



Climate change impacts on coastal tourism

Susanne Becken

Impact Sheet 6



Contents

Coastal tourism in Australia	1
Climate change impacts on coastal tourism	2
Adaptation.....	3
Sea-level rise	3
Nature-based tourism and sea-level rise.....	3
Extreme events.....	5
Beaches and extreme events.....	5
Coral reefs and extreme events.....	6
Coastline settlements and infrastructure and extreme events	7
Cruise ship tourism, boating and extreme events	9
Temperature	10
Coral reefs and higher sea surface temperature.....	11
Coastline settlements and infrastructure and higher temperature	12
Rainfall changes.....	13
Ecosystem changes.....	14
Coral reefs and ecosystem changes.....	14
Nature-based tourism and ecosystem changes	15
Case studies and supporting material.....	16
References	17

Disclaimer

The views expressed herein are not necessarily the views of the Commonwealth or NCCARF, and neither the Commonwealth nor NCCARF accept responsibility for information or advice contained herein.



Coastal tourism in Australia

Coastal areas are the mainstay of Australia's tourism industry and are also important places for recreation and sport. In response to market research that showed that coastal (particularly beaches) and aquatic (especially the Great Barrier Reef) attractions are the greatest drawcards for international visitors, Tourism Australia's marketing campaign in 2015 focused on coastal and aquatic tourism (Tourism Australia 2015).

The Great Barrier Reef catchment alone receives about 2.3 million international and 1.8 million domestic visitors per year (Tourism Research Australia 2015). The Great Barrier Reef Marine Park Authority (GBRMPA) records more than two million visitors annually to the marine park through the many commercial operators. Other examples of hotspots for coastal tourism include the Gold Coast (Queensland), receiving more than 11.6 million overnight and day visitors

(McLennan et al. 2015), and the Great Ocean Road (Victoria) with about 8 million overnight and day visitors per year (Tourism Victoria 2014).

It is useful to distinguish five different types of coastal tourism:

Beach and surf tourism: this form of tourism is the most prevalent and is relevant along the whole coastline of Australia, including some islands. Typical activities include walking, swimming, sunbathing, surfing, sport events (e.g. life saver competition), 4-wheel driving, and many other recreational activities.

Coral reef-based tourism: Most reef tourism occurs in Far North Queensland (based around Cairns and Port Douglas), but other regions (e.g. Whitsundays) or the Ningaloo Reef in Western Australia are also important. Typically tourists experience the reef through a commercial operator on a boat trip or involving offshore structures such as reef pontoons.

Coastline tourism: Tourism happens along rugged or other non-beach coastlines where visitors go for scenic drives (e.g. Great Ocean Road), walks, dune experiences (e.g. Fraser Island), visit attractions (e.g. lighthouses), or stay in coastal accommodation. This form of tourism typically involves built infrastructure.

Nature-based tourism: The most important forms of coastal or aquatic nature-based tourism in Australia in coastal areas include wildlife viewing, such as penguin watching (e.g. Philip Island), whale watching (e.g. Hervey Bay), and bird-watching (e.g. Kakadu National Park).

Cruise ship and boating: Cruise ship tourism is a fast growing tourism segment in Australia. In addition, recreational boating plays an important role at most coastal locations.

Climate change impacts on coastal tourism

Climate change has various impacts, including sea-level rise and beach erosion, high winds and storm surge, rising temperatures (air and water), changing rainfall patterns and amounts, extreme weather events (e.g. tropical cyclones and East Coast low pressure systems), and environmental changes (e.g. ocean acidification, or ecosystem changes) (for a global assessment see UNWTO et. al. 2008). Not all climate impacts have equal effects on the different types of coastal tourism. Table 1 provides an overview of the main impacts, noting that a wide range of other direct and indirect climate change impacts may also be relevant in particular areas, for example the risk of bushfires or the outbreak of diseases. This fact sheet focuses on the most pressing risks of climate change on tourism.

Table 1: Climate change impact matrix for coastal tourism (xxx: considerable impact; xx: strong impact; x: some impact); impacts are an indicative assessment and may vary depending on the particular human-environment system.

