



# Climate change impacts on coastal communities

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Impact Sheet 13



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## Key points

- The Australian coast is home to most of Australia's population and includes a diverse range of habitats, uses and settlements.
- The Australian coast faces a number of existing pressures, such as increasing urbanisation and recreational use, which are likely to be exacerbated by climate change.
- Climate change impacts pose particular challenges to coastal communities because they:
  - i) often occur simultaneously (e.g. storm surge, intense rainfall and catchment runoff),
  - ii) encompass direct and indirect impacts,
  - iii) affect the triple-bottom line, and
  - iv) may manifest differently in different places.
- Climate change impacts on coastal communities are likely to be a significant and enduring feature of Australia's future but through understanding the drivers of change, relay variables, and direct and indirect impacts, we are more able to effectively respond and build resilience.

## Introduction

Australia is primarily a coastal nation. Over 85% of Australia's population reside within 50 km of the coastline. The Australian coast includes diverse geomorphology, climatic zones, species, habitats and ecosystems, aquatic and terrestrial uses and settlement patterns. Australia's largest cities are located on the coast. The coast also sustains the livelihoods of multiple smaller Australian communities through industries such as tourism, ports and fishing. Migration towards coastal regions (including capital cities and some regional cities) is continuing, which reflects the long-term demographic trend of depopulation of Australia's interior. The 'bronzed Aussie' (although now sun aware) remains iconic. Australia has also dominated various international coastal sports for decades (e.g. surfing and lifesaving-related competitions).

Australian's love of the coast has placed numerous pressures on coastal form and function (e.g. increased sediments and nutrients through urban and rural activities, beach profile modification through seawall construction and sand renourishment activities (see Figures 1 and 2), construction of ports and associated dredging, residential and industrial development, and a range of extractive industrial and recreational activities). Climate change places additional pressures through incremental changes, such as sea-level rise, and more intense episodic events, such as increased storm surge from more intense tropical cyclones and East Coast Lows, and increased flooding, bushfires, and heat waves. Often these pressures create a range of primary impacts that, in turn, create additional systemic impacts.



**Figure 1:** Beach profile modification through seawall construction and sand renourishment activities. Photographs: © Dana Thomsen.





**Figure 2:** Sand bypass system. Photograph: © Dana Thomsen.

## Systemic impacts

Climate change poses complex challenges for coastal communities. This is especially true for Australia, as the vast majority of vulnerable infrastructure is in coastal urban areas. Typically, climate phenomena do not occur in isolation. For example, a bushfire event is usually combined with very hot weather conditions; similarly, an extreme coastal storm event typically combines storm surge with intense rainfall. Changes in the intensity and frequency of such events may be compounded when they occur together. In addition, the impacts of climate change often have flow-on effects and cause a range of additional issues. For example, a climate change impact on a particular agricultural crop, such as bananas, may lead to lost profits, unemployment of farm workers, foreclosures on mortgages, and loss of human, financial and social capital within communities. This example also demonstrates how climate change impacts manifest across the triple-bottom line (i.e. economic, social and environmental dimensions). Examples of other direct and indirect impacts are shown in Table 1.

In order to respond effectively to the likely climate change impacts on coastal communities it helps to understand: i) the drivers of change (e.g. the biophysical climatic changes), ii) relay variables (which may dampen or enhance the impacts of the changes such as impermeable surfaces exacerbating rainfall runoff), and iii) the range of potential direct and indirect impacts. In addition, decision makers need to consider that some impacts may be self-reinforcing and create positive or negative feedback loops within communities (e.g. an adverse impact on a particular economic sector may lead to a reduced financial base to re-invest in that sector, further adversely impacting the sector and facilitating continued community decline). Another complicating factor arises from the diversity of Australian coastal communities where settlements range from highly populated cities to sparsely populated rural areas. In addition, some States are more decentralised (e.g. New South Wales) than others (e.g. Western Australia). Consequently, some impacts will have common implications and others will manifest differently depending on their context.

**Table 1:** Examples of direct and indirect climate change impacts on Australian coastal communities.

Example event (rise or increase in):	Example of a direct impact	Example of indirect impacts
Sea level	Inundation of low-lying residential areas	Environmental: Salinity impacts on native vegetation and coastal water aquifers
		Social: Loss of social capital if communities are dispersed through relocation
		Economic: Loss of property assets
Storm surge	Extreme waves overtopping esplanades and reserves	Environmental: Foreshore vegetation damage
		Social: Loss of recreational amenity
		Economic: Loss of tourism revenue
Flooding	Damage to critical infrastructure such as a sewer pumping station	Environmental: Increased nutrients entering waterways
		Social: Increased risk of disease and infection
		Economic: Repair costs
Wind	Uprooting of trees	Environmental: Loss of mature vegetation and habitat
		Social: Reduced shade protection in summer
		Economic: Damage to homes and cars
Fire	Bushfire in a coastal national park	Environmental: Habitat fragmentation
		Social: Loss of amenity and recreational values
		Economic: Reduced purchases by visitors for local businesses

## Likely impacts on different types of coastal settlements

Comparable climate change impacts are likely for many coastal settlement types. However, the diversity in patterns of settlement, industrial activity, ecological systems, infrastructure and community expectations provide important distinctions for how impacts will be experienced.

