

Research for Action climate

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Addressing climate change

There are a number of natural influences on the world's climate, including changes to the Earth's orbit, volcanic and meteorite activity and tectonic upheaval. In addition to these influences, most scientists now accept that human activity is increasing the concentration of greenhouse gases in the atmosphere, leading to an enhanced greenhouse effect.

The greenhouse gas contributing most to the enhanced greenhouse effect is carbon dioxide (CO₂). Fossil fuel combustion for electricity and transport and from deforestation has increased CO₂ concentration in the atmosphere to 36% above pre-industrial levels. Other greenhouse gases, such as methane, nitrous oxide and water vapour, also contribute significantly to the enhanced greenhouse effect. These are usually expressed in CO₂ equivalents.

In 2007, Australia emitted 597 Mt of CO₂e. While this was less than 2% of total global gas emissions, Australia's per person emissions (28 t CO₂e) were twice the OECD average, and 4 times the world average.

NSW contributed 163 Mt (27%) of Australia's emissions in 2007. Energy production from coal-fired power stations accounted for 40% of NSW emissions. Fugitive emissions from coal mining, oil and natural gas production contributed 10.2%. Agriculture accounted for 10.8% of NSW emissions and, of this amount, 74% was methane from enteric fermentation in livestock, and 19% was from soils (mostly nitrous oxide emissions from fertiliser). Land-use change (mainly clearing) accounted for 7.8% of NSW total emissions, while forestry sequestered 1.7 Mt of CO₂e, offsetting 1.0% of total NSW emissions. Sequestration of carbon in soil is not currently included in the national inventory. Industry & Investment NSW (I&I NSW) estimates it could potentially sequester up to 18 Mt CO₂e per annum in NSW.

The increase in emissions of greenhouse gases (particularly CO₂ from combustion of fossil fuels) has altered atmospheric composition, and is increasing global temperatures and affecting global and regional climate systems. Even if emissions are capped at today's levels, changes to the climate are expected due to the lagged effects of past greenhouse gas emissions.



I&I NSW – PROFITABLE, ADAPTIVE AND SUSTAINABLE PRIMARY INDUSTRIES IN NSW

The role of the Science and Innovation Division of Industry & Investment NSW

The key questions that research needs to answer are:

- What are the impacts of climate change on primary industries and associated rural communities?
- How can primary industries and communities adapt to the impacts of climate change?
- What are the options available to primary producers to reduce their emissions and sequester carbon?

What research is required to inform the development of policies designed to address climate change?

The Science and Innovation Division of I&I NSW have adopted a strategic approach to ensure our R&D capacity and capability can respond to these challenges and has identified priority actions to assist this process <http://www.dpi.nsw.gov.au/research/topics/climate-change/discussion-paper> and the I&I NSW Framework for Action: Climate document.

I&I NSW has already implemented a number of key research initiatives that deliver on priority actions for climate change for NSW primary industries. These include developing models to downscale global climate projections for specific industries and regions in NSW; plant and animal breeding programs, decision support tools and production systems to cope with a changing and more variable climate; developing low

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cost accounting techniques for emissions at farm and forest scale; developing technologies to reduce emissions – such as methane and nitrous oxide from agriculture and forestry, sequester carbon in soil and forests; and to develop energy from biomass.

There is clear recognition of linkages between this Climate Change theme and the other four priority research themes in the Science and Innovation Division of I&I NSW (Water Management; Productivity and Food Security; Biosecurity and Ecosystems).

Working with our stakeholders

The Australian Prime Minister ratified the Kyoto Protocol in December 2007. Australia has committed to meeting its Kyoto Protocol target, and has set a target to reduce greenhouse gas emissions by 60% from year-2000 levels by 2050, including an interim reduction target of between 5% and 25% by 2020.

The Australian Government proposes to reduce emissions principally through the introduction of a Carbon Pollution Reduction Scheme (CPRS). The CPRS will impose a 'cap' on the amount of greenhouse gases that may be emitted, and will create a price for carbon, making it a tradeable commodity. Carbon trading will have significant impacts on both production costs and production methods of primary industries, irrespective of which primary industries are "covered" sectors. Mining activities will be included in the CPRS from its introduction in 2011, plantation forestry can 'opt-in' to the scheme, and a decision will be made in 2013 about the possible inclusion of agriculture from 2015. The fisheries sector will not be "covered" but will be affected by increased input costs, such as fuel.

The NSW Government is also committed to slowing and reversing the projected growth of greenhouse gas emissions and adapting to the impacts of climate

change. The NSW State Plan sets an emission reduction target of 60% by 2050. The NSW government will shortly release a Climate Change Action Plan.

I&I NSW is an active participant in the Primary Industries Standing Committee (PISC) RD&E Framework, which has climate change as a key focus through the Climate Change Research Strategy for Primary Industries (CCRSPI). I&I NSW is also a partner in the Primary Industries Adaptation Research Network (PIARN) set up under the umbrella of the National Climate Change Adaptation Research Facility (NCCARF).