Type of coastal tourism	Sea-level rise	Extreme weather events	Rising temperatures	Changes in rainfall	Environmental changes
Beaches	xx	xxx	x	x	x
Coral reef-based	x	xxx	xxx	xx	xxx
Coastline (tourism infrastructure)	xxx	xxx	xx	xx	x
Nature-based	xx	xx	xx	xx	x up to xxx
Cruise ship and boating	x	xx	x	x	x

Adaptation

As for other sectors and industries, the mainstreaming of adaptation into standard practices and policies is critical (Becken and Hay 2012). Moreover, tourism activities need to be integrated with other adaptation strategies and policies, for example in the area of risk and emergency management. Finally, for tourism, it is important to develop and implement destination-specific communications strategies to better inform stakeholders about the implications of, and the management response to, climate change. A good example of a region-specific assessment, including both risks and opportunities, is the "Tourism in south-west Western Australia: climate change vulnerability and adaptation" report produced by Tourism Western Australia and the Department of Environment and Conservation (2008). Adaptation strategies will differ for varying types of coastal tourism.

The fact sheet provides an overview of adaptation measures targeted at the audience of local government. Some measures directly involve action by the public sector, whereas others require action by tourism businesses or tourism organisations, but these can be encouraged through policy or provision of information by local government.

Sea-level rise

Sea-level rise will impact coastal tourism as a result of coastal flooding, erosion and changes to the frequency and height of extreme sea levels (e.g. spring tides) (Table 2 and Table 3). After removing other effects (e.g. El Niño and land movements), Australian sea levels have risen at an average rate of 2.1 mm/yr between 1966 and 2009 and 3.1 mm/yr between 1993 and 2009. More detailed information on sea-level rise in Australian waters can be found in the Climate Change in Australia website: <http://www.climatechangeinaustralia.gov.au/en/climate-projections/coastal-marine/coastal-marine-projections/> (accessed 4 April 2016).

Nature-based tourism and sea-level rise.

Wetlands (e.g. Kakadu National Park, see Turton et al. 2009) are facing increasing pressure from multiple climate change impacts, including sea-level rise, temperature increase and extreme events (Table 4). Natural landscape features, such as the escarpment in Kakadu National Park, may prevent retreat. Increased atmospheric CO₂ concentrations may also lead to changes in vegetation community structure and composition (see also 'environmental changes' further below).

Table 2: Beaches and sea-level rise.

Risk	Detail	Adaptation Measure	Comments on Implementation
Loss of sand and vegetation; beach erosion	While beach morphology is complex and erosion is not only a result of sea-level rise, rising seas are likely to exacerbate erosion and also reduce the size of the beach.	Encourage businesses/developers to minimise built structures close to the beach and plan for some form of managed retreat and adaptive access points to beaches.	Many beaches are high-use environments with high pressure on dune ecosystems and limited space for retreat.

Table 3: Coastline settlements and infrastructure and sea-level rise (see also further below under 'extreme events').

Risk	Detail	Adaptation Measure	Comments on Implementation
Loss of assets	As a result of several factors including sea-level rise, higher storm surges and larger spring tides will result in increased risk of coastal erosion and flooding/inundation.	Encourage developers to: <ul style="list-style-type: none"> • build critical infrastructure (e.g. power houses) further from the beach; • Keep distance of buildings from the beach; • Raise structures to a minimum height 	Barrier: High real estate value of land close to the beach.

Table 4: Adaptation of wetlands.

Risk	Detail	Adaptation Measure	Comments on Implementation
Saltwater intrusion	Saltwater intrusion of freshwater wetlands may lead to substantial ecosystem changes, but also impact on visitor expectations of the natural area.	Obtain expert engineering and environmental advice on measures needed to protect significant freshwater habitats from saltwater intrusion.	Cost of engineering options and limited demonstrated options.
Loss of habitat	Encroaching seas reduce the size of wetlands and other coastal ecosystems that are the basis of nature-based tourism.	Increase size of habitats, for example through restoration of wetlands, system repair, land swaps, compensation projects, development moratorium, etc.	Innovative financing mechanisms, e.g. through tourist offsetting dollars, could assist implementation.

Extreme events

At its core, coastal tourism represents an example of intensive risk in which “a large concentration of people and economic activities are exposed to intense hazard events that can lead to potentially catastrophic disaster impacts involving high mortality and asset loss” (UNISDR 2009). More specifically, there is a high concentration of multi-million dollar tourism superstructure and supporting infrastructure along the coasts in Australia. Further, tourism is highly seasonal and the peak season, for example in North Queensland, coincides with increased cyclone activity. Tourism stakeholders use a range of measures to reduce, manage and transfer their disaster risk. The measures cover all phases of disaster risk reduction (preparedness, preparation, response and recovery) and often involve public-private sector partnerships.

