

## Climate change impacts factsheet:

# 5. Settlements and infrastructure

**A**lmost 90% of Australians live in cities and large regional towns, and approximately 80% live within 50 km of the coast. Australia's settlements and infrastructure face challenges in responding to climate change that include:

- planning for secure infrastructure, including urban water and energy supply and transport systems, which can withstand climate change impacts and in particular any changes in the occurrence of extremes, and
- designing buildings and urban spaces to ensure maximum comfort for minimum energy use in a changing climate.

Appropriate governance and institutional arrangements are required to meet these challenges.

The lifetimes of the built environment and infrastructure are long – typically 40 years for energy and water systems, but rising as high as 90 years for bridges and 100 years for major transport routes. Planning for settlements and infrastructure must take into account climate change over much longer periods than is generally the case for other areas of human activity such as farming.

### Climate, settlements and infrastructure

The climate in which a settlement exists is an important determinant of its design, planning and infrastructure needs. Warm tropical climates demand shade and ventilation, cyclone-prone regions follow building codes designed to withstand these events and flood-prone regions have planning regulations and infrastructure designed to minimise flood damage.

### Future climate trends

Temperatures in Australia have warmed by around 1.5–2°C since the 1960s. From 1993 to 2009, sea levels around Australia rose by 1.5–3 mm per year in the south and 7–10 mm in the north.

Australia's annual average temperatures are projected to increase 0.4–2.0°C above 1990 levels by 2030, and 1–6 °C by 2070. Rainfall is expected to decline in southern Australia, and increase in the north-west. A sea-level rise of 0.2 to 0.8m above 1990 levels is projected by the end of this century.

It is likely that rising average temperatures will lead to more frequent and severe heatwaves, made worse in urban areas by heat island effects. Projections for other extremes are less certain: there may be more intense cyclones; cyclone tracks may move further south over Australia; rainfall extremes causing both drought and floods may become more common.

### Climate change impacts and vulnerabilities

Settlements evolve and are planned to be well adapted to their climate. In a warming climate, this adaptation may break down.

Examples of how this can happen include:

- Outdoor urban environment may not be designed for hotter temperatures and more heatwaves, offering little shade and protection from glare. Houses may not be designed to cope with hotter weather without air conditioning.
- Increasing temperatures and aridity can lead to more high fire-risk days, which may threaten peri-urban housing.
- Coastal settlements are vulnerable to sea-level rise and increased storm surge, exacerbated by continuing population growth and development demand.
- Some climate models suggest cyclones will track further south as a result of climate change, affecting places that are unprepared in terms of building design, methods and materials. The high-set Queenslander house is well-designed for hot and humid Queensland summers, but offers little protection in a severe wind storm.

Australia's infrastructure will be affected by climate change in the following ways.

- The energy sector is likely to be affected by extremes including wind storm (damage to power lines), extreme temperatures (increased cooling demand) and drought (lack of cooling water for power stations). The 2009 heat wave in Melbourne caused major power disruptions leaving over half a million people without power as the heat wave blew transformers and overloaded the grid.
- More frequent drought and extreme rainfall events are expected to affect the capacity and maintenance of storm water drainage and sewerage infrastructure, drinking water quality and water demand for irrigation and domestic needs. Managing competing demands for water is likely to emerge as a major policy issue as climate change intensifies.
- Transport infrastructure in flood-prone areas is vulnerable to climate change. Heat waves can cause major disruption to transport systems: in the 2009 Melbourne heatwave, 1,300 train services were cancelled in one week due to buckling rail lines, air conditioner failures and power outages.

### Social and economic impacts

Climate change will occur in the wider social, economic and demographic context of Australia. A growing and ageing population will place very different demands on settlements and infrastructure from those of the present day, for example, a greater requirement for aged care facilities. Planning for these changing requirements will need to take account of climate change.

Climate change will impact on vulnerable members of society disproportionately – the poor, the very old, the very young, the sick. Equitable provision of infrastructure will become a greater challenge, with climate change impacting upon water and energy security and cost. Houses may need to be retrofitted to withstand higher temperatures and extremes, which may challenge the financial capability of homeowners. Cheaper housing is often located in areas vulnerable to climate extremes, including flooding and bushfire. If these extremes become more common/more severe, such locations may no longer be safe.

Policy decisions to reduce greenhouse gas emissions are likely to place a greater emphasis on public transport. Urban spaces will need to be designed and built to meet the very different needs of a society seeking to reduce reliance on cars.

### Adaptation: practices, options and barriers

**Built environment:** adaptation responses will encompass innovative design practices and options, including green walls and roofing, electric vehicles, and urban rainwater retention. Houses will be built to provide comfort without over-dependence on costly air conditioning.

**Infrastructure:** the integration of distributed renewable energy sources with the existing concentrated transmission grid will raise challenges as well as offering opportunities to improve resilience of the energy supply system. Adaptation options for greater robustness in water security may involve measures which both increase supply and reduce demand. Engineers Australia is presently revising the guideline document for stormwater and flooding, *Australian Rainfall and Runoff* to include consideration of climate change; this will aid in implementing adaptive responses to changing rainfall intensities.

Adaptation options for coastal settlements generally fall into the categories of retreat, accommodate and protect. Other mechanisms include insurance for risk spreading, re-drafting of regulations and planning; research and education. Barriers to adaptation may include:

- Uncertainties around the precise nature of climate change,
- Historical precedents, legacies and inertias, such as legal precedents and expectations of continuing land use rights,
- Lack of understanding of the costs versus benefits of adapting new and existing assets.

### Costs

Cost comparisons may aid planners and designers to choose appropriate adaptation strategies. For example, reducing demand for water may be cheaper than increasing water supply capacity. Adaptation options for existing coastal settlements are likely to be the most costly, as they will inevitably involve either displacing communities, or building and maintaining protective structures and upgrading key infrastructure.

### Research priorities

NCCARF in its National Climate Change Adaptation Research Plan for Settlements and Infrastructure identified priority research questions around:

- **Planning:** How can urban planning principles, practices and governance be modified to incorporate adaptation?
- **Built environment:** What are the design options and principles, costs and benefits, for adapting new and existing buildings, and how can they be implemented? What are the equity issues; how should they be managed?
- **Coastal communities:** What are the interactions of climate change and sea-level rise with demographic changes, policy and regulatory frameworks?
- **Infrastructure:** What are the vulnerabilities to climate change, including changes in extremes? How should design standards be modified?
- **Cross-cutting issues:** linking climate change adaptation for settlements and infrastructure with physical, social, economic and institutional factors.

### About the Network

The Australian Climate Change Adaptation Research Network for Settlements and Infrastructure (ACCARNSI) is hosted by the University of New South Wales. It brings together researchers and stakeholders interested in climate change adaptation for coastal settlements, infrastructure, the built environment, and urban regional planning. ACCARNSI conducts collaborative interdisciplinary research to help government, businesses, and vulnerable communities to make informed adaptation decisions, hosts conferences and events including four National Early Career Researcher Forums, and offers scholarships to promising researchers. For more see: [www.nccarf.edu.au/settlements-infrastructure](http://www.nccarf.edu.au/settlements-infrastructure)



#### Left: Adaptation to wind storm damage

Following the devastating damage to Darwin caused by Cyclone Tracy in December 1974, Australia's building codes were changed. The results of these changes are clear from the damage caused by Cyclone Yasi at Cardwell, Queensland, in February 2011.

Top photo: Damage to a pre-Cyclone Tracy era house.

Bottom photo: Damage to a modern house.



Images: Matthew Mason