Sustainability Science
PO Box 11, Canberra City, 2601
ph: +612 6288.0760 f: +612 6287.4489

Professor Ross Garnaut
Garnaut Review Secretariat
Level 2, 1 Treasury Place
East Melbourne Vic 3002

Climate Change: Landuse, Agriculture and Forestry
Submission to the Garnaut Climate Change Review, January 2008

Dear Professor Garnaut

The following is a submission to your Review on the economic impacts and response options to Climate Change within Australia's Landuse, Agriculture and Forestry sectors.

It outlines relevant new scientific and economic analyses on how climate change is seriously and increasingly impacting this sector and practical options for responding to it.

The analyses are based on recent research by the Sustainability Science Team, a small independent research group linked to a wide range of land managers and professionals. The analyses coordinate peer reviewed scientific evidence from a wide range of disciplines to provide a realistic and substantiated systems understanding of the cause and impact of climate change and, therefore, the appropriate response options to climate change. These options extend beyond those from the CO_2-greenhouse models and assumptions which have dominated explanations of, and reactions to, climate change to date.

The submission outlines these new perspectives and options so they may be considered objectively, on merit, to help Australia formulate effective responses to climate change.

In this context the submission outlines key conclusions from these analyses on:

A. The current and pending impacts of climate change on Australian agriculture.

B. The current and projected costs of these impacts to Australia.

C. The scientific feasibility of mitigation options: what can and can not work.

D. Proposed response options.

E. Potential benefits from timely responses.

F. Recommended next steps.

We welcome the opportunity to further brief the Australian Government on the substantiating scientific evidence for, and consequences from, each of these analyses so they may help the Australian agricultural sector, regions and governments respond to the serious challenge of climate change, hopefully in time.

Yours sincerely

Walter Jehne
Director
18 January 2008

A. The current and pending impacts of climate change on Australian agriculture

1. After 30 years of scientific warnings the reality of climate change is finally being taken seriously, including its capacity to create major challenges, costs and consequences to Australian agriculture and the wider Australian economy.

2. However far from just increasing temperatures over the next century as predicted from CO_2/greenhouse models and reports from the Intergovernmental Panel on Climate Change (IPCC), the scientific evidence indicates that the impacts costs may be much wider, more serious and urgent and the costs much greater than the generic models and reports indicate.

3. Indeed serious impacts and costs are already occurring from the many, often synergistic, positive feedback processes governing the global climate system. These were raised by DEFRA in 2005 (ref Schellenhuber). However both the IPCC and governments acknowledge that they have not been considered in assessing climate risks, consequences or response options as they were too complex and uncertain to quantify, despite their potential impact.

4. Some of these feedback processes now pose risks of dangerous climate change with major adverse impacts to Australia's agriculture, economy and community over the next decade. Australia must urgently consider and address these risks if it is to respond to climate change effectively and in time.

5. For example, there is strong scientific and field evidence that we may have already triggered at least one of these feedback processes (Attachment 1) whose impact will be of fundamental consequence to Australia's agriculture, land management and economy.

Effectively evidence from the Australian Bureau of Meteorology and CSIRO indicates that:

a. The global warming of some 2 watts/m^2 to date has already intensified and extended air and heat circulation in the southern inter-tropical Hadley cell,

b. This has resulted in the southward displacement of the Ferrel cells from Antarctica, which has:

   - Which has significantly and systemically lowered the level and reliability of the frontal winter rainfall by up to 30% over much of southern Australia over the past 30 years, and
   - Reduced stream and reservoir inflow for cities from Perth, the Wimmera, Melbourne and Sydney by up to 60%, raising serious water security and cost issues.

c. Effectively, southern Australia may not be in a drought but facing a systemic 30% decline in the availability and reliability of its rainfall. This will fundamentally impact most agricultural, urban and industrial supplies and the viability of these economies.

6. It follows that climate change and its impacts are:

a. Real, already occurring, and will compromise much of Australian agriculture far sooner and more seriously than is widely understood.

b. Resulting in not just future warming and sea level rises as assumed from CO_2-greenhouse models but in the serious systemic decline in rainfall and its reliability in much of southern Australia.

c. Seriously impacting agriculture and land management in southern Australia which will require it to make major urgent adjustments if it is to stay viable.

7. Detailed assessments need to be made of the likelihood of and impacts from the above consequences of climate changes so they can be addressed via effective responses.

8. Similar detailed risk and response assessments need to be made on twenty other potentially dangerous feedback processes arising from climate change. Each represents a serious potential risk to Australian agricultural systems and economy (see Attachment 1).

B. The current and projected costs of these impacts to Australia.

9. Clearly it is not possible to provide comprehensive assessments of the economic cost of climate change to Australia until a detailed assessment is made of each of the twenty positive feedback processes and the risks and consequences arising therefrom to Australia.