Beaches and extreme events

For many destinations, beach erosion is the principal concern. Declining beach conditions impact adversely on tourism revenue; but conversely, in areas where eroded beaches have been restored, tourist visits and revenues have increased (Table 5).

Table 5: Beaches and extreme events.

Risk	Detail	Adaptation Measure	Comments on Implementation
Loss of sand; beach erosion	The loss of sand is a major problem for the tourism industry (e.g. on the Gold Coast) and extreme weather events (e.g. tropical cyclones and their wider effects) exacerbate natural erosion rates, leading to amenity value decline and – in the worst case – loss of access to beach or dangerous beach profiles. Sea-level rise and extreme weather events combine to increase erosion risk.	Soft (e.g. sand bags) and hard (sea wall, groynes etc.) structures for beach protection. Ecosystem-based protection of coastline. Sand pumping to replenish eroded sand. Avoid structures on the beach that exacerbate erosion.	Negative impacts on other parts of coastline due to hard structures that change sand movements. Lack of credible options that have been demonstrated and accepted. Cost of sand pumping and environmental impacts of moving sand.
Debris on beaches	Debris on the beach affects aesthetic values and can be a hazard.	Clearing of beach.	Costs of removal.

Coral reefs and extreme events

The destructive impact of extreme events, alongside water quality, has been identified as the key risk for the Great Barrier Reef (AIMS n.d.) (Table 6).

Table 6: Coral reefs and extreme events.

Risk	Detail	Adaptation Measure	Comments on Implementation
Destruction of reef	Damage from tropical cyclones reduces the resilience of reefs, in particular in conjunction with other pressures such as ocean acidification.	Encourage tourism operators to plan for extreme events by developing risk management plans to assist in preparing for and responding to significant coral bleaching events.	Limited control over impacts.
Sediment plumes	Extreme weather events often lead to heavy rain and sediment plumes that affect water quality (e.g. turbidity) and marine ecosystem health.	Reduce all other pressures on the reef, in particular minimise impact on water quality through increased nutrients, pesticides, herbicides and sediment in the water.	
Bad weather	Weather can negatively impact the enjoyment of tourists through increased likelihood of sea sickness and reduced visibility for sightseeing, snorkelling and diving. Sail boat operators in particular could be impacted by reduced demand due to an increase in the number of days with strong winds and rough seas.	Work with tourism organisations/operators to provide information on options (know-how, financing etc.) for investing in boats that can travel the distances in rough, exposed seas, such as those off Cairns. Operators will have to find alternate sites as travel days to unprotected outer reefs may be reduced. Consider adjusting permit allocation.	Barriers: Cost of investment into new boats. Operating permits, e.g. in the Great Barrier Reef Marine Park, are often tied to specific areas.

Coastline settlements and infrastructure and extreme events

Extreme events can be highly destructive to tourism infrastructure along the coasts (Table 7). On the Sunshine Coast, for example, the projections indicate a 9% decrease in tropical cyclone numbers, but an increase in the number of long-lived tropical cyclones, as well as storms with lower central pressures. A 60% increase in the number of the most severe storms is likely by 2030, with a 140% increase by 2070 (Sunshine Coast Regional Council 2010). Although the tourism industry is not responsible for the development or implementation of community disaster management plans and arrangements, destinations and tourism operators should, when possible, participate in disaster planning and management activities through relevant local, regional and national committees. Partnership with emergency management services can be mutually beneficial. This can include sharing of tourism resources, including helicopters, boats, satellite radios, interpreters, food resources etc.

Table 7: Coastline settlements and infrastructure and extreme events (and see over page).

