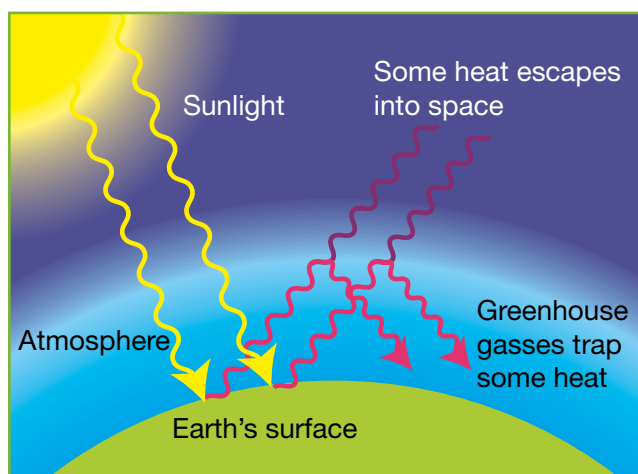


6. Climate Change

What are the Causes of Climate Change?

Much of the energy that drives the Earth's natural processes comes directly from the Sun. Around half of the Sun's energy that reaches the Earth penetrates the atmosphere as shortwave length radiation, the surface of the planet is warmed by this radiation as it is absorbed by objects and surfaces of the land and sea. The land and oceans then re-radiate that heat as short wavelength radiation. Short wavelength radiation has greater difficulty passing through the atmosphere and escaping into space. Some of this radiation is trapped or absorbed by 'greenhouse gases' in the atmosphere.

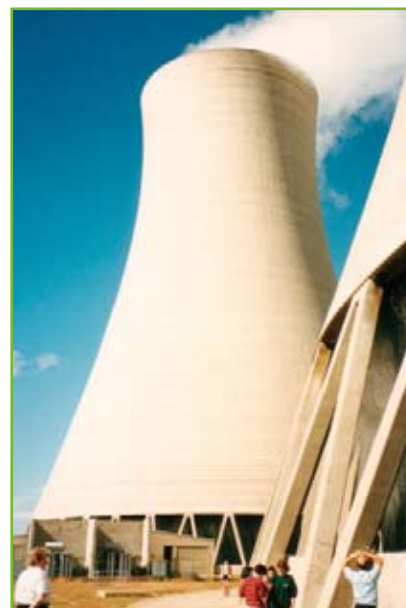


Simplified diagram of the greenhouse effect

The main greenhouse gases are water vapor, carbon dioxide, methane and nitrous oxide all of which occur naturally in the atmosphere. Nevertheless, this trapping of heat energy is known as the 'greenhouse effect' and keeps earth temperatures higher than they otherwise would be; much the same as the glass sheets on a greenhouse keeps the plants inside warm. Without this natural process, the global average surface temperature would be closer to minus 18°C, instead of the current +15°C average.



Clearing land through burning also generates considerable greenhouse gases, source: OceanWatch Australia



Coal fired power stations generate considerable greenhouse gas emissions, source: OceanWatch Australia

The problem the planet now faces is that human activities, particularly burning fossil fuels, agriculture activities, land clearing and pollution of oceans, is resulting in a rapid increase above the 'normal' concentrations of the greenhouse gases in the atmosphere. Since 1750, the amount of carbon dioxide in the atmosphere has risen approximately 35%, and the current concentration is higher than at any time in at least the past 650,000 years. The level of nitrous oxide has also risen 17% and methane 151%. Scientists assert that there will be continued warming and a resulting rise in sea levels. This would obviously have significant impacts on both natural systems and human activities. (From Climate change in the Northern Rivers Catchment, CSIRO, 2007).

The enhanced greenhouse effect or accelerated climate change phenomenon is expected to lead to warming of the earth's atmosphere and other climatic changes possibly including widely fluctuating extremes in the weather. Because this is the result of human activity across the planet it must be recognised as a global problem that requires a global response.

Observations and Predictions of Climate Change in Australia

What Are Some of the Observed Impacts?

- Australian average temperatures have increased by 0.9° C since 1950.
- Australian average sea level rise was around 1.2mm per year between 1920 and 2000.
- The Tasman Sea has experienced rapid warming.
- The acidity of the ocean has increased.
- The depth and extent of ice sheets in Australia's Antarctic Territory has reduced.

<http://www.bom.gov.au/climate/change/>

http://www.bom.gov.au/climate/change/observe_climate_change.shtml

<http://www.csiro.au/science/ClimateChange.html>

What are the Predictions?