10. However, based on the scientific evidence and observed effects from the above, climate change may represent a major direct economic and social cost to Australia in that:

- Much of the agriculture in southern Australia may become non-viable due to the cost and unreliability of water in both irrigation and rain-dependent farming systems. This could result in:
  - The collapse of much of agriculture in inland southern Australia at a direct loss of some $20b pa in GDP and $10b pa in lower export income, and
  - The collapse of many rural communities and economies that depend on these agricultural communities, commodities and rainfalls.
  - An increased demand for government social support for up to 200,000 people at some $5 b pa direct, plus $20 b pa indirect regional multiplier cost, and
  - Threats to Australia's food security with the possible need for Australia to import more food from under-supplied international markets at premium prices.

11. In addition to the above direct costs to farmers, regional communities and governments, such systemic drying due to climate shifts will also have major follow on and natural capital consequences and costs to Australia including from:

a. The **increased risk, incidence, intensity and damage from wildfires** that will extend into the moister forested regions in eastern Australia. This will further degrade their value as standing carbon sinks, bio-sequestration drivers, bio-diversity refuges, water resources and as buffers to climate stress.

b. The **increased extent and rate of land degradation** as a result of reduced plant cover, soil structural decline and reduced water infiltration, retention and availability which will also increase the risk of serious wind and water erosion.

c. The **reduced bio-productivity of most agro-ecosystems** due to water stress, shortened growing periods and the reduction in photosynthesis and pollination in many plants above 36ºC.

d. The **accelerated degradation of Australia's natural capital** asset base as a result of the loss of soils, bio-diversity and eco-system services.

e. The **enhanced desertification and reduced resilience** of agro-ecosystems, communities and economies throughout much of inland southern Australia.

12. Similar direct and indirect costs can be expected to arise from many of the as yet unassessed positive feedback processes and impacts arising from climate change (attachment 1).

13. Climate change will also impose forward financial costs on the Australian economy.

These include opportunity costs to farmers from changes in land management regulations imposed in response to climate shifts as well as forward liabilities to taxpayers. For example:

a. Now that Australia has agreed to ratify the Kyoto protocol we will be obliged to meet our 108% of 1990 CO_2 emissions target by 2012.

b. While 'accounting' measures from banning land clearing by farmers have enabled Australia to 'meet this target' to date, such 'credits' are a one off 'savings'.

c. Such accounting measures will not be adequate to offset ongoing liabilities from the 37% increase in Australia's urban and industrial CO_2 emissions post 1994 induced in part by the complacency fostered by such 'accounting' responses to our emission reduction liabilities.

d. As such Australia may have to buy external carbon credits to cover future excess emissions at premium global market prices currently some \$27/tCO_2 or \$100/t of C.

e. These forward liabilities are likely to impose major budgetary and economic costs on Australia by 2012 and beyond, particularly in a global recession, unless new carbon savings can be identified, primarily from the agricultural sector, to offset them.

Consequently, climate change will increasingly impose much higher direct and indirect costs on Australian agriculture, our natural capital, sustainability, economy and through these the welfare of the Australian community and future than widely realised.

While difficult to quantify, direct costs may approach \$50b pa but be dwarfed by much higher, longer term indirect costs and risks to the viability of much of our agriculture.

14. However ultimately climate change is not an economic or cost issue.

Unless it is addressed urgently, it risks escalating dangerously; particularly as we further accelerate some of the twenty serious positive feedback processes. Many of these may result in major climate crises and threats to much of the global economy and society within decades.

As such, climate change is now the major existential risk and too costly not to control.

C. The scientific feasibility of mitigation options: What can and cannot work

15. There is now widespread scientific and community agreement that climate change is real, is already impacting many regions and represents an urgent challenge and cost and, if not addressed, an existential risk to many current communities, economies and governments.

16. However, there is still much scientific uncertainty and disagreement as to how it is caused. Clearly until we understand its cause it is very difficult to identify and deploy effective avoidance, mitigation or adaptation strategies.

17. As illustrated from how climate change is already impacting in southern Australia, it clearly involves far more complex and serious, possibly secondary, changes than just the warming predicted from the CO_2 greenhouse effect in climate models.

18. Consequently we need to critically review the science and the observed realities to ensure that our understanding of what is causing climate change, and hence our proposed responses, are sound.

In doing so we need to critically review and understand why and how:

a. Climate change is already impacting regions much sooner, more severely than predicted by the CO_2 models through processes such as the changed rainfall dynamics observed in southern Australia and not just through increased predicted temperatures.

b. Such processes operate and their significance in understanding what is causing climate change and observed changes to global water and heat dynamics.

c. These conform with our current assumed explanation, based largely on models of the CO_2-greenhouse effect, of what is causing climate change as well as the assumption from these models that we can still mitigate climate change simply by reducing future CO_2 emissions via carbon trading and reduction targets.

19. Effectively, after twenty years of denial and delay the world may have one last opportunity to prevent climate meltdown, hopefully in time. We have to get it right.

To do so we must clearly understand the cause of global warming so that we can address it in an informed scientific way. Our current models and understanding are inadequate to do this.

What is causing climate change: a new systems understanding and its implication?

20. Although science and the community now widely acknowledge that climate change is real, significant scientific uncertainty remains about what is causing it and hence what we can do to mitigate it, hopefully in time. We have to resolve this uncertainty urgently or risk a costly, possible terminal, failure for much of our socio-economic system.