Risk	Detail	Adaptation Measure	Comments on Implementation
Lack of warning resulting in unnecessarily high impacts	Many tourism operators have a very good understanding of the local weather; however, research also shows that many are insufficiently aware of early warning systems and have no systems in place themselves to respond to warnings.	Connect tourism operators into an early warning system (e.g. contact tree, text message), and encourage them to establish weather information routines: <ul style="list-style-type: none"> • Check weather forecasts and warnings daily • Develop policies for dealing with warnings • Consider seasonal forecasts • Develop tourist-targeted warning systems (e.g. mobile app) 	Barriers: Tourism-specific weather warning services are required. Lack of staff resources and training. Events occur infrequently and operators 'forget' about risks.
Safety of visitors and staff	The health and safety of tourists and staff depend partly on the ability of destinations, and individual operators, to adapt planning and management practices to address the current and anticipated impacts of climate change, including the prevention of, and recovery from, weather- and climate-related disasters.	Tourism operators need evacuation plans, including: <ul style="list-style-type: none"> • Clear plan and signage for guests • Staff training and regular drills • Multi-hazard planning (e.g. fire, cyclone, strong wind etc.) • First aid kits, medically trained staff at hand • Sufficient emergency water and food 	Businesses already prepare for some hazards (e.g. fire) and can build on existing procedures to fully cover the impacts of extreme events.

Table 7: Coastline settlements and infrastructure and extreme events - *Continued.*

Damage to assets	More severe storms will put waterfront and coastal infrastructure at risk, including marinas, jetties, boat ramps, roads, restaurants, accommodation, and other buildings.	Conduct an infrastructure risk assessment to identify assets at risk from both chronic stresses (e.g. saltwater intrusion) and additional climate change impacts and extreme weather events. Keep distance of buildings from the beach by implementing a minimum distance away from the high tide mark.	Keep distance of buildings from the beach by implementing a minimum distance away from the high tide mark. New developments still occur in exposed sites and insufficient consideration is given to climate change impacts; a change of culture amongst developers and planners is urgently required.
Rising insurance costs	These increased risks to infrastructure will cause increases in the cost of insurances.	Encourage businesses to have sufficient insurance cover, including potential innovative forms of insurance such as index insurance. Businesses need a continuity plan and should invest into product diversification (e.g. non-coastal products in their portfolio). Public sector can offer emergency assistance packages if needed.	Barriers: Prohibitive insurance costs and lack of innovative instruments. Long negotiation times with insurances after an event, and limited immediate assistance.
Insufficient recognition of good practice	Many tourism businesses have some form of quality label/certification. These systems could also include a business 'resilience health check' to help a business make changes to become more resilient to climate and disaster risks.	Public-private sector partnerships to develop a risk-certification scheme (e.g. Ecotourism Australia, EarthCheck).	Barrier: not explicitly demanded by customers.
Reputational damage for businesses	Immediate and appropriate communication is essential and strategies (including templates) need to be prepared before the onset of a disaster.	Disaster communication plan for before and after an event, tailored to different audiences, including overseas wholesalers, travel agents, airlines etc.	Perception management is key in tourism.
Impact on destination image	Extreme events can affect a destination for a long time, especially when impacts are handled poorly. Concerted efforts for recovery are essential to 'be back in business' as soon as it is possible and appropriate.	Crisis management and communication plan (e.g. by the destination marketing organisation), media training for key staff. Development of an integrated (with other sectors) reconstruction and recovery plan	Barrier: fragmentation of tourism industry and limited disaster planning at destination level.

Cruise ship tourism, boating and extreme events

Boating infrastructure and itineraries are designed for typical weather patterns and climate variability. Climate change has now become one of the many concerns that must be addressed in planning for improvements in transportation, including cruise ships and recreational boating (Table 8).

Table 8: Cruise ship tourism, boating and extreme events.

Risk	Detail	Adaptation Measure	Comments on Implementation
Tourist discomfort	Increases in weather-related delays	Cruise ships to adapt itinerary according to weather and offer alternatives to tourists (in the worst case refunds).	Limited options for activity diversification on board a ship.
Accident/emergency	Cruise ships require detailed weather information in combination with weather-related emergency management systems.	Cruise ships to use operational forecasts with area-specific predictions that enable operators to make timely decisions to improve planning and resources, and routing in response to changing weather conditions.	Limited detail of weather forecasts for some parts of oceans.

Temperature

Climate change projections suggest that temperatures will generally increase and heatwaves will become more frequent. Some destinations may become uncomfortably hot for tourists, at least during parts of the year. In Kakadu National Park, for example, the number of days with temperatures exceeding 35°C is anticipated to increase from the current 147 days per year to up to 290 days per year by 2070 (Turton et al. 2009). Across Australia, it has been estimated heat-related deaths are projected to rise by a factor of four or more by 2050 in Australia's major cities, without planned adaptation (McMichael et al. 2003).