- By 2070, the air temperature will increase by 1.0° to 2.5°C (depended on the level of our future emissions).
- By 2070 the annual precipitation will change by -30% to +20% in central, eastern and northern areas, and by -30% to +5% in the south.
- Drought occurrence will increase over most of Australia, but particularly in south-western Australia.
- Storm surges will increase resulting in more severe flooding, erosion and the subsequent impacts on built infrastructure and natural ecosystems.
- Sea level rise will place low lying areas at increased risk from the effects of storm surges.
- Fire weather risk will substantially increase, particularly in south-eastern Australia.
- By 2070 the sea surface temperature will increase between 0.6° and 1.0°C along the south coast of Australia and between 1.2° and 1.5°C elsewhere.
- The acidity of the ocean will increase, particularly in the high to mid latitudes.
- The East Australia Current will become stronger, resulting in warmer waters extending further southward.
- The ice sheets in the Australian Antarctic Territory will continue to shrink.

What Are Some of the Likely Effects of Accelerated Climate Change?

- Hotter, drier conditions which will put crops under greater heat and water stress.
- Rivers are likely to change in condition and extreme weather events are likely to become more frequent.

- In the coastal zone, increased frequency and severity of storms may combine with a rise in the sea level to worsen coastal erosion.
- Increased ocean temperatures and greater acidity will likely influence marine life
- Bushfires are likely to become more frequent and intense.
- Mangroves and saltmarsh will migrate landward.
- Low lying areas currently inhabited by people may become less livable and so placing greater pressure on other land to be given over to people as a living place or creating a situation of pressure between competing landuses.



Beach erosion from storm surge is predicted to become more severe as a result of climate change, source: OceanWatch Australia



Sea level rise will result in inundation of low lying land such as this, source: NSW DECC (2005)

http://www.greenhouse.nsw.gov.au/data/assets/pdf_file/0007/7828/NorthernRiversDetailedFinal.pdf

<http://www.dar.csiro.au/information/climatechange.html>

<http://www.greenhouse.gov.au/science/guide/index.html>

<http://www.greenhouse.gov.au/science/faq/>

<http://www.wwf.org.au/ourwork/climatechange/>

http://www.acfonline.org.au/default.asp?section_id=6&c=263954

Most changes are expected to have negative impacts, although in parts of NSW some agricultural or forestry activities may benefit from small temperature and carbon dioxide increases because of the improvements in plant growth that may result from higher temperatures and increased CO₂ levels.

How Can We Plan for Climate Change?

Australian Government

It is important that we understand the causes, nature, timing and impacts of climate change in Australia so industry, the community and government can make more informed decisions and plan more effectively for the impacts of climate change. The Australian Government supports a range of research activities to help us to do this. One such activity is the Australian Climate Change Science Programme, developed in partnership with the Australian Bureau of Meteorology, CSIRO and other leading science agencies (administered by the Department of Climate Change).

This Programme looks at 6 key themes:

1. understanding the key drivers of climate change in Australia;
2. improved climate modeling system;
3. climate change, climate variability and extreme events;
4. regional climate change projections;
5. international research collaboration; and
6. communications.

www.greenhouse.gov.au/science/index.html

From such research and science that is currently available, the Australian Government developed a “National Climate Change Adaptation Framework” in 2007. This will direct the action taken by government in response to climate change over the next 5 to 7 years. It will help the regions and industries which are most susceptible to impacts of climate change to adapt to such changes e.g. agriculture, biodiversity, fisheries, forestry, housing, infrastructure, coastal water supplies, tourism and health.



The Australian Government is also helping Local Government to understand and manage the impacts of climate change, as local councils are responsible for managing many impacts of climate change and need assistance and guidance to do so.

The Australian Government has thus released a document titled *Adaptation Actions for Local Government* as part of the National Climate Change Adaptation Programme. This aims to help councils identify actions that they can take in response to the predicted impacts of climate change. The Australian Government has also released a *Local Adaptation Pathways Program* to increase council's ability to be able to respond to the impacts of climate change. www.greenhouse.gov.au/impacts/about.html

State Government Response

Climate change projections for NSW warn that the community should prepare for higher temperatures, less rainfall, rising sea levels, more frequent and more severe droughts and more extreme storms.

<http://www.environment.nsw.gov.au/threatspec/climatechange.htm>

These changes are likely to have significant impacts on agriculture, water supply, infrastructure, biodiversity and human health. Thus we need to be able to adapt to these changes and have adequate management responses to these predicted impacts. For example, buffer zones of native vegetation between waterways and urban or industrial development areas are required to protect aquatic habitats and water quality in the waterways. The size of buffer zones will need to be increased in order to take into account rising sea level and increased storm surge.

http://www.greenhouse.nsw.gov.au/climate_change_in_nsw/climate_change_in_nsw_links/coastal_erosion_nsw

http://www.greenhouse.nsw.gov.au/climate_change_in_nsw/climate_change_in_nsw_links

The NSW Government has created a new government department called the Department of Environment and Climate Change that incorporates previous functions of the National Parks and Wildlife Service, the Environment Protection Authority, parts of Department of Natural Resources and the NSW Greenhouse Office. This was envisaged as a way of bringing together many of the relevant environmental and natural resource related issues along with the emerging and unprecedented challenges of climate change.