21. The commonly understood explanation is that global warming results from:

- our increased burning of fossil fuels and increased emissions of CO_2,
- the abnormal increase in atmospheric CO_2 levels,
- the heating of the planet by some 0.8^{o}C (or 2w/m^2) via the CO_2 contribution to the natural greenhouse effect since 1750AD.

22. As such it is argued that we should be able to mitigate the impacts of global warming by reducing our future CO_2 emissions and sequestering CO_2.

23. Although the CO_2 greenhouse effect is of course real and does contribute some 4% to the global heat dynamics and balance, we also know from climatology that the planet's and regional temperatures and climates are governed by many complex processes and balances.

In fact several water-based processes have governed and regulated over 95% of the heat dynamics and balance of the blue planet for over 4 billion years and still do so today.

24. The CO_2-greenhouse models have, however, ignored most of these water effects on the assumption that, as humans are responsible for global warming, it must be due to the clearly abnormal increase in CO_2 levels assumed to result from our use of 300GTC of fossil fuels.

Humans, it is assumed, could not possibly have altered the planet's water dynamics, and hence, this dominant factor governing global heat balances.

25. Consequently our climate change models and the IPCC analyses and predictions *a priori* assume that the CO_2 greenhouse effect is responsible for and can explain global warming. Although extensive meteorological data has been collected to try to monitor the greenhouse effect and warming trends, this is assumed to be due primarily to the increased CO_2 levels.

While the models acknowledge that water processes, including poorly understood cloud effects, are fundamental in governing and understanding the global heat dynamics, balance and climate as they are as yet impossible to quantify mathematically the models disregard them as being, not primarily involved in the human or CO_2 induced global warming.

26. Based on these models and assumptions on the cause of global warming, it is then assumed that we can still mitigate global warming by reducing future CO_2 emissions.

However, even if this was the cause, science makes it clear that this is no longer possible.

Due to CO_2 absorption by oceans, ocean lag effects and CO_2 residence times, some 50% of the CO_2 emitted since 1970 has yet to be fully equilibrated into the atmosphere.

As such we can no longer prevent CO_2 from rising above 500 ppm by 2030 nor prevent the resultant 2-4^{o}C temperature increase from accelerating further dangerous climate feedback processes by reducing future CO_2 emissions.

27. Effectively we are already twenty years too late to now prevent CO_2 levels and the resultant temperature increases from triggering dangerous climate feedbacks by any, even a 100%, level of future CO_2 emission reduction.

We can no longer rely on CO_2 reductions or targets to prevent dangerous warming.

Our only chance is to find more effective, immediate ways to cool regions and the planet.

We need to offset the heating effects from the locked in CO_2 rise so as to prevent accelerating further dangerous positive feedback meltdown processes from the inevitable rise in CO_2 levels above 500 ppm within the next twenty years.

We have to face this scientific reality urgently and find effective global cooling options.

Our last chance to mitigate global warming

28. If, as the science makes clear, we can no longer prevent dangerous climate change by reducing future CO_2 emissions to any level, we have no option but to either:

a. Wait for the inevitable serious climate and economic meltdown as early as 2030, or

b. Cool regional and the global climate to offset the 2 w/m^2 heating effect from the current greenhouse effects thereby restoring the former global heat balance.

29. However if we wish to cool the planet we must do this urgently, within a decade, so as not to risk accelerating further dangerous positive feedback processes and temperature increases.

30. Fortunately there are highly effective, safe natural processes for doing this.

However they require us to look beyond our current CO_2 greenhouse assumptions which are acting as a barrier to fully understanding global warming and in taking effective action.

Indeed there is compelling scientific evidence that:

- The earth's climate is governed substantially by undisputed natural water-based processes that regulate global and regional heat dynamics and balances, and that
- Humans have grossly disturbed these processes through widespread deforestation resulting in global warming and the observed changes in clouds and rainfalls.

31. It follows that we may be able to safely cool the planet, as nature has done for over 3 billion years, by enhancing either or both:

- The nucleation of dense clouds to restore former albedo processes to reflect additional solar radiation of up to 100 w/m^2 back out to space, or
- The latent heat fluxes that transmit and dissipate additional infrared heat again of up to 100 w/m^2 from the surface back out to space.

32. Even at 1% of their potential effectiveness these processes would be adequate to provide a regional cooling 'forcing' more than adequate to safely and naturally offset the 2 w/m^2 mean global heating observed to date from the human induced increase in the greenhouse warming.

33. Simple, practical, safe and affordable; even profitable, options exist to restore such cooling processes in most regions of the world so as to address global warming and avoid further accelerating dangerous climate feedbacks, such as the rainfall decline in southern Australia.

There are no barriers or risks to applying such solutions - beyond changing our current assumptions.

In contrast to ineffective carbon emission reduction strategies, they also do not require us to 'crash' our energy use, economies and equitable human welfare.

While the decline in the availability and affordability of oil and financial deflation will force us to face the need for energy efficiencies soon enough, hopefully this can be achieved through the planned rationalization of demand and via available alternatives based on sound economic policies so as to minimize economic and social dislocation.

