose what they might wish to do about this new valid market reality as well as when and how they could best respond to it by either:

- Investing in innovations to reduce emissions via efficiencies that are readily available, reductions of over 30% would deliver meaningful rewards as the price rose.
- Purchasing verified carbon credits from farmers under defined criteria that could ensure that an equivalent quantity of stable carbon has been safely sequestered, or
- Paying the then applicable carbon levy to a public fund for any emissions that have not been offset with those funds being invested in drawing down or achieving carbon efficiencies elsewhere in the economy to counterbalance the original emissions.

Mr Jehne outlined that once a firm chooses to invest in such savings it will be in its competitive interest to fully exploit that capacity and scale advantage. Thus we can expect much larger and faster reductions in emissions by firms and nationally under NERI than would occur where innovation is handicapped by arbitrary 5% or other reduction targets; the benefits from which may not meet administrative compliance costs.

He added that to optimize their competitive advantage lead firms are also unlikely to raise their prices, instead using that advantage to gain market share from competitors that have not innovated and are at a disadvantage due to their higher NERI payments. This should have the highly beneficial effect of:

- Forcing all suppliers in that sector to innovate to match the price competitiveness of the market leader.
- Preventing these suppliers from just passing on the NERI levy onto their products and customers as this risks their accelerated loss of market share and viability.
- Being anti-inflationary and stimulating economic activity in sharp contrast to other ETS or carbon tax options where firms are likely to simply pass on the carbon costs to inflate and depress markets, without any incentives for efficiencies at the firm, farm or consumer level.

Forum participants agreed that further major benefits from NERI included:

- Industry and strategic equity markets recognizing the advantages and profits from co-investing not just in the extraction of fossil fuels but also the bio-sequestration of its CO₂ emissions via farmers.
- The NERI levy funds are re-invested in catalysing further industry innovation and landscape regeneration to lower our emissions and raise our carbon draw down capacity.
- The NERI is extended to include importers of products with subsidised externality liabilities so that 'dirty' products are not dumped on our market and firms can compete equally in open free markets consistent with World Trade Organisation objectives.

Mr Jehne said NERI should also enable governments to meet their emission reduction and revenue objectives via existing taxation structures without vast new bureaucratic or industry compliance or trading costs.

It was agreed that the reality is that Australia can now only meet its carbon draw down responsibilities by harnessing the capacity and synergistic commercial interest of Australia's farmers and industry. Mr Jehne emphasised that we must allow farmers to do so by removing the market distortions by providing the incentives and means through a NERI to catalyse the needed changes.

Attendees thanked Mr Jehne for his presentation.

Proactive Carbon Farming in a Variable Climate – Dianne Haggerty, Mixed farming

Attendees welcomed WA farmers Ian and Dianne Haggerty to the proceedings. They outlined their story of change and success using biological principles on their mixed farming enterprise. Dianne explained that in 2000 they decided their conventional method of farming was demanding more and more inputs to achieve decent crops and was struggling in the dry years. Having applied lessons learnt from others over a period of years, they have now implemented biological farming ideas, are able to achieve improved profits per hectare and are growing crops on just 160-170 mm of rainfall per annum. They have recorded a minimum of 35% increase in carbon levels in their soils since 2003.

Dianne explained that they initially started making small changes and using their observations to modify their farming practices, including:

- Initially providing free choice mineral supplements for sheep – these are no longer required due to increased microbial activity in the soil and changes to nutrient inputs;
- No drenching, mulesing, grain supplements or antibiotics;
- No use of pesticides and minimising herbicide use;
- Using biological nutrients and agents, as opposed to mineral fertilisers;
- Maintaining ground cover; and
- Direct marketing of their pasture fed lamb.

Dianne continued by explaining some of the higher level imperatives in carbon management within the landscape. She said that to achieve our carbon draw down imperative of 1 btC/ha within the next decade, regional farming communities Australia wide will need support in adopting effective land management changes over more than 100 million Ha of our landscape.