In addition, the Intergovernmental Panel on Climate Change expressed very high confidence that sea surface temperatures around Australia will rise. For example, near-coastal sea surface temperatures around Australia are projected to rise by about 0.4-1.0°C by 2030 and around 2-4°C by 2090 (for high emission pathway RCP8.5, compared to current (1986–2005)). The implications for beach tourism are set out in Table 9.

Table 9: Beaches and higher temperatures.

Risk	Detail	Adaptation Measure	Comments on Implementation
Tourist comfort decreased and heat hazard	Increasing temperatures pose a challenge for tourism in destinations that are already classified as hot or potentially 'uncomfortable'.	Provide more shaded areas; social marketing on health risks of heat exposure. Consider planned changes in seasonality (i.e. shift away from current peak seasons to shoulder seasons) – local government to work with regional and state tourism organisations.	Changing entrenched behaviours and travel patterns is difficult.

Coral reefs and higher sea surface temperature

Coral reefs are also important beyond their biodiversity and recreational values, because they provide a natural defence against storms and flooding (Becken and Hay, 2012). They are also the basis of a substantial tourism industry in Australia. The Great Barrier Reef alone has been estimated to generate \$5.7 billion per year (Deloitte Access Economics 2013). Increasing sea temperature is probably the single biggest risk factor for the reef over the short to medium term (decades) because of its direct effect on corals (Table 10).

The long-term average surface water temperature of the Great Barrier Reef has increased by about 0.5°C in the last 100 years. Two mass coral bleaching events have been observed (in 1998 and 2002) and a third is currently underway (2015-2016). The Ningaloo Reef in Western Australia saw a significant coral bleaching event in early 2011, due to thermal stress. For more information, see the AIMS website: <http://www.aims.gov.au/docs/research/climate-change/position-paper.html> (accessed 4 April 2016).

In addition, a wide range of stress factors are affecting coral reefs and marine biodiversity, and reducing their resilience. Human activities, such as sewage discharge, waste pollution, physical damage, and disturbance of marine organisms, are adding to local pressures.

Table 10: Coral reefs and higher sea surface temperature.

Risk	Detail	Adaptation Measure	Comments on Implementation
Coral bleaching	Activities that help reduce pressure on coral reefs will contribute to reef resilience and ability to cope with higher water temperatures (see Great Barrier Reef TCCAG 2009).	<p>Encourage operators to:</p> <ul style="list-style-type: none"> • Support existing research on climate change by hosting scientific researchers on tourist vessels. • Minimise coral damage from anchors, divers and vessel groundings. Educate divers and snorkelers. • Facilitate responsible use of public and private moorings. • Become actively engaged in community programs aimed at improving water quality, and make sure waste and wastewater are disposed of appropriately. • Experiment with techniques to prevent coral bleaching at high value sites. Although strategies to prevent mass coral bleaching by shading or cooling reefs are impractical at large, ecosystem-level scales, these methods may hold some promise for protecting small, high-value tourism sites. For example experiment with potential techniques, such as shade cloth or sprinklers. 	<p>Barrier: Limited control over water quality and water temperatures.</p> <p>Facilitator: tourism operators operate in small areas and depend on their integrity. They are therefore highly committed to maintain resilient coral ecosystems.</p>

Coastline settlements and infrastructure and higher temperature

Tourism activity and infrastructure are extremely weather dependent (Table 11). A recent study assessed the impacts of projected climate change on Australia's tourism industry by examining changes in 'preferred' conditions, including temperature (Amelung and Nicholls 2014). The study projects a southward shift in the most desirable conditions and a decline in the climatic attractiveness of northern locations. The authors concluded that the adoption of a pro-active rather than reactive stance to climate change will maximise the ability of tourism stakeholders to successfully adapt.

Table 11: Coastline tourism infrastructure and higher temperatures.

