

Garnaut Climate Change Review

Tourism in south-west Western Australia: climate change vulnerability and adaptation

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This paper has been prepared in response to a request from the Garnaut Climate Change Review Secretariat, with the south-west region of Western Australia being representative of Australian iconic tourism areas experiencing climate change.

Due to multiple constraints preparing the paper, the views herein have been prepared primarily by Tourism Western Australia and the Department of Environment and Conservation, without the benefit of comprehensive tourism industry input.

1 Summary

WA's south-west region attracts tourists from other parts of the state, from other parts of Australia and from overseas. The region's tourism industry employs about 4,000 people, about 6% of total regional employment, and generates some \$600 million visitor expenditure per year.

The region's main tourism attractions include its variable landscapes and coasts, recreational opportunities (such as fishing, surfing, diving, bushwalking, camping), agricultural products including high value wines, dairy products, olive oils, truffles and fruit and cultural activities, all of which are directly or indirectly dependent on or affected by climate. The region's tourism industry is therefore potentially vulnerable to changes in climate conditions.

The region currently enjoys a mild Mediterranean climate dominated by long dry summers and mild, wet but sunny winters. Summer temperatures are generally moderated by the region's proximity to the Indian and Southern Oceans, with much of the region experiencing cool afternoon winds on even the hottest days. Winter rainfall is balanced by sunny days. Heatwaves, floods, drought and cyclone landfall are rare. Neighbouring regions are less moderated by ocean influences and tend to be warmer in summer.

The region became warmer and received less rainfall in the period 1975 to present compared with the preceding 50 years. Both changes have been at least partially attributed to human induced climate change. Climate projections indicate further increases in temperature and decreases in autumn and winter rainfall. These changes in climate have combined to result in reduced stream and river flows and concerns about ground water reserves. Because the population of this region and neighbouring regions is increasing rapidly a growing competition for water resources is already becoming evident. Sea level rise poses a significant risk for coastal infrastructure.

Most impacts on the tourism industry will result from detrimental effects of climate change on natural, agricultural and cultural attractions on which the region's tourism industry depends. The tourism industry needs to work with managers of other sectors to ensure they take account of climate change in their management planning and practices. The tourism sector also needs to avoid placing its built assets and clients in places where they will be exposed to danger or damage from climate-related impacts.

However, the south-west WA tourism region could benefit from climate change if warmer winters enable its prime tourism season to be extended or if the region is viewed as a convenient and effective option to avoid increased summer heat in neighbouring regions.

The industry and its players will need a clear strategic oversight of climate change and agile management practices to seize potential opportunities and avoid costs and losses from climate change impacts.

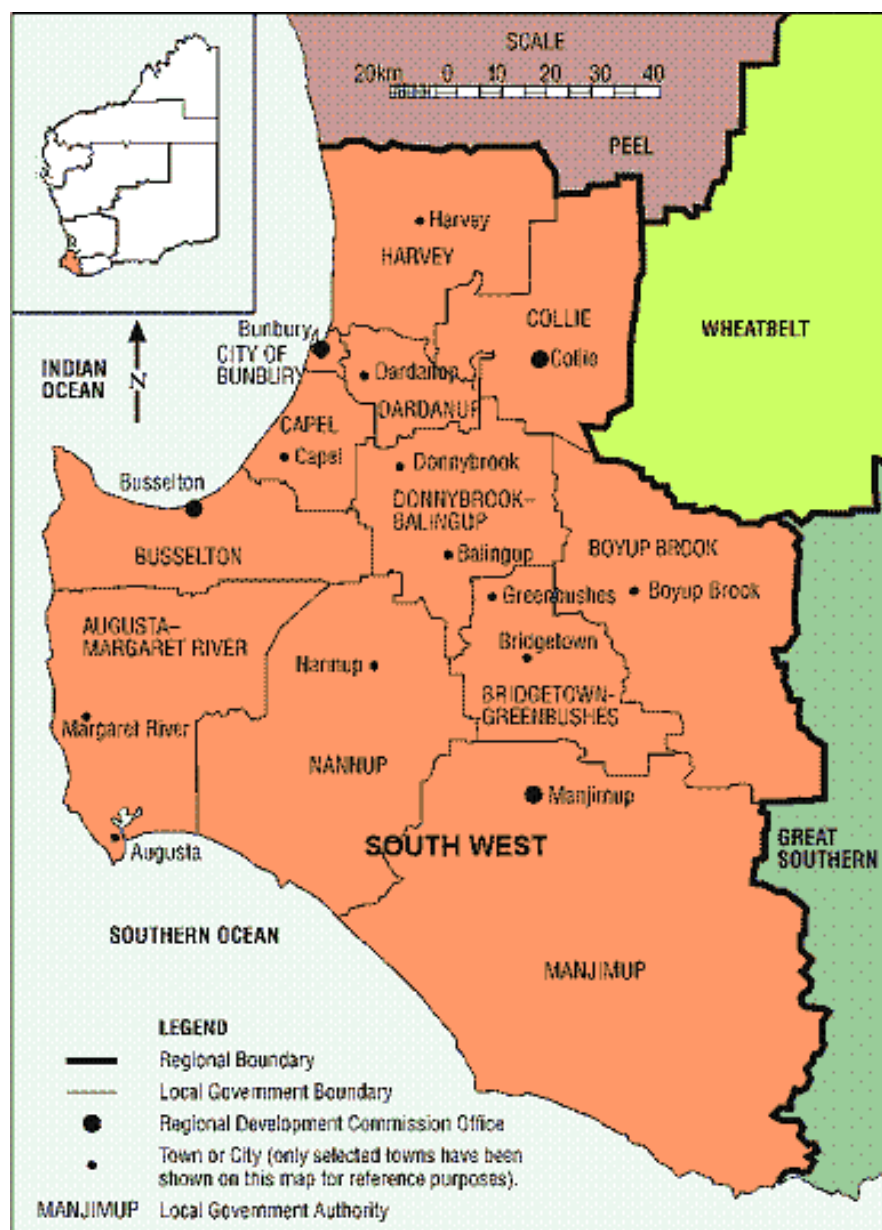
2 Introduction

Tourism is a major industry in WA's south-west region, drawing people from other parts of the state, from other parts of Australia and, increasingly, from overseas.