While potentially very beneficial in revitalizing these rural bio-systems, communities and economies, such changes need to be tailored to the specific needs of each region and sector and 'owned and driven' by the local commercial innovators and interests.

Causing change with the many regional and sectoral interest groups, will require the support for key local innovators and farmer champions to help refine and extend the new practices, initially to interested peers 'across the fence', and then to the wider regional target.

To facilitate each of these regional carbon farming 'breakout' strategies financial backing may be needed to document and evaluate regional plans, refine key information and coordinate strategic mentoring, the development of supply chain and marketing concepts to commercialize each regional revitalization plan.

However, as is being reinforced savagely in parts of WA, we may be running out of time.

With the systemic declines in rainfall in south-western WA conventional grain crops are becoming too risky and non viable. Only those areas with higher soil moisture and resilience due to their higher soil carbon contents are now likely to produce an adequate yield, return on invested capital and a viable future. We need to urgently catalyse the regional extension of these relevant practical strategies. The costs of delay in not doing so to food production, exports and regional viability is significant. Conversely the benefits from such catalytic regeneration support can far exceed their cost.

Multiplied 100 fold throughout Australia this regenerative process now provides us with perhaps our last chance to avoid increasing further land degradation, the loss of key sectors and regions and the risk to our welfare and future.

From either a national capital, social or climate perspective; the regeneration of the carbon levels, water retention and resilience of these degraded soils provides Australia with both a fundamental imperative and opportunity.

They alone could bio-sequester and benefit from the additions of a large part of our target to draw down 1 btC/an as additional stable soil carbon. In fact we cannot afford for them not to be so.

Harnessing key demand drivers for the essential commercial changes - John White, Ignite Energy

Mr White emphasised the importance of market leaders with the influence to provide the commercial critical mass to break out of the status quo inertia and make soil carbon farming viable. He added that in turn this dominant player needs to be driven by a clear commercial imperative and logic to change, adding that it was vital that Government set a clear carbon price via NERI, then get out of the way.

Mr White informed participants that equally compelling may be the recent warning from China and India that they are under external pressure to reduce the emissions from the coal they are importing from Australia. He said that as these countries may have difficulties in meeting these liabilities they may need to discount payments to Australia for that coal to meet these clean up costs, may be forced by other to do this for us at our cost. Unless we are willing to take responsibility for the emissions we are 'dumping' on them so as to provide them with 'Greenhouse Neutral Coal' we, and other fossil fuel exporters, will be made to pay sooner or later.

Attendees agreed that if applied to most of Australia's exports of over 300 mt of coal and projected exports of 600 mt/an, this would impact greatly on Australia's coal industry, coal regions and the national economy.

Mr White emphasised that by accepting and anticipating this responsibility and costs, the Australian Government and industry have committed billions to research the viability of geological carbon capture and storage technologies. He added, however, that despite continuing efforts, the scientific and commercial reality is that geological carbon capture and storage is too uncertain, too limited, too expensive, too risky and will be far too late. He noted that we do have safe, reliable, highly cost effective and beneficial options for the biological capture and storage of carbon.

As nature perfected and has done for 450 million years we can use bio-carbon capture and storage (BCCS) processes to also draw down CO₂ that is freely and safely transported in the atmosphere and store it as biomass, timber or as humates, glomalin or bio-char in our soils.

Forum participants agreed that biological carbon capture and storage processes can greatly benefit the regeneration, health and bio-productivity of our landscapes and thereby the bio-systems driving this carbon draw down.

Biological carbon capture and storage that can conservatively draw down over 10 tC/ha/an and, if extended over an adequate area needing regeneration, could readily draw down 1 btC/an.

Mr White noted that biological carbon capture and storage could more than offset all of Australia's emissions from our proposed coal exports, enabling us to lead in selling 'Greenhouse Neutral Coal' at premiums as an energy bridge as we transition to a more efficient low carbon industrial ecology.

It was agreed that Australia has the land, the skills in farming and the imperative to offset the emissions by selling only clean Greenhouse Neutral Coal. It was also agreed that to get there we need a NERI and commitment from the mining industry to drive this transition in the environment's and its own commercial self interest.