Risk	Detail	Adaptation Measure	Comments on Implementation
Increased demand for air conditioning (costs and increased CO₂ emissions)	Tourism and community infrastructure will be affected by hotter temperatures and changes in demand for energy, especially during peak times.	<p>Ensure that tourism operators offer cool spaces/buildings:</p> <p>Designs for hotels and visitor centres that create shade and cool buildings will be increasingly important in the hotter times ahead (e.g. natural air flow).</p> <p>Energy efficient systems e.g. ocean thermal energy conversion.</p> <p>Thermal energy from air conditioning exhaust vents to be used in resorts for heating water systems.</p> <p>Use of solar energy to benefit from renewable energy source to run air conditioning at zero emissions.</p>	Barrier: lack of innovation amongst architects, designers, and developers who tend to be conservative and repeat 'existing and trusted' designs.
Reduced tourist comfort	Tourists may alter their destination choices to avoid uncomfortably hot climates.	<p>Minimise use of air conditioning, but provide shaded areas with natural air flow.</p> <p>Offer activities during less hot times during the day, e.g. morning and late afternoon.</p> <p>Networking with other businesses offers advantages in reducing impact of adverse weather conditions (e.g. heatwave).</p>	Changes in seasonality may provide some opportunities for destinations to achieve more even distribution of arrivals.

Rainfall changes

Climate change is projected to reduce precipitation in some regions of Australia, decreasing freshwater availability. Increased variability in rainfall events can lead to flood events, including dangerous flash floods. The impacts are far reaching, including for coastal ecosystems. The main impacts from rainfall changes are expected for infrastructure along the coastline (Table 12).

Table 12: Coastline settlements and infrastructure and changes in rainfall.

Risk	Detail	Adaptation Measure	Comments on Implementation
River Flooding	Inundation of coastal tourism infrastructure and settlements, and more frequent or severe flooding. Impacts can be exacerbated by storm effects and storm surges (e.g. in port areas).	Increases in the standard for drainage capacity for new transportation infrastructure and major rehabilitation projects, improvements in monitoring of conditions.	Barrier: relatively low frequency of adverse conditions makes people complacent.
Water shortage (drought)	Tourist businesses are often high water consumers. There is increasing need to contribute to water savings initiatives, both to reduce operational costs and as part of broader destination stewardship.	<p>Maximising use of water-efficient equipment (e.g. low flow shower heads).</p> <p>Staff training (e.g. housekeeping) and guest education (e.g. towel programs).</p> <p>Minimising water losses (e.g. leakage, evaporation from pools etc.)</p> <p>Building rainwater capture and storage tanks.</p> <p>Recirculation of recycled water to irrigate garden areas.</p>	<p>Barrier: Need to consider hygienic issues for storing water and use of recycled water.</p> <p>Initial costs of investment.</p> <p>Facilitator: greater self-sufficiency and potential long-term cost savings.</p>

Ecosystem changes

Coral reefs and ecosystem changes

A 2009 survey of users at the Great Barrier Reef, concluded that "a hypothetical reduction in fish abundance, coral cover and coral diversity of 80, 30 and 70 per cent, respectively, may lead to an 80% decrease in the number of reef trips taken by divers and snorkelers (Kragt et al. 2009). A significant environmental change for marine ecosystems is the increasing concentration of CO₂ in the oceans, associated with an increase in atmospheric concentrations. This will in turn increase the acidity of the water, impacting in particular on coral reefs (Table 13).

Table 13: Coral reefs and ecosystem changes.

Risk	Detail	Adaptation Measure	Comments on Implementation
Change and loss of species	Declining coral reef condition and changes in the abundance and location of fish, marine mammals and other iconic species are likely to have the greatest impact on the industry, especially in the Cairns area which has fewer island experience alternatives.	<p>Contribute to environmental monitoring initiatives such as Eye on the Reef, Sightings Network and BleachWatch to provide reliable reports about changing condition.</p> <p>Participate in Crown-of-thorns Starfish (COTS) Watch.</p> <p>Minimise coral damage from snorkelling, diving and anchoring. Minimise vessel groundings. Legislative and regulatory requirements will be raised for review. The GBRMPA undertakes operator workshops focussed on education in key compliance areas.</p>	Barrier: staff turnover requires constant re-training of tourism staff.

Nature-based tourism and ecosystem changes

A considerable share of tourism in Australia depends on the natural environment – often in the coastal zones, but also in the immediate hinterland or catchments. Key tourist activities include bushwalking, wildlife viewing, and – in some areas – wine tourism (e.g. Margaret River, Western Australia) (Jones et al. 2010 and Turton et al. 2009). Shifts in species composition, as well as in the quantity and quality of flora and fauna, have the potential to significantly impact the allure of coastal and marine parks and other protected areas throughout Australia (Table 14).

Table 14: Nature-based tourism and ecosystem changes.