Tourists are attracted to south-west WA by its landscapes, recreational opportunities, agricultural, horticultural and viticulture products and cultural activities. All of these attractions are directly or indirectly dependent on or affected by climate, and they are all potentially vulnerable to changes in climate.

This paper provides a description of the potential vulnerability of the tourism sector in south-west Western Australia to human induced climate change and possible adaptation options. The area discussed conforms to the Australian Bureau of Statistics South West Statistical Division, as shown on Figure 1.

Figure 1 South-west region of Western Australia



The paper has four main sections:

- the tourism industry in south-west Western Australia,
- the climate of south-west Western Australia,
- potential impacts of climate change on the tourism industry of south-west Western Australia, and
- current and possible future adaptation of the tourism industry to climate change.

3 The tourism industry of south-west Western Australia

3.1 Regional profile

The South West Tourism Region of Western Australia faces the Indian and Southern Oceans in the south-west corner of Western Australia and covers an area of 24,000 square kilometres. It comprises 12 local government areas (the City of Bunbury and the shires of Harvey, Dardanup, Capel, Busselton, Augusta-Margaret River, Nannup, Donnybrook-Balingup, Collie, Bridgetown-Greenbushes, Boyup Brook and Manjimup) and a population of 145,000 people. The region attracts retirees and others seeking its lifestyle and economic activities, generating demand for services, infrastructure and recreation.

The region's economy is very diversified, including agriculture, horticulture and viticulture; timber and forest products; mineral extraction, processing and manufacturing; retailing; tourism; construction; other manufacturing; service industries; fishing and aquaculture. Its gross regional product increased to more than \$9 billion for the financial year 2006/07, an increase of 17.7% on the previous year and a 71.5% increase compared with five years ago. The mining, property and manufacturing industries dominate the economic production of the region at 29.1%, 11.8% and 11.4% of total value respectively. Unemployment is consistently low.¹ Tourism provides about 6% of the region's employment (Table 1).

Table 1 South-west population¹ and employment²

Local Government Area	LGA population	Total employed	Number employed in tourism	% employed in tourism
Augusta-Margaret River (S)	11,689	5,194	655	12.62
Boyup Brook (S)	1,501	810	18	2.26
Bridgetown-Greenbushes (S)	4,001	1,962	90	4.59
Bunbury (C)	31,865	14,586	801	5.49
Busselton (S)	27,546	10,743	1,060	9.87
Capel (S)	9,568	3,582	132	7.32
Collie (S)	8,829	3,690	158	4.28
Dardanup (S)	10,424	4,675	211	9.19
Donnybrook-Balingup (S)	4,782	2,286	79	3.44
Harvey (S)	19,669	9,008	362	7.93
Manjimup (S)	9,736	5,190	385	7.42
Nannup (S)	1,236	567	58	10.27

¹ Source: Regional Population Growth, Australia and New Zealand, 2004–05 (ABS cat. no. 3218.0)

² Source: Tourism Task Force—Tourism Employment Atlas for Australia, 2004

In Tourism Western Australia, *Regional Development Commission Fact Sheet South West 2006*

3.2 Tourism in south-west Western Australia

Over 1.6 million overnight tourists and 1.9 million day trippers visit the SW Region each year (Table 2). Most visitors to the south-west region live in the Perth Metropolitan Region or the south-west region. All ages visit the region, but there is a significantly smaller proportion of those aged 60+ compared to other age groups. Popular tourist attractions include food, wine, fishing, forests, beaches, surfing, whale watching, wildflowers, bushwalking and cultural heritage. Perth and south-west originating visitors who prefer to visit the south-west region are termed 'Indulgiers' or 'Outdoor Adventurers'.

¹ South West Development Commission: *Annual Report 2006–07* and *Stats News Jan 2008*.

- Indulgers want to relax and take it easy on beaches in warm weather and with good food and wine.
- Outdoor adventurers seek nature based activities including enjoying beaches, fishing and surfing, wildflowers and forests. Virtually all international visitors participate in these activities.

Many of the region's natural features comprise its key attractions. For instance, recreational fishing in rivers, lakes, estuaries and the ocean is regionally important for both residents and visitors. Similarly, the region's viticulture produces internationally known premium wines and many tourism opportunities.

South-west WA is also renowned for its natural beauty, biodiversity and aesthetic values. The region is part of the South West Botanical Province, Australia's only internationally recognised 'biodiversity hotspot' and one of only 25 such hotspots globally. The Province supports an immense variety of plant species with approximately 8000 species of flowering plant having been recorded of which 50 per cent are found only in this Province. SW WA has four bio-regions (areas with similar geology, soils and vegetation) the jarrah forest, mallee, Swan Coastal Plain and the Warren region. The coast ranges from broad sandy beaches to granite, limestone and basalt outcrops and embayments, with offshore reefs found in many locations.