I&I NSW works closely with the Minister's Advisory Council for Primary Industries Science (MACPIS) and for commodity advisory councils on Agriculture, Forestry, Fisheries and Minerals.

I&I NSW has established formal partnerships with key universities active on climate change research. These include: UNE, through the National Centre for Rural Greenhouse Gas Research, CSU through the EH Graham Centre, Sydney University, Griffith University, Queensland University of Technology, Melbourne University, Massey University, Southern Cross University and Newcastle University.

The climate change research staff of I&I NSW also actively collaborate with a number of other organisations including: CSIRO, ACIAR, several Cooperative Research Centres, Research and Development Corporations including GRDC, RIRDC, MLA and FWPA and a number of Catchment Management Authorities.

Effective integration with the extension staff in I&I NSW will ensure that primary industries have the capacity to adopt R&D innovations and technologies, while strong links with policy staff will ensure that policy is supported by sound science.



OUTCOME

Impacts of climate change on primary industry production and wild harvest systems are identified and monitored

Objectives

Forecast the impacts of climate scenarios on key agricultural, forest and fishing systems in NSW

Monitor impacts of changing climate and use information to inform modelling

Strategies

1. Develop a spatially explicit modelling framework to analyse the impacts of climate change on primary industries
2. Form strategic alliances with key climate modelling groups to ensure a coordinated approach to quantifying climate impacts on primary industries
3. Identify the coping range and resilience of key production systems to forecast changes in climate variables
4. Apply modelling framework to downscaled global circulation model (GCM) outputs and coping range data to forecast the impacts of climate change on key NSW industries and regions
5. Estimate the probability and consequence of a range of likely impacts
6. Impacts prioritised by industry and region to inform development of adaptation responses
7. Model the risks associated with key biosecurity issues (pests, weeds and diseases)
8. Long term research sites incorporated into NSW monitoring and environmental reporting (MER) program

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OUTCOME	
Government and primary industries have the tools and knowledge to adapt to a changing climate	
Objectives	Strategies
Develop adaptation options for primary industries production systems (agriculture, plantation forestry, aquaculture)	<ol style="list-style-type: none"> 9. Form strategic alliances with key R,D&E partners to ensure a coordinated approach to developing adaptation responses for primary industries including: <ul style="list-style-type: none"> • Climate Change Research Strategy for Primary Industries (CCRSPI) • The Primary Industries Adaptation Research Network (PIARN) • Academic institutions and Cooperative Research Centres (CRCs) 10. Develop R&D programs in collaboration with key primary industries stakeholders for production systems in: <ul style="list-style-type: none"> • livestock industries • broadacre cropping and mixed farming • horticulture and viticulture • irrigation • aquaculture • plantation forestry
Develop adaptation options for natural and wild harvest systems (native forests and wild harvest fisheries)	<ol style="list-style-type: none"> 11. Develop R&D programs in collaboration with key primary industries stakeholders for wild harvest systems in: <ul style="list-style-type: none"> • wild fisheries and aquatic ecosystems • native forestry 12. Develop risk management tools for primary producers 13. Undertake socio-economic assessment of climate change impacts and adaptation strategies.



OUTCOME	
Increased industry and community application of sustainable mitigation technologies	
Objectives	Strategies
Develop accounting methods incorporating life cycle assessment to quantify greenhouse gas emissions by primary industries	<ol style="list-style-type: none"> 14. Develop cost effective GHG measurement, accounting and modelling techniques to quantify: <ul style="list-style-type: none"> • the principal greenhouse gases emitted by agriculture and forestry systems (methane, nitrous oxide and carbon dioxide) • the amount of carbon sequestered above and below ground by key agriculture and forestry systems 15. Develop a farm level emissions calculator for key agriculture and forest systems 16. Quantify the greenhouse balance of key agricultural systems in NSW
Develop and evaluate options to reduce greenhouse gas emissions from, and sequester carbon in agriculture and forestry systems in NSW	<ol style="list-style-type: none"> 17. Develop and evaluate options to reduce methane emissions from ruminant livestock 18. Develop and evaluate options to reduce nitrous oxide emissions from agriculture and forestry systems in NSW 19. Develop and evaluate systems for increasing carbon stored in soils in agriculture and forest systems in NSW 20. Develop and evaluate options for sequestering carbon in forests and forest products
Develop sustainable bioenergy options for primary industries	<ol style="list-style-type: none"> 21. Quantify the sustainable level of biomass resources currently or potentially available in NSW for bioenergy uses 22. Develop, evaluate and apply technologies to convert biomass to bioenergy, value added products or stable forms of carbon including: <ul style="list-style-type: none"> • lignocellulose • biochar

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OUTCOME	
Climate change policy is underpinned by sound science	
Objectives	Strategies
Actively participate in the development of national policy to manage emissions from, and sequestration options in, primary industries	23. Undertake biophysical and economic research to underpin the development of policy to manage emissions from, and sequestration options in, primary industries

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