Communicating the essential changes and the benefits - Jennie Cameron, Outcomes Australia

Mr Gould welcomed Ms Jennie Cameron to proceedings to discuss the task of communicating the changes required.

Ms Cameron noted that based on the information presented we can draw down 1 btC/an; over 100 times that from reducing emission 5%, but achieving this will require catalytic support via relevant strategic incentives, extension and a demand driver to achieve the essential commercial critical mass.

She said that because the target requires innovative thought and challenges key parts of the status quo, we also need to communicate it and its benefits professionally to a wide range of stakeholders. She stressed that:

- Now is the last chance to secure our safe climate by rapidly and safely drawing down our current and past CO₂ emissions to below the 350 ppm needed to secure our safe climate;
- Now is the time to regenerate the natural processes underpinning the health, bio-productivity and resilience of our soils and landscapes and their capacity to:
 - a. restore the natural hydrological and carbon balances to stabilize our climates, and

- b. provide us with the water, food and bio-system services essential for our future.
- It is also time to transition economies profitably from their current extractive and protected dead ends into more open efficient and cyclic industrial ecologies not impeded by false price distortions, and
- Assist the viability of farmers throughout Australia by revitalizing their incomes, resilience as well as re-building the natural capital values of their and the nation's soil and water assets;
- Revitalize rural regions throughout Australia by securing their key industries, incomes, employment opportunities and the significant multiplier benefits flowing from these changes;
- Benefit industry by providing them with the confident and transparent forward price signals to let them invest in efficiencies and secure market advantage in the new industrial ecology;
- Benefit Australia's fossil fuel exporters by enabling them to profitably offset their emissions so they can market 'Greenhouse Neutral Coal' at premiums as a bridge in this transition;
- Benefit Governments financially and strategically by enabling them to;
 - a. Remove and thus save the current subsidies and protection for carbon pollution that has distorted markets and helped create our climate crisis.
 - b. Generate income from the NERI so that it can be fully re-invested back into securing additional emissions efficiencies and offsets to cover the basis of levy.
 - c. Generate significant income from the savings and normal taxation arising from the increased economic and multiplier activities driving this transition.
 - d. Lead globally in demonstrating and extending how such effective strategies can be used to help regenerate landscapes, adapt to and secure our safe climate and transition societies to the more sustainable and equitable industrial ecologies.

Question and Answer analysis of key issues and options arising - Bill Hurditch, Director Fifth Estate

Mr Hurditch welcomed attendees to the participative part of proceedings, noting that this was the opportunity to capture feedback from the audience regarding issues and proposals raised during the Carbon Management Forum.

He said that where there are key areas of interest and debate we should advise that Outcomes Australia proposes to host workshops with interested parties to further resolve such areas and there would be the opportunity for Forum attendees to participate in these.

Mr Hurditch asked attendees to ponder “what will Australia’s bio and physical landscape look like in ten years time?”

Mr Martin Royds asked Mr Tim Wright how he identified the nutrient level of his stock, including the practicalities and budget.

Mr Wright noted that it was difficult to begin with, particularly as the location of his property has primarily granite based soil. He said every year saving stock feed in winter presented a challenge but he saved enough feed during the warmer months not to require the purchase of winter feed. Mr Wright said 95% of nutrition needs of his animals was provided through moving them and having a grazing plan. He outlined the following:

- Resting land – provides the opportunity for roots to go down deeper therefore biota works well
- Laying down humus – building soil

Mr Cam McKellar asked Mr Walter Jehne what the real incentive was for farmers to change their attitude and embrace the proposed NERI system as it may impact tax offsets and GST.

Mr Jehne said the issue involved the practicality of the farmers on the ground and the scheme was clearly defined and progressive. He added that as it was a direct product it would be considered a new income source and would be anti-inflationary.

Mr Martin Royds asked Mr Jehne about the specific of his PowerPoint graph presented earlier on proceedings and it was agreed that a possible workshop specifically on the NERI scheme could be scheduled.