Table 2 Visitor summary—annual averages

	2002 and 2003		2003 and 2004		2004 and 2005		2005 and 2006	
	Visitors	%	Visitors	%	Visitors	%	Visitors	%
Overnight visitors								
Intrastate visitors ¹	1,476,500	86%	1,465,500	84%	1,414,500	85%	1,405,000	85%
Interstate visitors ¹	140,500	8%	177,500	10%	161,000	10%	149,500	9%
International visitors ²	96,200	6%	91,600	5%	91,100	5%	91,500	6%
Total overnight visitors	1,713,200	100%	1,734,600	100%	1,666,600	100%	1,646,000	100%
Overnight visitor nights								
Intrastate nights	4,462,500	77%	4,544,500	73%	4,521,000	73%	4,244,500	75%
Interstate nights	689,000	12%	1,224,500	20%	1,053,500	17%	638,000	11%
International nights	652,900	11%	490,700	8%	608,000	10%	749,900	13%
Total nights	5,804,400	100%	6,259,700	100%	6,182,500	100%	5,632,400	100%
Average length of stay (nights)								
Intrastate stay	3.0		3.1		3.2		3.0	
Interstate stay	4.9		6.9		6.5		4.3	
International stay	6.8		5.4		6.7		8.2	
Daytrips								
Domestic day trips ³	1,738,500		1,652,500		1,652,500		1,892,500	

Percentages and figures may not add up to total due to rounding

(1) Overnight Domestic Visitors Definition: Australian residents aged 15yrs and over who spent at least one night away from home in Western Australia

(2) Overnight International Visitors Definition: International visitors aged 15 yrs and over who spent at least one night in the region

(3) Domestic Day Trip Definition: Day trips or same day visitors are those who travel for a round trip distance of at least 50km, are away for home for at least 4 hours, and who do not spend a night away from home as part of their travel. Same day travel as part of overnight travel is excluded as is routine travel such as commuting between work/school and home. Routine shopping is included as is travel for all purposes, not just pleasure.

Source: Tourism Research Australia—*International Visitor Survey; National Visitor Survey*

Table 3 Estimated visitor expenditure—annual averages (two year rolling average)

	2002 and 2003 \$	2003 and 2004 \$	2004 and 2005 \$	2005 and 2006 \$
Domestic	509,489,750	570,967,000	580,927,210	518,219,325
International	48,967,500	36,066,450	47,582,080	61,566,790
Total	558,457,250	607,033,450	628,509,290	579,786,115

Source: Tourism Research Australia, Domestic and International Tourism Expenditure Research Programme 2000 to 2005.
 (See Tourism Western Australia, [http://www.tourism.wa.gov.au/Publications%20Library/Research/Southwest%20\(RDC\)%202006.pdf](http://www.tourism.wa.gov.au/Publications%20Library/Research/Southwest%20(RDC)%202006.pdf) for further information relating to this information)

4 The climate of south-west Western Australia

South-west Western Australia enjoys a Mediterranean climate dominated by hot dry summers and mild and wet but sunny winters, similar to southern California, the Mediterranean basin and the Cape Region of South Africa. Summer temperatures are generally moderated by the region's proximity to the Indian and Southern Oceans, with much of the region experiencing cool afternoon winds on even the hottest days. Winter rainfall is less variable than in many other parts of Australia. Heatwaves, floods, drought and cyclone landfall are rare. Average annual rainfall ranges from about 800mm to 1200mm, most of it falling between July and November.

The region's climate has changed during the period from 1950 to present. However, while the entire region has experienced less rainfall (Figure 2) and warmer temperatures (Figure 3), the dominant characteristics of the climate remain essentially unaltered. Decreased rainfall in this region is 'probably due to a combination of increased greenhouse gas concentrations, natural climate variability and land-use change'², one of very few instances globally where measured changes in rainfall have been attributed to human-induced climate change. Similarly, greenhouse gas emissions have 'very likely ... significantly contributed to ... warming since 1950'.³

Figure 2 Trend in annual total rainfall 1950–2007 (mm/10yrs)

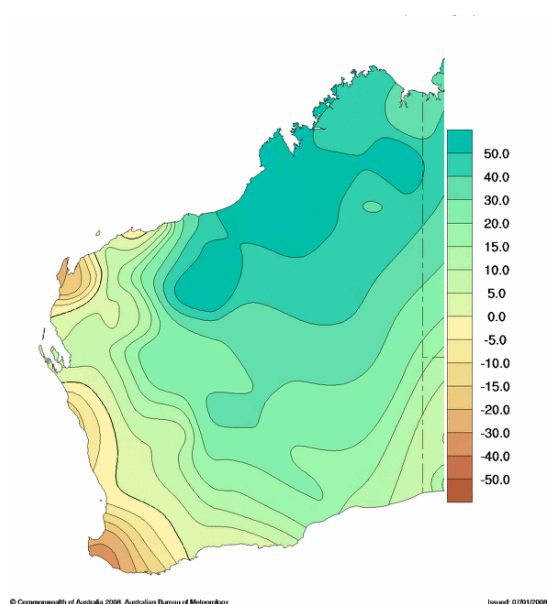
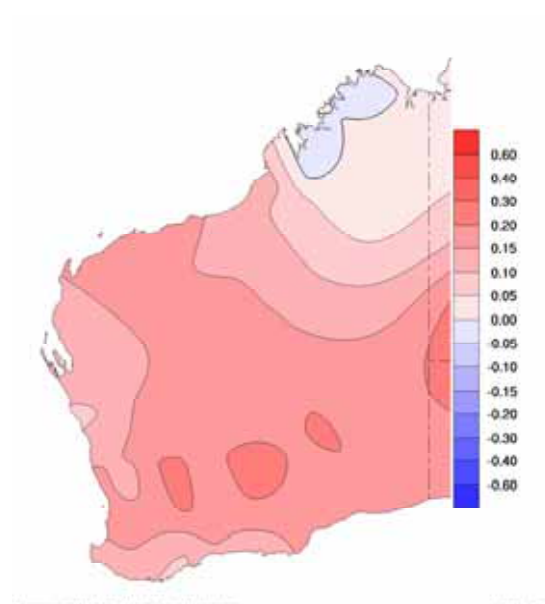