We need to stop compromising both our climate change and end of oil responses by confusing them as being the same. If we don't resolve the former directly within a decade its economic effect may make the need for the latter redundant.

D. Proposed response options

34. As outlined above, there still are highly effective natural hydrological options through which Australia and the world could minimize the risks and impacts from climate change.

Furthermore, once established, these processes can be effective in cooling regions and the planet within days, not the centuries required for CO_2 reductions to be marginally effective.

However we have left it hopefully not too late to take advantage of such options.

35. Although these hydrological options are natural, safe and immediate they are also innovative in that they require a paradigm shift in how we understand and respond to climate change.

As such they have been rejected so far by policy areas, even for critical evaluation.

However as they are now the only viable option to prevent meltdown, the Garnaut Review may wish to:

a. Critically examine the merits of all - even these more innovative - proposed solutions.
b. On merit, identify and recommend practical, low risk, natural restoration ecology options to re-establish the former hydrological processes, heat dynamics and balances.
c. Recommend the urgent extension of the required on the ground changes.

36. The following provides a summary of three complementary elements of a practical strategy whereby Australia could restore such natural processes, cool regions and lower the current and pending risk of dangerous further climate change impacts, hopefully in time.

Implemented optimally, with and by Australian farmers, these options could substantially and urgently address the adverse impacts of climate change without crashing the economy while also delivering major benefits to Australia's environment, society and economy.

37. The specific elements of this strategy to maximize value from climate change involve:

a. The re-forestation of northern and inland Australia to restore natural rainfalls.

b. The enhancement of stable soil carbon levels in profitable carbon farming systems.

c. The creation of autonomous regional bio-fuels capabilities and carbon savings.

Response option a

The re-forestation of northern and inland Australia to restore natural rainfalls

38. Although global warming will further raise temperatures and sea levels, of more urgent concern to Australia is that climate change has already begun to reduce rainfall and its reliability throughout much of southern Australia. As such it is already putting at risk much of Australia's agriculture, eco-systems and their dependent societies and economies.

39. Consequently, and irrespective of ongoing international non-agreement, Australia and/or regional communities need to urgently protect, secure and restore their fundamental rainfall resources or risk becoming the first major international casualty of climate change.

40. The scientific evidence suggests that the decline in westerly Ferrel rainfalls in southern Australia will be permanent. Eastern Australia is also likely to experience more frequent and intense El Nino droughts as the equatorial Pacific heats up. Both will further reduce national water security and threaten communities and economies significantly.

41. However the scientific evidence also indicates that significantly increased heating is occurring in the tropical Indian Ocean which now represents one of the world's major zones of evaporation with latent heat fluxes exceeding 180 w/m^2. Much of this evaporated water vapour flows naturally to the south east across Australia where some of it precipitates.

42. How much of this humid air flow precipitates depends fundamentally on specific cloud and rainfall nucleation processes. Up to 4000 years ago, when these processes were more active, northern and inland Australia was cooler, wetter and substantially forested. Lake Eyre was a lake 25 meters deep recharged by the former more regular Australian monsoon.

43. Our water and climate change crises now provides us with the imperative to restore this Australian monsoonal rainfall and its associated cloud albedo and cooling effect . In part this is already occurring naturally as evidenced by the significant increase in rainfalls in NW Australia over the past 50 years.

Indeed the rain throughout inland south eastern Australia in December 2007 came from the Indian Ocean and was typical of such former monsoonal rainfall. It did not indicate a La Nina, the restoration of 'normal' rainfall conditions nor 'break the drought', but simply reinforced that we have this one last option to avoid the widespread desiccation of southern Australia.

44. Fortunately highly effective, natural and safe options may exist to restore such rainfalls. We may be able to re-establish the former Australian monsoon by influencing the extent to which water vapour flowing naturally over inland Australia is first nucleated to condense into cloud micro-droplets and then coalesced via larger precipitation nuclei to precipitate as rain.

The increased induction of clouds could readily enhance albedo cooling effects to mitigate climate change while the enhanced rainfall could help restore many of the degraded bio-systems over much of inland Australia affected by the previous decline in the monsoon and the recent systemic drying of southern Australia.

45. Different land covers, particularly forests, influence the production of both these nuclei. We should therefore be able to enhance the production of these nuclei and hence rainfalls through appropriate natural land management practices. Significant anthropological evidence indicates that this is the case. Field evidence similarly confirms such options (NSF 12-2007).

46. As such we may be able to significantly cool much of Australia, offset climate change, enhance rainfalls, and restore the bio-systems needed to sustain these cloud and rainfall nucleation processes by the strategic restoration of appropriate natural forest systems.

47. Indeed the savannas of northern Australia still contain over a thousand patches of remnant rainforest from previous wetter epochs that, with appropriate land management, will extend naturally to help re-establish such bio-systems, hydrology and rain nucleation processes.

48. The enhancement of such natural restoration ecologies could contribute significantly not just to maintaining rainfall, healthy bio-systems and economies across inland Australia but also represent a major additional global bio-sequestration option and carbon sink.