Risk	Detail	Adaptation Measure	Comments on Implementation
Change in species composition and ecosystem resilience	Fast changes in multiple physical parameters (e.g. temperature, precipitation, ocean currents, wind, salinity) will affect some species that cannot cope with new conditions.	Identify baseline parameters to effectively monitor the environmental changes. Continue to improve data management and the technical capacity of park staff. Undertake economic impact assessment of climate change impacts on key nature-based tourism activities (e.g. Penguin colony in Phillip Island).	Tourism can be an ally for nature conservation and help justify public sector investment into nature conservation and climate resilience measures.

Case studies and supporting material

An example of a climate change impact assessment process for an Australian key tourist destination - Kakadu National Park (Turton et al. 2009): <http://www.bmwhi.org.au/docs/The%20Impacts%20of%20Climate%20Change%20Summary.pdf> (accessed 28 April 2016).

A paper that explains the application of a regional tourism adaptation framework model to the Surf Coast destination, within the state of Victoria, Australia (Jopp et al. 2013).

A good example of a crisis management plan developed for the tourism industry: the Queensland Tourism Crisis Management Plan (Tourism Queensland, 2007).

A case study showing the importance of hazard mapping: flooding in Cairns under current conditions and with enhanced climate change conditions (Turton et al. 2009): <http://www.bmwhi.org.au/docs/The%20Impacts%20of%20Climate%20Change%20Summary.pdf> (accessed 28 April 2016).

Examples of climate change impacts in Europe and adaptation measures undertaken (Nicholls 2014): <http://europeanclimate.org/climate-change-implications-for-tourism/> (accessed 28 April 2016).

A study assessing the impacts of projected climate change on the Australian tourism industry - temperature and tourist comfort (Amelung and Nicholls 2014).

A case study of the tourism-related climate change impacts on the Margaret River wine region and the adaptation responses undertaken (Jones et al. 2010): https://www.researchgate.net/publication/47561105_The_impact_of_climate_change_on_the_Margaret_River_Wine_Region_developing_adaptation_and_response_strategies_for_the_tourism_industry (accessed 28 April 2016).

References

- AIMS, n.d.: Backgrounder: Climate change and the tropical marine environment. Accessed 1 April 2016. [Available online at <http://www.aims.gov.au/docs/research/climate-change/position-paper.html>].
- Amelung, B., and S. Nicholls, 2014: Implications of climate change for tourism in Australia. *Tourism Management*, **41**, 228-244.
- Becken, S., and J.E. Hay, 2012: *Climate Change and Tourism: from Policy to Practice*. Routledge, Abingdon.
- Deloitte Access Economics, 2013: Economic contribution of the Great Barrier Reef, Great Barrier Reef Marine Park Authority, Townsville. Accessed 1 April 2016. [Available online at <http://www.environment.gov.au/system/files/resources/a3ef2e3f-37fc-4c6f-ab1b-3b54ffc3f449/files/gbr-economic-contribution.pdf>].
- Great Barrier Reef Tourism Climate Change Action Group (TCCAG), 2009: Great Barrier Reef Tourism Climate Change Action Strategy: 2009-2012. Published by the Great Barrier Reef Marine Park Authority. Accessed 28 April 2016. [Available online at http://www.gbrmpa.gov.au/_data/assets/pdf_file/0009/3987/gbrmpa_CCActionStrategy-Full_2011.pdf].
- Jones, R. and Coauthors, 2010: The impact of climate change on the Margaret River wine region: developing adaptation and response strategies. CRC for Sustainable Tourism Pty Ltd, Gold Coast, Qld. Accessed 1 April 2016. [Available online at https://www.researchgate.net/publication/47561105_The_impact_of_climate_change_on_the_Margaret_River_Wine_Region_developing_adaptation_and_response_strategies_for_the_tourism_industry].
- Jopp, R., DeLacy, T., Mair, J. and Fluker, M., 2013. Using a regional tourism adaptation framework to determine climate change adaptation options for Victoria's Surf Coast. *Asia Pacific Journal of Tourism Research*, **18**(1-2), 144-164.
- Kragt, M.E., P.C. Roebeling, and A. Ruijs, 2009: Effects of Great Barrier Reef degradation on recreational reef-trip demand: a contingent behaviour approach. *The Australian Journal of Agricultural and Resource Economics*, **53**(2), 213-229.
- McLennan, C., A. Bec, C. Wardle, and S. Becken, 2015: Gold Coast Tourism Industry Report: Year Ending June 2015. Griffith Institute for Tourism Research Report Series Report No 9, October 2015. Accessed 8 February 2018. [Available online at https://www2.griffith.edu.au/_data/assets/pdf_file/0032/18878/June-2015-Report-9-Tourism-Industry-Report-merged.pdf].
- McInnes, K.L., Walsh, K.J.E. & Pittock, A.B. (2000). Impact of sea-level rise and storm surges on coastal resorts. Final Report. CSIRO Tourism Research Program.
- McMichael, A.R., R.E. Woodruff, P. Whetton, K. Hennessy, N. Nichols, S. Hales, A. Woodward and T. Kjellstrom, 2003: Human Health and Climate Change in Oceania: A Risk Assessment 2002. Climate Change Health Risk Assessment. Accessed 4 April 2016. [Available online at <http://www.bvsde.paho.org/bvsacd/cd68/oceaniaclim.pdf>].
- Nicholls, M., 2014: Climate change: Implications for Tourism. Key findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report. University of Cambridge. Accessed 28 April 2016. [Available online at <http://europeanclimate.org/climate-change-implications-for-tourism/>].
- Sunshine Coast Regional Council, 2010: Climate Change Background Study, Climate Change and Peak Oil Strategy 2010-2020. Sunshine Coast Regional Council, Sunshine Coast, Australia, 88pp. Accessed 8 February 2018. [Available online at <https://d1j8a4bqwzee3.cloudfront.net/~media/Corporate/Migrated/Files/Uploads/addfiles/documents/opof/climatechange/climatechgbg-std.pdf?la=en>].