Figure 3 Trend in mean temperature 1950–2007 (°C/10yrs)



These changes in climate have combined with rapidly increasing populations in this and neighbouring regions to generate a growing competition for water resources and reduced stream and river flows.

² IPCC AR4 WG2 Chapt 11 s11.2.1

³ IPCC AR4 WG2 Chapt 11 s11.2.1

5 Potential impacts of climate change on tourism in south-west Western Australia

Six of the top ten leisure activities undertaken by domestic visitors are dependent upon or impacted by climatic influences:

- general sight-seeing
- go to the beach (including swimming)
- visit wineries
- bushwalking or rainforest walks
- visit national parks or state parks
- picnics or BBQs.

Tourism is vulnerable to five main types of impacts from climate change:

- loss of attractions
- loss of quality of attractions
- cost of adaptation
- cost of replacing tourism capital
- developing new or better attractions.⁴

In addition to these potential impacts the tourism sector needs to be aware of changes to health risks for visitors and to public perception of the region's tourism industry in terms of climate change commitment or vulnerability as climate awareness increases.

The degree of climate change impact will be determined by the extent of climate change in this region, the vulnerability of an activity, resource or infrastructure to climate change, and how other similar regions in WA, Australia and overseas are affected by climate and other forces during the same period. The nature of public information about regional changes resulting from climate change will be a significant influence on how and how much they affect the tourism industry. Some climate changes, such as increased winter temperatures, could result in tourism benefits to this region as the length of its prime tourism season lengthens or conditions worsen in other regions.

This section first discusses projected expressions of global climate change in south-west WA, and then discusses how these changes could affect the tourism sector in south-west directly and indirectly.

5.1 Climate change projections for south-west Western Australia

CSIRO best estimate climate change projections for Australia suggest that in 2050 south-west WA will experience an increase of 1.5oC to 2.0oC in annual mean temperature and a reduction in annual precipitation of between 5–10%, based on SRES A1F1 emission scenarios.⁵ A statistical downscaled projection for this region indicated that total precipitation would likely be reduced by 3% to 22% in the Cape Naturaliste to King River area, with a greater range of rainfall change in inland areas.⁶ The same projections indicate increases of up to 80% in drought incidence in south-western Australia by 2070, which would affect this area both directly and by reducing flows of rivers which rise inland and

⁴ Sustainable Tourism CRC report, *Climate Change and Australian Tourism*, Australia. 2007.

⁵ CSIRO 2007, *Climate Change in Australia* – Technical Report 2007, Revised Edition.

⁶ Ibid.

pass through this region. A 14% reduction in surface water runoff is projected in south-west Australia in the period 2021 to 2050 relative to 1961 to 1990.⁷ Wind speeds are likely to increase.

Sea levels are projected to rise by 260mm to 590mm by 2090 under the A1F1 emission scenario.⁸

However, while the climate throughout Australia is projected to become warmer during the 21st century and rainfall declines are most confidently projected for south-western Australia, any increases in temperature are likely to be moderated in the south-west WA tourism region, due to the influence of the Southern and Indian oceans.

In addition, while climate change projections are currently generated for regions, the impact of climate change will be highly location specific. For instance, mean annual maximum summer temperatures could increase measurably in inland centres such as Donnybrook but could remain at current levels in Walpole or Augusta due to stronger onshore breezes on hot summer days. Similarly, the location and degree of coastal impacts from combinations of higher sea levels and storm surges will depend on whether the storms are associated with tropical systems which move southerly from North West Cape, which would affect the Capel to Busselton coast most strongly, or with more intense or more frequent south-westerly storms, which would mostly affect the coastline from Cape Naturaliste to Walpole and east to Esperance.

Climate science will not be able to provide certain projections of climate changes at the level of detail required to form optimised adaptation plans or strategies. A risk management approach is therefore required, involving ongoing climate science research, climate monitoring at a scale that will generate local climate understanding, increasing understanding of the likely impacts of climate change on key tourism assets, and better understanding and management of emerging visitor preferences.

5.2 Vulnerability of tourism assets to climate change

This discussion outlines types of impacts anticipated for the south-west WA region. The particular impacts in a specific location will require further more detailed consideration.

Tourism assets will be affected by a combination of impacts:

- loss of an attraction
- loss of quality of an attraction
- cost of adaptation to new conditions
- cost of replacing tourism capital
- developing new or better attractions.

The resilience of the tourism sector is therefore in its own hands:

- How well can the sector work internally and with other sectors to avoid the loss of attractions and the loss of quality of attractions in order to reduce the cost of adaptation and the cost of replacing tourism capital?
- How effectively can the tourism sector recognise new tourism opportunities or new features of existing attractions and communicate these to potential visitors and provide the necessary facilities to ensure a satisfying visitor experience?