49. Even the partial reforestation of the 500 m Ha of inland and northern Australia that would benefit from such rainfalls, (at conservative bio-sequestration rates of 10 tonnes of carbon per hectare per annum (tC/Ha/an)), could sustainably sequester over 2 billion tonnes of carbon per annum (2GTC/an), some 25% of current global emissions, and return some $200 billion pa in carbon credits to Australia at current carbon values.

50. However this annual economic return is likely to be far exceeded by the additional economic benefits from avoiding the otherwise serious further desiccation of southern Australia and its agricultural industries due to the current climate changes.

Response option b

The enhancement of stable soil carbon levels in profitable carbon farming systems

51. As the most urgent and severe impact of climate change is likely to be its threat to Australia's rainfall and water security, Australia's priority in mitigating climate change must be to restore and secure its rainfall and water supplies, not just lower CO_2 emissions per se.

52. However carbon can directly and naturally contribute to the restoration of these natural hydrological processes in that stable soil organic matter substantially governs the infiltration, retention, water holding capacities and thus the availability of water in most Australian soils. Furthermore bio-sequestered cellulose and lignin also provides the building blocks for the growth, and hence transpiration and production of rain nuclei by these trees and forests.

53. As such the restoration of soil organic matter and structures will be critical in restoring global forests and through them the; transpiration, cloud nucleation, albedos and rainfalls to cool regional and global climates. The restoration of stable soil organic matter will also be critical in improving the structure and water availability from soils to enable such forests to grow better and longer even on poor primary soils.

54. Indeed the expansion of vegetation and forests over the past 400 m years was substantially governed by the rate at which carbon could be bio-sequestered from the very high levels then in the air into stable soil carbon to progressively enhance soil structures, water retention, root proliferation, drought resilience to synergistically assist forest productivities and expansion.

55. It follows that restoring the organic matter status, or stable carbon levels, of our soils now provides the most effective practical means to enhance not just the establishment and growth of forests and their critical cloud cooling and rainfall processes but also the availability of water from that rainfall to further support growth of that forest and its cooling effects.

56. Ratification of the Kyoto protocol also now enables Australian land managers to be paid, up to $100/t, for carbon that they can bio-sequester from the atmosphere via plants and stored as long lived stable soil humates and glomalins in managed soils.

57. Consequently 'carbon farming' now provides Australia with a new market opportunity to bio-sequester stable carbon in soils so as to secure carbon credits while enhancing water infiltration, retention and availabilities and the bio-productivity, resilience and value of land.

Potentially soil carbon credits from the 100m ha of managed land in Australia may yield some $100 b pa in carbon credits. This would be additional to the $200b pa potential income from carbon credit from the above ground bio-sequestration of carbon in the forests that could be restored in inland Australia to restore rainfalls and climates.

58. Carbon farming systems can be tailored for different agro-ecosystems to optimize the bio-sequestration of, and value capture from, stable soil carbon while also optimizing the restoration, productivity, viability and sustainability of Australia's land systems.

In addition to mitigating climate change, soil carbon farming could substantially address the:

a. Soil degradation over the past 200 years which has reduced the level of stable carbon in over 300 m Ha of Australia's top soils from often over 5% to below 0.5%.

b. Loss of some 150-300 tonnes of carbon /Ha or 0.5-1.0 GTC which contributed to the increase of 150 GTC of CO_2 in the global atmosphere over this period.

c. The degradation of Australia's soil structure, its water infiltration, water holding capacities and the productivity and sustainability of many dependent agro-ecosystems.

59. As water stresses intensify with climate change and extremes, it is critical that farmers restore the natural resilience of their soils and agro-ecosystems to such stress. To achieve this farmers must urgently restore their former stable soil carbon levels and through that their soil structures and buffering capacity.

60. Innovative practical methods are available to safely and profitably do this including via combinations of cell grazing, pasture cropping and mosaic land management practices. Practical methods are also available to enhance, measure and verify the stable carbon sequestered so as to secure premium value capture from this carbon farming opportunity.

Successfully implemented these carbon farming practices have the potential to bio-sequester some 10T carbon per Ha per annum into stable soil humates and glomalins over some 100 m Ha throughout Australia's agriculture and agro-forestry sectors.

61. At current carbon prices this bio-sequestration of 1GTC/an into stable soil sinks represents a potential direct farm income of some $100 b pa in addition to the far more valuable on farm and national eco-system services benefits from the improved soil productivities, water dynamics, resilience and climate protection.

62. Once demonstrated and extended throughout Australia's agricultural sectors, soil carbon farming has the potential to provide Australia with a major opportunity to restore its soil natural capital, reinforce the resilience of future agro-ecosystems to climate extremes and substantially mitigate climate change.

63. Leading Australian carbon farming interests are refining capabilities to aid in the commercial extension and uptake of such restoration ecologies, land management practices and new farming opportunities and business systems throughout Australia. These capabilities and further detailed briefings on them may be highly relevant to this Review to optimize agricultural response options to both the challenges and opportunities from climate change.

64. However such strategies can only be implemented by land managers, not by governments, agencies or by coercive regulation. Government policy can play vital roles in fostering the growth and viability of Australia's new carbon farming industry and innovation capacities to help address our climate, land degradation and rural restructuring challenges. However they need to do this with, and not contrary to, the interests of landholders.