<http://www.epa.nsw.gov.au/>

<http://www.environment.nsw.gov.au/threatspec/climatechange.htm>

<http://www.greenhouse.nsw.gov.au/>

The NSW Greenhouse Plan is the NSW Government attempt to set out an agenda for change and outlines new and ongoing strategic actions to limit greenhouse emissions in NSW, and achieve key emission reduction targets announced by the Government.

The Plan recognises that immediate and sustainable action to limit greenhouse gas emissions is needed now in order to limit global warming impacts for future generations. In NSW and across the planet a concerted effort is required to slow and reverse the projected growth in emissions and to avoid dangerous climate change.

Read more about the NSW Greenhouse Plan at <http://www.greenhouse.nsw.gov.au>

The NSW Government is taking a leadership role in responding to climate change. In late 2005 the NSW Greenhouse Plan was released, which outlines the NSW Government's response to climate change.

The NSW Greenhouse Plan outlines policies and actions in three main areas:

- **Awareness Raising**
- **Adapting to Climate Change**
- **Reducing Greenhouse Gas Emissions**

NSW Department of Primary Industries is working with NSW farmers and rural communities to better prepare them for the impacts of Climate Change. They are running 10 regional forums in partnership with Catchment Management Authorities, Landcare and local government, to help farmers and rural communities:

- understand current climate change predictions;
- identify the constraints their farming systems and communities may face;
- identify possible adaptation strategies for their industries and region; and
- identify the information and training needed to develop and implement those adaptation strategies.



Farmers will need to be prepared to deal with the predicted impacts of climate change, source: OceanWatch Australia

What Are Some of the Various Government and Non Government Organisations Doing?

The Nature Conservation Council of NSW is running a project called "Let's Cool It" which seeks to achieve ongoing, significant and measurable household greenhouse gas reductions in NSW. The NCC will work with local councils, businesses, community groups and individuals to educate and promote ways in which people

can become more energy efficient and take up programs and products that help reduce their greenhouse gas emissions. Through interactive forums and workshops, web support and media programs, NCC plans to empower communities to take a greenhouse challenge and work together to reduce greenhouse pollution and avoid dangerous climate change. For further information see www.nccnsw.org.au

The Australian Conservation Foundation – ACF

The ACF considers that solving climate change has become Australia's greatest challenge. However, they believe that Australia has huge potential to address the issue and take action, claiming that:

- Australia is in the perfect position to tackle greenhouse pollution, climate change and energy insecurity.
- Australia has huge potential to stop wasting energy and become more energy efficient and also have abundant sources of clean, renewable energy.
- Individuals can make a significant difference for example by switching to accredited GreenPower electricity straight away.

ACF is also campaigning for

- Legally binding national targets to cut greenhouse pollution by at least 30% by 2020 and 80-90% by 2050 (from 1990 levels).
- Ratification of the Kyoto Protocol and international leadership in the post-2012 Kyoto target negotiations.
- An effective price on greenhouse pollution – to encourage business to cut pollution.
- A national renewable energy target of 25% by 2020.
- A world's best national energy efficiency package that will stabilise energy consumption by 2010.

World Wide Fund for Nature – WWF

WWF have developed a 2050 Vision statement whilst also developing a series of important shorter term actions and strategies that they consider should be taken immediately.

WWF-Australia believes that in order to stay below a 2 degree increase the next Australian Government must implement a national plan to reduce Australia's greenhouse gas emissions. This plan must:

- set targets to stabilise emissions by 2010, and then reduce emissions by 20-30% by 2020;
- implement world's best practice energy efficiency and vehicle emission standards;
- implement a national emissions trading scheme that is operational by 2010;
- ensure no new coal-fired power stations are built unless they have carbon capture and storage;
- implement a renewable energy target of 25% of electricity generated by 2030; and
- ratify the Kyoto Protocol.

http://nccnsw.org.au/index.php?option=com_content&task=blogsection&id=22&Itemid=646

http://www.acfonline.org.au/default.asp?section_id=6

<http://wwf.org.au/ourwork/climatechange/>

http://www.greenhouse.nsw.gov.au/climate_change_in_nsw/climate_change_in_nsw_links



Vehicle emissions are a major contributor to elevated greenhouse gas concentrations, source: OceanWatch Australia

What Can You Do to Live More Sustainably?

See www.livingthing.net.au for actions you can take at home, work and play to live more sustainably.

The small things you do now make a big difference. Your everyday actions will reward both the environment and you.

Learn how to be water wise and energy smart; how to reduce chemical use and waste, recycle, tread softly and enjoy the outdoors; and discover alternative transport options and volunteering opportunities.



Cycling to work or part of the way to work instead of driving is one way you can help to make a positive difference, source: OceanWatch Australia

Sources of Additional Information

www.greenhouse.nsw.gov.au

www.livingthing.net.au

www.greenhouse.nsw.gov.au/_data/assets/pdf_file/0007/7828/NorthernRiversDetailedFinal.pdf

<http://www.climatechangeinaustralia.gov.au>