⁷ Chiew, FHS, TI Harrold, L Siriwardenena, RN Jones and R Srikanthan, 2003: Simulation of climate change impact on runoff using rainfall scenarios that consider daily patterns of change from GCMs. MODSIM 2003: International Congress on Modelling and Simulation: proceedings, Townsville, Modelling and Simulation Society of Australian and New Zealand, Canberra ACT, 154–159.

⁸ IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Landscapes and biodiversity are likely to be affected by increased temperatures and decreased rainfall, with south-western Australia being specifically nominated as a region at risk. Natural systems are known to have limited adaptive capacity, and in some places projected rates of climate change are very likely to exceed rates of evolutionary adaptation in many species. Vulnerability is likely to be high by 2050 in a few identified Australian hotspots, including the south-west.⁹ Changes in species distribution and ecosystems in national parks are likely to alter their tourism appeal.

Public infrastructure is likely to be at increased risk, with design criteria for extreme events very likely to be exceeded more frequently by 2030. Risks include failure of floodplain protection and urban drainage/sewerage, increased storm and fire damage, and more heatwaves.

Tourism and private infrastructure could be affected directly by increased incidence of extreme weather, including combinations of sea level rise and storm surges, and also indirectly through the disclosure of increased hazards and risk to lenders and insurers. However, due to the relatively well moderated climate of this region, these impacts are likely to be lower than in many other regions which are more exposed to weather extremes, except where infrastructure is located where sea level rise and storm surges could combine to result in inundation or erosion.

Agriculture and forestry production is projected to decline over much of southern Australia by 2030, due to increased drought and fire and generally reduced soil water availability. The viticulture, horticultural and other high value agricultural crops of the south-west region will be able to compete financially with most other industrial uses for water resources, but this and other climate impacts will impose costs on these industries.

Fisheries are expected to be affected by changes in ocean temperature, currents, winds, nutrient supply, acidification and rainfall. Marine intrusions resulting from sea level rise are highly likely to affect coastal fisheries and inshore sub-tidal breeding and nursery areas. Warmer waters and lower runoff will likely reduce population sizes of cool-water and freshwater species.

Beaches, coastal environments and reefs are likely to be affected by rising sea levels, increasing water acidity (and the ability of reefs to withstand this impact) and storm surges.

Hazard increases such as flooding, storm surges, heatwaves, cyclones, fires and droughts could adversely affect transport, personal safety, communication, water availability and natural attractions such as coral reefs, beaches, freshwater wetlands and forests.¹⁰

Sea-level rise is virtually certain to cause greater coastal inundation, beach erosion, loss of wetlands and salt-water intrusion into freshwater sources, with impacts on infrastructure, coastal resources and ecosystems. This will require careful coastal management initiatives.

Visitor comfort and safety could be affected by several aspects of climate change. Heat-related deaths are projected to rise by a factor of four or more by 2050 in Australia's major cities, without planned adaptation¹¹, raising the need to manage the safety and health of elderly visitors who may be more active as tourists than they are in their home environments. While this risk may be lower in the south-west than it would be in most other areas of south-west WA due to climate moderation, greater heat in other parts of WA could influence a greater number of elderly visitors to travel to this region to avoid peak summer heat periods. Similarly, warmer winters could induce greater visitation over an extended peak period. However, some extension to the geographical range and seasonality of mosquito-borne infectious diseases must be anticipated. Public safety concerns associated with extreme weather events, such as cyclones, are unlikely to be significant issues in south-west WA, but fires associated with heat waves could become an increasingly significant factor for fire response organisations, especially where visitors explore remote areas along the coast or in forests.

⁹ Hennessy, K., B. Fitzharris, B.C. Bates, N Harvey, S.M. Howden, L. Hughes, J. Salinger and R.Warrick, 2007: Australia and New Zealand. Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group 2 to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hansen, Eds, Cambridge University Press, Cambridge, UK, pp 507–540.

¹⁰ World Tourism Organisation, 2003

¹¹ McMichael, AR, RE 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*.

6 Adaptation by tourism in to climate change south-west Western Australia

Climate change is now a factor that must be included in strategic planning by the tourism industry. (Some current initiatives are outlined in Appendix 2.) However, several other factors complicate an analysis of potential climate change impacts on this region, including past land clearing and surface and ground water use by agriculture, industry and households. For instance, a review of the dropping water level in Lake Cave (AMRSC) highlighted the role of factors other than climate change: 'the virtual absence of fire during the previous 25 years has allowed a dense growth of under storey vegetation and accumulation of ground litter, which through interception and evapotranspiration of rainfall, is hypothesised to be a major contributing factor to the watertable decline.'¹²

In addition, there is little empirical evidence of actual adaptations to climate change impacts made by the tourism industry. While the tourism industry is inherently adaptable in its development of products to meet changing public interest, the public is even more agile in its choices, which respond to factors such as economic and financial conditions, safety, available time and emerging personal interests and options as well as climate conditions. The following discussion summarises anticipated tourism sector challenges and adaptations and responses.¹³

6.1 Beaches

Incremental impacts such as erosion have already been addressed with the inclusion of building setbacks in planning schemes but could also result in relatively less vulnerable waterfront areas experiencing increased use, affecting development location preferences and scale. This is a considerable challenge for tourism planners, as visitors want to stay close to the beach.

Extreme events could alter existing beaches and create new beach features. Tourism planners and providers will need to identify alternative beaches or modify their product attraction where beaches are considered to be vulnerable. Significant beach loss could result in tourist facilities such as accommodation being less viable in affected areas.