65. In view of the significant potential relevance of soil carbon farming to Australia's farming

sector and in mitigating climate change, the design of any future national carbon trading system should involve close consultation with this new Australian industry to optimize both commercial and strategic national objectives from this carbon farming opportunity.

Response option c

The creation of autonomous regional bio-fuels capabilities and carbon savings.

66. Australia's rural economy is currently highly dependent on imported fossil fuel. It has high transport requirements for both imports and exports and fuel represents up to 70% of the on farm inputs such as for cultivation, fertilizers, pesticides and harvesting. Much of the on and off farm infrastructure that supports farming also has high embodied and operational fossil fuel inputs. As a result Australia's agricultural sector has a high carbon footprint representing some 28% of Australia's total carbon emissions.

67. As the availability and affordability of oil declines over the next decades, fuel prices will severely impair Australia's agricultural sector. Carbon accounting and emission trading to try to limit carbon emissions will further impact current agricultural systems.

68. While commodity prices may increase, they are unlikely to offset the increased fuel costs. Many currently indebted farmers may have to cease operations with major economic and social multiplier costs and erosion of export incomes.

69. Consequently rural industries need to urgently re-design operations so as to:

a. Lower their demand for fossil fuel associated with their direct and embodied inputs.

b. Minimise emission liabilities under future carbon trading systems.

c. Develop alternative autonomous fuel supplies from local sources.

d. Maximize local value creation and capture from such new local bio-fuel options.

e. Avoid the likely collapse of regional economies if still dependent on fossil fuels.

70. Fortunately effective options exist for rural communities to enhance their fuel autonomy and achieve the above objectives. These are complementary with and flow from the above proposals to restore Australia's forests, regional rainfalls and soil organic matter levels, soil productivity and resilience.

71. Effectively the restoration of natural forests over 200m Ha of inland Australia has the potential to produce biomass at 10 t/Ha/an bio-sequestering some 2 GTC/an. However the wood and carbon sequestered in such forests is vulnerable to fire and termites and not a stable valuable long term carbon store. Ideally this carbon needs to be routinely converted into stable and much higher value carbon sinks through regional operations and technologies.

72. Highly effective technologies exist for new regional industries to do this commercially.

a. Over 60% of the wood biomass may be able to be sustainably harvested and converted into high value long lived timber products such as structural framing for affordable housing.

b. The remaining wood and woody wastes can now also be converted via regional controlled anaerobic pyrolysis technologies into;

   - Hydrogen and methane gas which can be scrubbed and compressed into a liquid natural gas for use as an economical regional transport and farm fuel.
   - Residual activated carbon or bio-char which is an ideal water filter to remove effluent nutrients to enable re-use of the water and also produce a valuable nutrient-enriched stable carbon bio-fertilizer to substitute the more expensive oil based fertilizer inputs.

73. Such BECS (Bio-Energy with Carbon Sequestration) capacities could be established commercially throughout regional Australia as part of this forest expansion enabling rural communities to substantially:

a. Become autonomous in their sustainable viable production of low emissions transport fuel.

b. Minimize carbon emissions from the current widespread burning of biomass.

c. Provide options for the autonomous production of regional electricity needs from the heat generated as part of the BECS process.

d. Minimize the high current carbon footprint and liability in many regional industries.

e. Replace current fossil fuel based fertilizers with local stable carbon bio-fertilizers.

f. Improve the structure and water infiltration, retention and availability in local soils.

g. Improve the quality, availability and re-usability of limited water supplies.

h. Stimulate the development of new regional eco-businesses with major multiplier benefits.

74. Although the benefits from BECS technologies and operations have been confirmed, they are most viable when they form an integrated part of a wider biomass based industrial ecology.

Potentially they provide unique innovative solutions to climate change being the only option through which regions can trap, harvest and convert solar energy into low emissions transport or electrical bio-energy while also profitably bio-sequestering most of the biomass carbon.

75. Such integrated biomass and BECS strategies now provide rural communities with the opportunity to fundamentally:

- Transform many of the current high risk, low value, fossil fuel dependent commodity operations into,
- The profitable farming and conversion of solar energy into valuable products via autonomous, sustainable new operations subsidized by international carbon credits.

76. Through such strategies, rural communities and regions now have the potential to:

- Mitigate climate impacts,
- Restore natural productivities and capital,
- Re-juvenate their regional economies, and
- Re-position themselves to be competitive in the global market opportunities and industrial ecology of the twenty-first century.

77. Australia has unique potential strategic and competitive advantages to capture such markets and premiums on account of its:

a. Extensive available but often degraded land with suitable climate especially once enhanced.

b. Unique forest and microbial bio-systems and resources that are able to sustain high biomass productivities even under minimal input and site conditions.

c. Advanced scientific understanding and practical skills in managing such bio-systems.

d. Access to leading technologies for enhancing, verifying and maximizing value capture from such bio-mass, carbon farming and bio-conversion operations.

e. Political and legal stability to enable secure long term investment in such carbon farming.