### Cities

All seven of Australia's largest cities are located on the coast (i.e. Sydney, Melbourne, Brisbane, Perth, Adelaide, Gold Coast, and Newcastle) and account for almost 68% of Australia's population. In addition, there is a number of rapidly growing regional cities situated along the coast. Mega-cities, such as those in Asia, have been highlighted globally as a key area for climate change action. Australian urban environments have extensive infrastructure and include ethnically and culturally diverse communities. Figure 3 shows dense development of infrastructure around the coast of Gold Coast. Services are typically distributed throughout the city centre and extend to satellite concentrations and the suburbs. Climate change impacts in cities are likely to cause the most significant damage in financial terms because of the location, extent and intensity of infrastructure, businesses and residences. In addition, the environmental impacts may be of critical importance because of existing stresses already faced by many species in these highly modified environments (e.g. through reduced habitat connectivity and extent). Furthermore, the flow-on effects of climate change impacts are likely to be more complex from a socio-economic perspective due to the diversity of cultures, uses, and values.

### Peri-urban areas

Peri-urban areas are broadly defined as transition zones between urban and non-urban environments. They typically exhibit areas that retain some rural enterprises (e.g. horticulture) but are becoming increasingly urbanised. There are often new residential subdivisions combined with lifestyle acreages and employees tend to commute long distances via road networks to and from their workplaces. Similarly, many services such as medical facilities and specialist shops tend to be accessed over distances that necessitate private motor vehicle use. Hence, climate change impacts in peri-urban areas are likely to affect mobility and may effectively disassociate communities from their places of employment, education and health needs for unknown periods of time.

### Regional centres

Regional centres are similar to cities but smaller in scale and often provide critical services for their regional surrounds. For example, regional centres are frequently the hub for specialised services such as healthcare, secondary and tertiary educational facilities, and larger consumer outlets. The flow-on effects of climate change impacts on a regional centre may be noticeably pronounced because of the dependency of the surrounding region on those assets affected. For example, a regional centre may hold the only hospital for several hundred kilometres.





**Figure 3:** Dense development of infrastructure around the coast of Gold Coast. Photograph: © Dana Thomsen.

## Regional settlements

Regional settlements include small clusters of residential areas such as villages and hamlets. Many smaller regional settlements have high levels of social capital among the resident population but also include temporary residents through tourism and second homeowners. The local economies are often affected by seasonal visitation, where the population may more than double during peak holiday periods. There tend to be few educational and career opportunities for younger people. Typically, many smaller regional settlements are defined by an aging population and lower than average household incomes. Climate change impacts are likely to require a high proportion of these communities' financial capital to rectify and responses are likely to depend on financial decisions made in other locations to subsidise investment. As a result, a climate change impact on a local asset, such as a boat ramp, may not be immediately rectified despite being the only facility available to access a particular recreational pursuit.

## Rural areas

Rural areas are in themselves diverse, depending as they do on the dominant agricultural activity (e.g. extensive grazing or intensive horticulture). However, of all the settlement types, the livelihoods of those living in rural areas are often most directly affected by climate change impacts (e.g. by crop failure). The direct impacts on livelihoods in rural areas have a range of additional effects that may ultimately lead to significant losses in social capital. Rural areas have also been in a period of transition over several decades, driven by the consolidation of rural holdings by large corporations and the increasing average age of farmers. These trends have inherent social impacts and are likely to place greater strain on community resilience when coupled with climate change impacts. However, climate variability is well known within rural communities and has enabled a range of adaptive strategies to be tested and refined over a substantial time period.

## Implications and summary

Climate change impacts are likely to affect all Australian coastal communities to varying degrees. Some of these impacts will have slow onset and responses may be planned over generations, while others will have rapid onset and require immediate response. Many impacts are common along the Australian coast, although there are important differences largely due to geographical context. This commentary has focused on significant contextual differences between various settlement types—noting, however, that other important contextual differences remain to be considered, such as the climatic zone and geomorphology. Similarly, different types of impacts (especially indirect impacts) may manifest in different ways over time, and if not recognised and understood, may lead to significant community impacts in years to come.

In summary, while climate change impacts on Australian coastal communities are diverse and often far reaching, effective responses may be assisted by taking a systemic approach to understanding what is driving change, how it manifests, and the resulting direct and indirect impacts. Without taking a systemic approach, an isolated response to a particular climate change impact may lead to maladaptation or create a path dependency that may ultimately reduce community resilience.

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