South-west local authorities have conducted a series of conferences dealing with coastal planning. A Mandurah workshop (Climate Change and the Coast¹⁴) concluded that while many gaps existed relating to detail at the regional level (which needs concerted focus), the major component missing is 'action' and urgency of action. A coastal vulnerability study would support sound medium-long term facility and infrastructure planning and establish leadership on this matter in WA.

6.2 Inland waterways

Extreme events such as drought or flood could render rivers and other waterways unusable for recreation or tours due to reduced or dangerous flow. Boat ramps, jetties and infrastructure may not be available further limiting access.

Alternate land-based activities such as walk and bike trails or tours would support tourism in the affected areas.

Government policy relating to the availability of dams as well as their catchment areas for recreational use is currently under review as a result of reduced dam capacity. Demand for such facilities will increase the pressure on alternative sites.

¹² Eberhard, S.M. (2002) *Jewel Cave karst system, Western Australia – environmental, hydrogeology and groundwater ecology*. Report prepared for the Augusta Margaret River Tourist Association Inc., Western Australia. 121 pp.

¹³ See Appendix 1 for a more complete presentation of the key South West tourism products (i.e. those attributes which have a major influence on visitation to the region) and the likely outcomes and response of the tourism industry to:

- extreme climate change events (increased fires, cyclones, storm surges, floods, et al) may be temporary or permanent
- gradual impacts of climate change (temperature, rainfall and season changes)
- indirect impacts.

¹⁴ Travers, A. Elrick, C. and R. Kay (2007) *Climate Change and the Coast Workshop Summary Report CZM Working Paper 2007/1*

6.3 Forests

Extreme events such as fire severely interrupt public access and visual amenity, reducing the attractiveness of the area affected for an extended period of time. The tourism industry and forest managers will need to identify a number of alternative options to maintain the image of a 'green, treed south-west region'. Visitor safety will require well-developed strategies.

6.4 Underground caves

Changes to the structure and growth of stalagmites and stalactites are already being observed. Cave lake levels are also dropping or disappearing. Some cave tours have been cancelled. Visitor facilities (such as car parks and toilet blocks) are being relocated away from the cave sites, and visitor expectations need to be carefully managed.

6.5 Diving

Extreme events may render tourism dive wrecks unstable and unsafe. Changed ocean condition could change the best fishing locations. Conversely, warmer sea temperatures may increase coral reefs and improve diving and snorkeling.

6.6 Accommodation and other structures

As visitors become more concerned about environmental sustainability and notwithstanding the direct environmental benefits, buildings will need to demonstrate energy and water efficiency and other sustainability principles to meet public expectations of visiting a region in which sustainability is a key maxim. Waste minimisation, passive solar design, intelligent use of air-conditioning and other design and management practices will become increasingly important. Designs for long-lived structures will take account of changes to seasons (e.g. the cooler start to recent summers) and changes to the tourism seasons (e.g. the peak season is extending beyond January).

To promote sustainability within the tourism sector Tourism WA has developed a state-wide tourism industry education program termed Better Business Blitzes (BBBs), which include a specialised climate change component to be run in conjunction with the Property Council of WA for:

- relevant environmental design guidelines for developers and builders of tourism infrastructure
- AAA Tourism 'Green Star' rating for accommodation operators

Increased off-season tourism is likely to generate year-round demand for outdoor facilities such as barbecues, balconies, sporting and recreation facilities.

6.7 Tours, man-made attractions

Tourism operators noted during the 2007 season that hotter weather encouraged increased visitor satisfaction with time spent on beaches, with less demand for tours and attractions. This may indicate a changing visitor preference. While there is limited knowledge about visitor response to environmental changes, there are significant implications for tourism if substantially increased visitation to an area result from climate change and demographic growth.¹⁵

6.8 Biodiversity and national parks

Gradual climate changes are expected to alter the 'natural attraction' of the region's appearance, with potentially significant impacts on coastal and other wetlands. Cooperation between the tourism industry, key government agencies and local government will be required to enable natural attractions to be enjoyed and appreciated without being degraded.

¹⁵ Jones, B. and Scott, D. Implications of Climate Change for Visitation of Ontario's Provincial Parks, *Leisure/Loisir*, 30(1):233–261

6.9 Discussion

South-west Western Australia has already been affected by climate change and is likely to be further affected in ways which will likely create risks and impacts on the attractions and infrastructure on which the region's tourism sector is based.

Because most visitors to this region come from nearby areas which will be affected by similar but probably greater climate change impacts, the relative attractiveness of this region to tourists is unlikely to be reduced and may be increased. Moreover, the peak tourism season of this region could become extended if its winters become warmer and dryer.¹⁶

Nevertheless, some climate change impacts will require adaptation responses by the tourism industry because;

- lenders, investors or insurers will require risks to their interests to be minimised
- the losses the climate impacts would impose would result in a sudden and major impact on the region's tourism industry
- visitors will likely demand all industry, including the tourism industry, demonstrate sustainability principles and energy and water efficiency in the face of climate change
- increasing demand for a diminishing or limited resource such as water will require resolution, including greater efficiency or recycling or reuse.

The tourism sector will need to work with other sectors to ensure effective management of climate change impacts and to advocate and achieve greenhouse emissions reductions to limit the scale of climate change impacts.