78. Consequently both the opportunity and foundations are in place for Australia to foster such a new biomass and carbon farming industry and in doing so help to address:

a. Australia's pending climate change crisis, risks and their socio-economic impacts.

b. Australia's critical water supply and security crisis.

c. Australia's economic challenges from the declining availability and affordability of oil.

d. Australia's serious degradation of its critical bio-systems, natural capital and sustainability.

e. Australia's social and economic welfare in re-positioning capabilities to better serve the global opportunities and industrial ecology of the twenty-first century.

79. Although Australia's strategic response to these issues and opportunities may be beyond the scope of the Garnaut Review, these proposals may fundamentally influence:

a. Australia's options to respond to and address climate change.

b. The impact and cost of climate change on Australia's agricultural sector and communities.

c. The design and effectiveness of any Australian carbon trading system.

80. As the recommendations from the Garnaut Review may significantly enhance or retard the further development of, and value capture by, Australia's carbon farming and biomass industry it is requested that the above issues and proposals are considered by the review.

E. Potential benefits from timely responses to Australia's climate change challenge

81. As climate change and dangerous feedback effects increasingly impact throughout Australia, there are clearly major benefits if we can avoid these social, economic and environmental impacts by mitigating climate change, hopefully in time.

82. Although impossible to evaluate financially, there are also fundamental benefits from preventing the further degradation of Australia's bio-systems, natural capital and resilience. The natural safe restoration ecologies being proposed to offset and mitigate climate change should contribute significantly in preventing and restoring such further degradation.

83. Based on the likely costs from just the current drying of southern Australia, climate change already risks costing Australia up to $50 b pa in lost agricultural production, exports, business viability and social and regional multiplier impacts. Further intangible costs may also be involved.

However, until the risk and potential cost from some twenty other possible dangerous feedback processes that may be triggered by climate change are assessed it is not possible to estimate the full direct or indirect cost of climate change to Australia.

84. The benefit of the proposed urgent cooling of regional and the global climate to prevent the further acceleration of such risks and impacts can however be assessed based on the cost of the, potentially existential, consequences that are thus avoided.

85. The proposed cooling and bio-sequestration responses by Australia's agricultural sector to avoid and mitigate climate change may also deliver direct financial benefits.

The proposed strategies, if implemented fully by Australian land managers, could potentially capture up to $300 b pa from international carbon credits at current prices.

Even if implemented at only 10% of its potential this income is equivalent to Australia's current agricultural GDP but should deliver higher returns due to the lower input costs.

How much of this potential can be realized depends substantially on how policies either enhance or retard the development of Australia's new carbon farming industry.

86. Additional direct financial benefits can be captured if new regional biomass industries can be developed to utilize and maximize local value capture from the resource and input savings.

Although difficult to estimate, these benefits may involve $10 b pa in income and multipliers from the regional production of new high value timber products plus $10 b pa from savings in current direct and embodied input costs.

87. In addition to such regional benefits, Australia's leadership in and development of such technologies and strategies may have major international significance and potential value.

Climate change is impacting globally with similar urgent crises threatening the rainfall, water resources, food security, soil capital, productivity, resilience and sustainability of much of the world's agro-ecosystems and regions and much of their dependent economies and societies.

88. Australia's service industry potential to help to avoid such global collapses is substantial.

Conversely if Australia continues to fail to develop such capabilities, so too will be the cost.

89. Whether we can realize the potential economic benefits outlined in the above strategies depends substantially on whether such new regional industries can overcome major structural impediments, competitive interests and status quo inertia in our current business environment.

Government policies, including the creation of open information, analyses and debate, and free markets are critical so as not to impede the growth of such innovative solutions.

90. Government policies, particularly with regard to carbon rights and trading, will also be critical in determining investment in this new industry.

While the costs of implementing the on farm changes are modest, the scale of the challenge and proposal will require major shifts in investment from the current speculation in virtual financial products to long term secure investments to restore tangible natural capital.

91. Although Australia's productive land based industries are likely to become even more attractive to international capital due to our natural comparative advantages, stability and high potential returns, much depends if the carbon credits generated by land managers can be captured from such investments and traded freely on global markets.

This is also affected by the design of Australia's future carbon trading system.

92. Such investment and the development of an Australian carbon farming industry may be of major benefit to the Australian economy in the context of the pending global financial crisis.

While Australia can expect substantially increased foreign investment due to its resource base, stability and comparative high interest rate, this capital creates dangerous inflationary pressures unless it can be attracted into long term non inflationary capital and capacity building projects such as the proposed growth of Australian bio-carbon industries and regions.

93. Policies which support the restoration these bio-systems may enable governments to realize major benefits from enhanced regional employment, revitalization and incomes at minimal public cost while also avoiding the otherwise inevitable serious climatic impacts.

94. Most of all the above analyses and proposals may also benefit Australia significantly by helping our understanding of, and planned responses to, climate change move beyond the current inertia and by providing economic, safe options to cool regions and the planet.

95. After decades of delays and denials, this Review now provides Australia with its last chance to avoid triggering further dangerous climate change and its consequences.

To that end the Review must be based on a full scientific understanding of all the processes involved so it can respond effectively cognizant of all the resultant social and economic costs. To achieve this we need open critical analysis and debate. It is hoped that the above outline is of benefit to this understanding and response to climate change, hopefully in time.