Tourism Queensland, 2007: Regional Tourism Crisis Management Plan Template. A guide to preparing a Regional Tourism Crisis Management Plan. Brisbane, Australia, 32pp. Accessed 28 April 2016. [Available online at <https://www.scribd.com/document/51339709/QLD-Regional-Tourism-Crisis-Management-Plan-Template>].

Tourism Australia, 2015: Research Underpins New Push to Promote Australia's Aquatic and Coastal Experiences. Accessed 4 April 2016. [Available online at <http://www.tourism.australia.com/content/dam/assets/document/1/6/w/s/z/2002067.pdf>].

Tourism Research Australia, 2016: Tourism statistics. Austrade. Accessed 4 April 2016. [Available online at www.tra.gov.au].

Tourism Victoria, 2014: Great Ocean Road. Market Profile: Year ending December 2013. Accessed 4 April 2016. Available online at <http://www.tourism.vic.gov.au/component/edoc-man/?view=document&task=document.download&id=917>].

Tourism Western Australia and the Department of Environment and Conservation, 2008: Garnaut Climate Change Review: Tourism in South-West Western Australia: climate Change Vulnerability and Adaptation. Accessed 29 March 2017. [Available online at [http://www.garnautreview.org.au/CA25734E0016A131/WebObj/01-LTourism/\\$-File/01-L%20Tourism.pdf](http://www.garnautreview.org.au/CA25734E0016A131/WebObj/01-LTourism/$-File/01-L%20Tourism.pdf)].

Turton, S., W. Hadwen, R. Wilson, B. Jorgensen, and D. Simmons, 2009: The Impacts of Climate Change on Australian Tourism Destinations: Developing Adaptation and Response Strategies. Sustainable Tourism Cooperative Research Centre. Gold Coast, Australia. Accessed 4 April 2016. [Available online at <http://www.bmwhi.org.au/docs/The%20Impacts%20of%20Climate%20Change%20Summary.pdf>].

United Nations International Strategy for disaster Reduction, 2009: UNISDR Terminology on Disaster Risk Reduction. Accessed 4 April 2016. [Available online at http://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf].

UNWTO, UNEP and WMO, 2008: Climate Change and Tourism: Responding to Global Challenges. Madrid: United Nations World Tourism Organization; Paris: United Nations Environment Program; Geneva: World Meteorological Organization. Accessed 4 April 2016. [Available online at <http://sdt.unwto.org/sites/all/files/docpdf/climate2008.pdf>].

This Impact Sheet was prepared by Susanne Becken from the Griffith Institute for Tourism. Please cite as:

Becken, S., 2016: Climate change impacts on coastal tourism. CoastAdapt Impact Sheet 6, National Climate Change Adaptation Research Facility, Gold Coast.



www.coastadapt.com.au



Australian Government
Department of the Environment and Energy