Mr John White asked Mr Gourlay why the CSIRO did not advocate the same remote sensing solutions. Mr Gourlay commented that farmers were well ahead of the science and that he believed that perhaps CSIRO desired control of Intellectual Property (IP). He added that, in his view, the CSIRO were well aware of the solutions.

Mr Hurditch informed attendees that Outcomes Australia would be happy to receive further questions via email.

Mr. Tony Windsor, MP and Mr. Rob Oakeshott, MP were both welcomed to proceedings.

Mr Oakeshott emphasised the positive climate for change in the existing parliamentary arrangements and the opportunity to provide different opinions. He noted cross-party involvement and the parallel work being undertaken by the Henry Review and carbon sequestration.

Mr Windsor stated that history has illustrated that the bureaucracy was reluctant to act without scientific proof. He encouraged forum attendees to submit material into the Multi

Party Committee on Climate Change (MPCC) which was currently examining a range of options.

The Hon. Gary Nairn noted that in the past, assistance had been provided to those farmers who were not always the best choices, particularly in respect to drought assistance. Mr Oakeshott said the opportunity to be engaged on such issues existed through Mr Windsor, who had carriage of the Australian Parliament's Murray-Darling Basin Plans Economic and Social Impacts Committee and who would continue to promote the regional agenda.

Mr Tony Coote commented that the current parliamentary arrangement presented the best opportunity for regional Australia to be heard and strong leadership was required.

Mr David Marsh said that he found the attitude from bureaucrats regarding innovation frustrating, and the negative, adversarial attitude needed to be changed. Mr Nicholas added that the decision to cut 50% of funding for sustainable agriculture from the CSIRO created a catch-22 situation.

Mr Windsor commented that the Murray-Darling Basin Plan would be the test for this government and it was important that regional issues stay strategic. He added that issues are policy driven and have often relied on 'fashion', noting that ten years ago salinity was the major issue.

It was agreed that local governments played a role in the carbon management issue, and composting and recycling organic material were considerations. It was noted that it took between 3-4 years for the benefits to become evident following implementation of on-farm composting systems. Mr McKellar said he spent approximately \$300 000 to establish on-farm composting and the government could consider possible grants for farmers as incentives.

Peter Andrews raised the need for government to have scientific proof that bio sequestration works and that the proof is in the Australian landscape. Mr Windsor emphasised that the MPCC will question the science and it was vital to have the proof. General Jeffery added that it was important to promote the success stories to the scientists and to get the national attitude to water changed.

General Jeffery thanked Mr Windsor and Mr Oakeshott for attending the forum.

Heather Wieland, National President of the Country Women's Association (CWA), stated that her constituents believe that their capacity to realise the potential of carbon sequestration was losing momentum. Positive stories of carbon farming were needed to highlight this potential and how to realise it, with more support needed for farmers and communities actively improving their soil carbon content. She sees the CWA as a valuable network to pass these reinforced messages.

Dr Christine Jones outlined recent measurements on Mr Col Seis' property outside Gulgong, NSW. Speaking to the photograph (below), she highlighted that the soil under pasture cropping (left side of measure) had increased by 144 t CO₂/ha over two years (171 t up from 27 t) equivalent to a carbon fixation rate of 20 tC/ha/an, with at least 10 tC/ha/an likely to be stable. These soil C improvements had been achieved on only 209mm of rainfall in addition to the biomass carbon achieved from a grain crop and the pasture consumed by grazing. Dr Jones went on to explain the larger C content in deeper soil zones and the fact that the root zone extended below 500mm, with obvious benefits for resilience.



Action priorities for catalysing change – Major General (ret) John Hartley, Exec Director Future Directions International

General Hartley advised participants that the aim of this part of the forum was to reinforce that, while what we are proposing is natural, simple, practical, profitable, attainable and safe. But it is innovative and conflicts with the status quo. He added that therefore we need to define what are the critical success factors for the desired changes, and what strategies can achieve these changes.