F. Recommended next steps

96. Based on the above analyses Australia needs to face the reality that:

a. Climate change and its dangerous feedback effects are real, already occurring and more serious and urgent than understood by the wider Australian public.

b. Climate change is already seriously impacting on the viability of Australia's agricultural sector and regions, particularly through the systemic drying of southern Australia.

c. These impacts will inevitably change current economies and societies and require us to urgently transform our farming systems to be more productive and resilient.

d. Further dangerous climate change effects will be triggered within decades and can no longer be prevented by any level of future CO_2 emission reductions or emissions trading.

e. Effectively we have left it twenty years too late to now prevent further dangerous climate change by future CO_2 emission reductions. We urgently need other more effective options.

f. Fortunately we do have a last chance, to cool regional and the global climate and thereby avoid further accelerating dangerous climate feedback effects, hopefully in time.

g. Although fully substantiated by science and although we can do this safely, naturally and profitably, it requires us to see beyond current assumptions on the cause of climate change.

h. If we are prepared to do so, we should be able to cool the climate by restoring the earth's natural water and heat dynamics and hence balance to offset global warming effects.

i. This it will require changes to land management so as to restore the natural transpiration, cloud nucleation, albedos, rainfalls and the soil conditions underpinning such cooling effects.

j. Fortunately this can be done profitably by fostering and enabling Australia's carbon farming industry to capture the carbon credits to extend the industry and its significant benefits.

k. However to realize this potential the industry must not be impeded by government policies.

l. Consequently further discussions are needed to ensure that policies and industry strategies maximize the effectiveness and strategic benefits from this only option for now preventing dangerous climatic and economic meltdown within decades.

97. In this context it is requested that the Garnaut Review and the Government:

a. Critically review the scientific evidence substantiating this analysis and understanding of the cause and our last chance mitigation option to avoid dangerous climate change.

b. Critically review the likely economic impacts, costs and consequences of climate change arising from this analysis and understanding.

c. Critically review the scientific evidence underpinning the feasibility of the proposed strategy to cool regions and the global climate to avoid dangerous climate change.

d. Critically review the potential of Australia's new carbon farming industry, if allowed to develop, to contribute to implementing the needed actions to mitigate climate change.

e. Liaise with relevant scientific and industry specialists to ensure that policies and strategies in this area complement each other and are effective in addressing this critical challenge.

98. As requested, detailed scientific and economic substantiation can be provided in relation to the above analyses, options and proposals within our resource constraints. We would be pleased to contribute constructively to identifying effective solutions to meet this challenge.

Thanking you for your consideration of these important issues.

Attachment 1

Positive climate feedback processes and risks of triggering dangerous climate shifts

Further to dangerous impacts identified by Schellenhuber (DEFRA 2005)
Occurring now or triggered at >2ºC temperature increase when CO_2 >500ppm

No	Feedback process	Consequences	Like.	Cons.	Risk	When
1.	Reduced artic ice albedo	Heating, thawing, polar bear habitat		3	2	6 now
2.	Reduced albedo on Tibet plateau	Heating, floods, droughts	3	3	9	now
3	Breakup Greenland ice sheet	Heating, 7m sea level rise, ocean current disruption	3	3	9	now
4.	Break up Antarctic ice sheet	Heating, 25m sea level rise, major inundation	3	3	9	?
5.	Thawing of tundra	Heating, methane release, floods, drought	3	3	9	now
6.	Release of 10,000 GTC from methane hydrates	Methane GH, anoxia, terminal mass extinction	1	3	3	?
7.	Increased soil respiration	Heating ,loss of soil OM, water, food security	3	3	9	now
8.	Increased forest fires, CO_2 and pollutants	Heating, loss of C sink, biodiversity, pollution	3	3	9	now
9.	Reduced transpiration and rainfalls	Heating, desertification, bio-sequestration capacity	3	3	9	now
10.	Reduced photosynthesis, pollination above 36ºC	Less bio-sequestration, food insecurity	3	3	9	now
11.	Drying of Amazon forest Drying of large regions	Less bio-sequestration Heating, food insecurity	3	3	9	now
12.	Slowing ocean conveyor and heat, CO_2 transfer	Freezing of Europe Less bio-productivity	3	3	9	now
13.	Acidification of oceans	Coral collapse, CO_2 release, productivity	3	3	9	now
14	Heat layering in oceans H_2S production	Heating, anoxia, mass extinctions	3	3	9	?
15.	Less phytoplankton and food chains	Less bio-sequestration, food insecurity	3	3	9	now
16.	Change in rainfall cells More severe storms	Desertification, floodsdamage, non viability	3	3	9	now
17.	Desertification due to variability and extremes	Less bio-sequestrationWater and food insecurity	3	3	9	now
18.	Decline in soil OM and structures and stability	Less bio-sequestrationWater, food insecurity	3	3	9	now
19.	Water and food insecurity Urban dependencies	Social crises, conflict, disease incidence, impacts	3	3	9	now
20.	Increased disease risk and impacts	Social crises, pandemics Eg SARS, H5N1	3	3	9	now