- Support from the local community will be important as the tourism industry responds to the changes posed by climate change, raising the need for community education and training programs that support the tourism industry and the application of Stakeholder Relationship Models to assist and support regions and communities to respond to the major issues surrounding climate change.¹⁷
- Collaborations between tourism operators and social scientists would generate better understanding of underlying behavioural factors affecting visitor preferences and responses to climate change impacts, especially in light of the significantly differing time scales involved in incremental climate change impacts and decisions by tourists and tourism experience and facility providers.¹⁸
- Collaborations between the tourism sector and climate scientists are required to enable recreation and tourism planners, providers and participants to be actively involved in research projects, and to ensure findings are disseminated in practitioner as well as traditional research settings. That is a particular challenge as the majority of tourism enterprises are small businesses which by necessity operate in an adaptive or reactive manner, making decisions in response to environmental contingencies such as consumer demand or the weather, rather than with any long-term, proactive or strategic agenda.¹⁹

¹⁶ Research from Canada indicated that even under the most conservative climate change scenario, visitor increases to national parks were projected to increase, with a substantial share of the growth to occur outside the traditional peak summer season. Jones, B. and Scott, D. Implications of Climate Change for Visitation of Ontario's Provincial Parks, *Leisure/Loisir*, 30(1):233–261

¹⁷ Scanlon, N.L., Stakeholder Response Strategies to Climate Change Impacts on the Economic and Environmental Sustainability of Tourism Destinations, *Tourism Review International*, Vol. 10, pp 103–111.

¹⁸ Nicholls, S. Climate change, tourism and outdoor recreation in Europe, *Managing Leisure* 11, 151–163 (July 2006), Routledge Taylor & Francis Group.

¹⁹ Nicholls, S. Climate change, tourism and outdoor recreation in Europe, *Managing Leisure* 11, 151–163 (July 2006), Routledge Taylor & Francis Group.

7 Conclusions

South-west Australia has already been affected by human induced global climate change. The region has become warmer and has received less rainfall, river and other surface water flows have reduced, and many wetlands have lower water levels or longer dry periods. Further warming, rainfall reductions and higher sea levels are projected for 2050 and thereafter.

The impacts of these broader regional climate changes on the south-west WA region are expected to be moderated in comparison with neighbouring regions because of the influence of the Indian and Southern oceans which border much of this region. Most impacts on the tourism industry will result from detrimental effects of climate change on natural, agricultural and cultural attractions on which the region's tourism industry depends. The tourism industry needs to work with managers of other sectors to ensure they take account of climate change in their management planning and practices.

However, the tourism sector also needs to avoid placing its built assets and clients in places where they will be exposed to danger or damage from extreme events such as fire or incremental change combined with extreme events, such sea level rise and storm surges. These precautions are necessary both to avoid loss of assets and harm to visitors and also to demonstrate to capital providers and insurers that the risks of climate change are being addressed responsibly. It also needs to be recognised that developers and operators of coastal accommodation projects seek easy and close beach-front access based on consumers' demand and propensity to pay a premium for access to such properties. These results of these opposing objectives will need to be managed carefully.

Conversely, the south-west WA region could benefit from climate change in at least two ways. First, to the extent that the climate of this region becomes warmer during winters, its prime tourism season will be extended. Second, if climate change results in neighbouring regions becoming much warmer during summer, the south-west WA region will be viewed as a convenient and effective option to avoid summer heat, increasing tourism demand.

Thus the tourism industry in Western Australia's extreme south-west region is likely to experience both risks and opportunities as a result of climate change.

The resilience of the tourism sector is largely in its own hands:

- How well can the sector work internally and with other sectors to avoid the loss of attractions and the loss of quality of attractions in order to reduce the cost of adaptation and the cost of replacing tourism capital?
- How effectively can the tourism sector recognise new tourism opportunities or new features of existing attractions and communicate these to potential visitors and provide the necessary facilities to ensure a satisfying visitor experience?

The industry and its players will need to have a clear strategic oversight of climate change and agile management practices to seize potential opportunities and avoid costs and losses.

Appendix 1 Potential climate change impacts on the tourism sector in south-west Western Australia

Tourism industry and tourism market adaptation based on level of impact

South-west tourism product	Extreme CC events ¹	Gradual impacts of CC ²	Indirect impacts ³
Landscapes and biodiversity (bushwalking, scenic driving, bird watching, painting, picnics, camping).	<ul style="list-style-type: none"> Fires, storms and floods could result in a sudden and enduring loss of existing landscape values. 	<ul style="list-style-type: none"> Ongoing and incremental changes to flora and fauna could significantly change the 'natural attractiveness' of south-west WA. The 'greenness' of SW landscapes is a key appeal to many tourism visitors. Wildflower varieties and locations may reduce appeal for some visitors. Wetland systems could retreat or disappear as groundwater tables drop. 	
Beaches (white sandy stretches, coves, bays, cliffs, swimming, sun baking, surfing, fishing, diving, snorkeling)	<ul style="list-style-type: none"> Storm surges erode beaches and damage beach infrastructure. Dive wrecks may become unstable. 	<ul style="list-style-type: none"> Rising sea levels increase risks for low-lying areas, especially those located where erosion is likely or possible. Dryer and warmer climate will encourage more beach holidays Water temperature changes may alter fish types in some locations. Warmer sea temps may increase coral reefs and improve diving and snorkelling 	<ul style="list-style-type: none"> Accommodation developments will need to identify and locate on less vulnerable areas. Ocean and beach safety programs will need revision and extension.
Inland waterways (fishing, boating, canoeing, eco-cruising, etc)	<ul style="list-style-type: none"> Low / no water and floods will both result in reduced or no inland water tourism and recreation opportunities. Boat ramps, jetties, other infrastructure not available 	<ul style="list-style-type: none"> Some waterways become no longer accessible for recreation (e.g. dams and catchments exclusively used for drinking water) or fishing. Additional demand for alternative locations 	<ul style="list-style-type: none"> Region may have changed tourism product, and different visitor type requiring different information, equipment and services. Retail sales of equipment will change. Recreational displacement impact from current preferred water-based activity to land-based activity (such as long distance walk and biking trails and associated infrastructure) Increased social and environmental impacts on other water bodies as demand becomes concentrated on remaining opportunities.