General Hartley commented that there was a need to provide understandable information and to identify the most receptive targets, noting that some groups may be unsupportive and/or sceptical. Attendees agreed that it was in their own interests to debunk the misinformation that currently exists and to cooperate with government agencies. It was highlighted by an ex senior member of the Public Service that the most effective means of influencing bureaucrats was by taking them directly to examples of leading practice to see for themselves.

General Hartley led the discussion to identify stakeholders that should be engaged. The outcomes and stakeholders discussed included:

- State, Federal and local Governments
- Council of Australian Governments
- Environmental/Green Groups
- General Public
- Banks
- Educators
- Science Community
- Research Institutes
- Big Business Manufacturers
- Large suppliers of agriculture equipment/services
- Farming Organisations
- Farmers
- Carbon systems designers
- Indigenous population/groups
- Womens' Organisations
- Health Sector
- Supermarket/Retail Industry

It was agreed that the range of stakeholders was extensive and the consultation aspect will be labour intensive. Further work is required to analyse:

- Real interests and potential leverage points of the various stakeholders
- Priority for engagement and a detailed engagement plan.

Next step action needs and responses in key areas - Simon Gould

Mr Gould restated the key outcome from the Forum was the production of a submission to the Prime Minister's Climate Change Committee that addresses the ways and means to identify and refine practical cost effective actions on how to draw down excessive CO₂, through improved landscape use, so as to address our joint climate and water challenges. The submission would need to cover three challenges that have been clearly identified from this Forum:

- Verifying the most efficient landscape methods for sequestering carbon,
- Realising efficient, affordable methods for measuring the amount of carbon sequestered, and
- Incentivising broad scale adoption of leading practice carbon management in the landscape.

Participants were invited to contribute to workshops that would look in detail at these areas.

He then explained how the Outcomes Australia Food Integrity Program planned to address improved water and carbon management through a phased approach.

- **In Phase One (to June 2011)** 10-15 case studies would be selected to document, demonstrate and promote leading practice in land management with a priority to water efficiency and building soil health.
- **Phase Two (July 2011-2016)** will build momentum for widespread change by addressing impediments to change and encourage incentives for extension of leading practice. This phase will look at streamlining the regulatory frameworks, ensure that education and training embraces leading practice techniques with follow through mentoring, that a series of consumer demand drivers are in place that encourage change and that farmers are rewarded for their investments in improving eco-systems and sequestering carbon.
- **Phase Three (2016-2025)** sees the establishment of leading practice as the norm across Australia through a combination of Government policies, corporate support, enhanced farmer education and consumer demand.

He described the broad work structures that will be used, as:

1. Understanding the problem
2. Communicating that understanding
3. Continually documenting, demonstrating and promoting leading practice, and
4. Future planning and building momentum for change.

Achieving Australia's carbon management imperative and outcomes – Michael Jeffery

General Jeffery summed up that the challenge is the global complex of interacting imperatives that must be addressed. These are

- Climate changes and their impacts
- Water security crisis
- Food integrity and security issues
- Sustainable energy futures, and
- Threats to social security.

He stressed that carbon is at the heart of all these imperatives.

The attendees noted that we can draw down carbon practically and profitably by regenerating the landscape and the unique hydrological and carbon draw down processes that created and govern the bio-productivity and resilience of our bio-systems. They also noted that there is scientific evidence to confirm our capacity in that we have:

- Immense brown coal deposits,
- Soft spongy soils with up to 17% carbon levels, and
- Immense carbon sinks and draw down capacities of old growth forests.

General Jeffery emphasised that we must act urgently to support innovative farmers and above all implement a commercial incentive for farmers to change their methods. He stressed, however, that in order to achieve our goals we must also stop subsidising and protecting carbon emissions and instead levy them at their full externality cost to provide a level playing field for innovations in carbon efficiencies and offsets.

He stated that demonstrated innovations in Australia could be expended globally as the best chance to secure a safe climate, regenerate landscapes and essential water, soil, food and bio-systems.