South-west tourism product	Extreme CC events ¹	Gradual impacts of CC ²	Indirect impacts ³
Forests (tours, self-drive, treetop and forest floor walking trails, bike trails, recreation areas, etc)	<ul style="list-style-type: none"> • Fire and large storms may result in some locations not being accessible or as visually attractive. 	<ul style="list-style-type: none"> • Altered dieback and other effects may reduce options for visitation • Loss of significant flora and fauna attractors • Loss of visual amenity reduces attraction for accommodation variety. • Some springs are already drying up resulting in reduced amenity in the affected areas. 	<ul style="list-style-type: none"> • Reduced potential for new eco tourism product to be developed
Wineries (vineyard tours, tastings, restaurant/café, galleries, retailing, souvenirs, etc)	<ul style="list-style-type: none"> • Storms, heat waves, floods, frost and other extreme weather events can significantly reduce or in some cases entirely destroy a grape crop or vine plants. • Less product at wineries to attract visitors 	<ul style="list-style-type: none"> • Incremental changes in temperature, water availability, humidity and other climate conditions can require a corresponding change to grape varieties or new techniques in winemaking • Tourism markets not expected to change significantly. 	<ul style="list-style-type: none"> • Costs increase of oil/fuel to drive to SW may reduce some market demand • Fewer visitations to cellar doors/visitor amenities could affect tour, accommodation and meal providers and other services in the areas affected.
Underground caves (7 major caves in the SW are open to the public, 5 of which are vested in SW Tourism Associations)	<ul style="list-style-type: none"> • None identified. 	<ul style="list-style-type: none"> • Changes are already being noticed to the structure and growth of stalagmites and stalactites. Cave lake levels also dropping or disappearing, resulting in a change or loss of attraction. 	<ul style="list-style-type: none"> • Visitor facilities (such as car parks) being located further away from caves • Cave tours/access expected to decrease. • Loss of income for the tourism associations managing the caves. • Loss of employment in the industry.
Accommodation (NB 12 months lead time for peak season)	<ul style="list-style-type: none"> • Extreme weather will disrupt visitor activity and could damage or destroy structures and gardens 	<ul style="list-style-type: none"> • Drier and warmer years will directly benefit some accommodation such as caravan parks by extending the camping season • Drier and warmer years will also benefit other accommodation by extending the tourism season • Increasing temperatures will generate economic rationale and visitor expectation for energy efficient design for buildings/infrastructure 	<ul style="list-style-type: none"> • Potential image modification (less cosy fire-lit options) • Additional requirements for outdoor facilities (barbecues, balconies, sporting and recreation)
Tours, attractions per se	<ul style="list-style-type: none"> • Extreme weather conditions will generate requirements for visitor safety measures. • Network relationships between different providers in the same localities may provide alternative options at times of extreme weather. 	<ul style="list-style-type: none"> • Tour providers will need to modify their products as climate changes alter visitor options and experiences. 	<ul style="list-style-type: none"> • Hotter weather could generate greater interest in passive beach recreation in place of attractions and tours.

1 Extreme CC events (e.g. increased fires, cyclones, storm surges, floods)—that is, temporary interruptions

2 Gradual impacts of CC (e.g. temperature rises and rainfall season changes)—that is tourism product's capacity to change

3 Indirect impacts—that is, impacts on regional employment, communities and economies

Appendix 2 Current Initiatives

Tourism Ministers' Council

In August 2007 it was announced that Australia's tourism ministers had established a national Tourism and Climate Change Taskforce to fast track the development of a Tourism Action Plan on Climate Change. The taskforce includes representatives from the tourism industry, states and territories and the Australian Greenhouse Office. A National Climate Change Adaptation Framework endorsed by the Council of Australian Governments (COAG) in April identified the tourism industry among the industry sectors most vulnerable to climate change impacts. Further information can be found at the Department of Resources, Energy and Tourism website on <http://www.ret.gov.au/General/Tourism-SIT/Pages/TourismActionPlanonClimateChange.aspx>

Tourism Council Western Australia

Tourism Council Western Australia (TCWA) has developed and operated the National Tourism Accreditation Program (WA) since 1996. The current program has an environmental component which encourages tourism operators to consider how efficiencies can be made. However a national accreditation program is now being developed that will be delivered on-line and be able to propose a much stronger message of environmental management.

Further information may be found by contacting <http://www.tourismcouncilwa.com.au/site/>

Office of Climate Change (Western Australian Government)

The Western Australian Government established the Office of Climate Change (OCC) in the Department of Environment and Conservation in 2006 to provide a focus for climate change issues in Western Australia and to provide leadership for all responses to climate change. The Office of Climate Change is responsible for whole of government policy and strategy focusing on the economic, environmental and social impacts of climate change. Adaptation to unavoidable incremental and extreme climate change is a key element of the work of the OCC. Tourism WA is a member of core OCC initiatives.

On 6 May 2007, Premier Alan Carpenter released a major statement; <http://www.actnow.wa.gov.au/act-now/about/premiers-climate-change-statement.html>, which included the allocation of \$8.625 million to help businesses and communities adapt to the impacts of climate change through climate research and adaptation initiatives.

Further information may be found at the http://portal.environment.wa.gov.au/portal/page?_pageid=54,5690855&_dad=portal&_schema=PORTAL