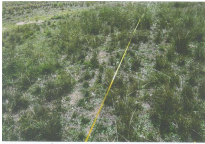



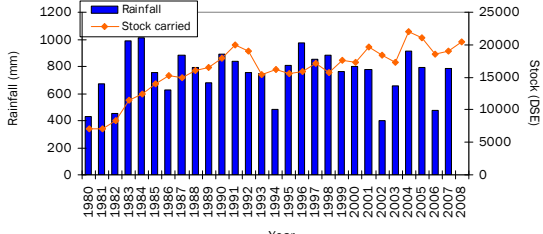

General Jeffery concluded by reiterating that drawing down 1 billion tonnes carbon annually to help return global CO₂ levels to below 350ppm was critical to securing our safe climate. He stressed that the time was now and people were listening with four independents ensuring the government was accountable.

He thanked all attendees for their interest and invited follow up participation and support.

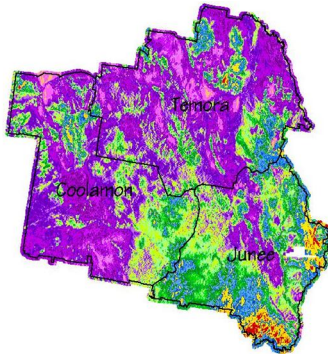
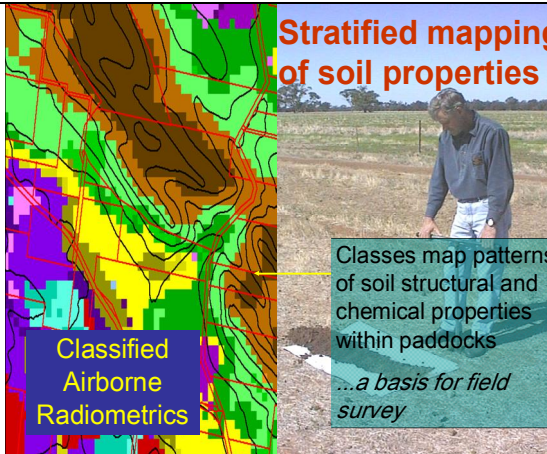
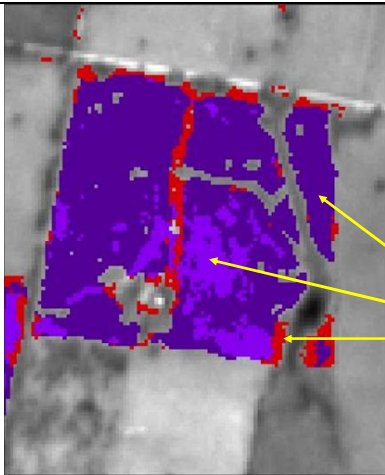
Enclosures:

1. Key slides from Tim Wright's presentation
2. Key slides from Rob Gourlay's presentation

KEY SLIDES FROM TIM WRIGHT'S PRESENTATION

<h3>Water & feed were in short supply</h3>  <p style="text-align: center;">1</p>	<h3>Mineral cycle and Energy flow</h3>  <ul style="list-style-type: none"> - Mineral cycle: <ul style="list-style-type: none"> . Dead, non-decaying material indicates an ineffective mineral cycle - Energy flow: <ul style="list-style-type: none"> . Aim to trap maximum sunlight energy via green leaf  <ul style="list-style-type: none"> - Quote from Christine Jones – <ul style="list-style-type: none"> “40% of carbon fixed in green leaves can be transferred to soil and humified resulting in soil carbon sequestering from 5 - 20 tonnes of CO₂ per ha per year via the mycorrhizial fungi carbon highway” <p style="text-align: center;">8</p>
<h3>Planned vs continuous grazing</h3> <h4>Landcare funded trials</h4>     <p style="text-align: center;">12</p>	<h3>From 1980 to 2008, 'Lana' increased its rainfall use efficiency</h3>  <p>By adopting a planned grazing management approach based on time, animal impact and soil biology has led to rapid rebuilding of our carbon rich top soil, resulting in less run-off, less evaporation of water and removing tonnes of excess CO₂ from the atmosphere.</p> <p style="text-align: center;">12</p>
<h3>Summary</h3> <ul style="list-style-type: none"> - Highest return on capital has been from education, not regulation - Biggest breakthrough has been the ability to plan ahead through feed budgeting - Managing the whole system with HM/PG is more rewarding than high input systems and sown pastures - We are improving our triple bottom line – environmental, economic and social - In the future, we need to develop ways to monitor soil biota and convince others of the benefits  <p style="text-align: center;">12</p>	

KEY SLIDES FROM ROB GOURLAY'S PRESENTATION

<h3 style="text-decoration: underline;">Basis of soil carbon measurement</h3> <ul style="list-style-type: none"> ▪ An increase in soil carbon % over time will produce changes in plant nutrients (health) that are reflected in light emissions from a plant in satellite measurements (nutrient change and variation detection) ▪ The sequestration of soil carbon varies according to soil health properties and this variation can be measured based on soil pattern differences (soil property mapping) ▪ Existing soil sample techniques, eg. grid sample to define soil variation is too costly and ineffective to measure and verify soil carbon changes across Australia ▪ The satellite and airborne data to measure the variation in soil and vegetation cover already exists in the government archives of Geoscience Australia ▪ The data processing techniques to measure the soil and vegetation variation has existed in industry since the early 1990's. 	<h3 style="text-decoration: underline;">Regional soil property mapping</h3>  <p>Gamma-ray data provides the only effective means to map soils over large areas and accurately define the soils, spatially. This map provides the base for stratifying sampling and mapping soil properties, eg. soil carbon variation.</p>
 <h3 style="text-decoration: underline;">Stratified mapping of soil properties</h3> <p>Classes map patterns of soil structural and chemical properties within paddocks <i>...a basis for field survey</i></p> <p>Classified Airborne Radiometrics</p>	 <h3 style="text-decoration: underline;">Canola Distribution and Variation</h3> <p>Harden</p> <p>Yield High Medium Low</p>
<h3 style="text-decoration: underline;">Conclusion</h3> <ul style="list-style-type: none"> ▪ The measurement and verification of soil carbon levels can be effectively obtained from the application of remotely sensed data and field measurements ▪ The patterns of variation in soil health and plant health provide an effective basis for stratifying field sampling and extrapolation of measurements over very large areas ▪ Farmers only have to measure where there is a in either soil or plant health variation and record the soil carbon levels at a range of soil depths ▪ Satellite data from the 1970's is available in government archives. ▪ There is a need for a national soil and health vegetation mapping and measurement program that includes soil carbon. 	

CARBON MANAGEMENT FORUM ATTENDANCE

Federal Government

Department of Agriculture, Fisheries & Forestry
Department of Climate Change Offsets Methodology Team Land Division
Department of Prime Minister & Cabinet
Department of Sustainability, Environment, Water, Population and Communities
Biodiversity Conservation Branch Land & Coasts Division
Department of Sustainability Environment, Water, Population & Communities
Ecosystems & Climate Change Section
Senator Christine Milne Green's staff
Mr Rob Okeshott MP
Mr Tony Windsor, MP

Organisations

Australia 21
Australian Industry Group
CMA Namoi Region
Compost Australia
Country Womens Association
Future Directions International
The Global Foundation
Healthy Soils Australia
Krelinger Wines, Tasmania
Landcare Australia
Lawrie Co Sustainable Agriculture
Minerals Council of Australia
Meat and Livestock Australia
Mulloon Creek Natural Farms
National Farmers Federation
Natural Sequence Association
NSW Farmers Association
The Australia Institute
Visy Industries

Media

The Australian
ABC Radio
Canberra Times
WIN TV

Individuals

Mr Rob Gourlay
Mr & Mrs I Heggarty
Dr Bill HurditCh
Dr Christine Jones
Mr David Marsh
Ms Julia MacKay
Mr Bruce McCormack
Mr Cam McKellar
Hon Gary Nairn
Mr Col Seis
Mr John White
Mr Tim Wright

OutComes Australia

Jennie Cameron
Simon Gould
Michael Jeffery - Chair
Walter Jehne
Don McDonough
Rachel Letts