



Office of
Environment
& Heritage

Integrated Regional Vulnerability Assessment: South East New South Wales Pilot Study

Volume 2: Priority Sector Workshops – Summary Findings

*'Identifying workable adaptation
responses to climate change'*

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Office of Environment and Heritage
59–61 Goulburn Street, Sydney
PO Box A290
Sydney South NSW 1232

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TTY: (02) 9211 4723

Email: info@environment.nsw.gov.au

Website: www.environment.nsw.gov.au

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1 Introduction

Between February and June 2010, various NSW and ACT Government agencies and local governments held eight priority sectors workshops to assess the vulnerability of South East NSW to climate change. The priority sectors were:

- human settlements
- infrastructure
- landscapes and ecosystems
- primary industries
- tourism
- water
- emergency management
- human health.

In each workshop, participants who work in each of the priority areas used a systems approach to identify key areas in which the sector may be vulnerable to climate change, in the context of current and projected regional dynamics and trends. Findings included:

- the impacts of climate change on the sector
- the flow-on impacts between sectors
- the sector's adaptive capacity to climate change
- barriers to adaptation.

In the workshops, stakeholders identified indicators of adaptive capacity under the 'five capitals' framework categories – Human, Social, Natural, Physical and Financial. This information could then be analysed to provide a measure of current adaptive capacity, and identify barriers to adaptation and the scale at which the adaptive capacity operates: local, regional or state/national.

The qualitative indicators of adaptive capacity within each sector were identified by posing the following questions:

Given what we know are the likely effects of climate change in this region, for your sector:

- *What must change to service the community and why?* (indicator)
- *What is needed to enable change?* (capacity constraints)
- *Where is change needed most/least?* (variation across region)
- *What information is available to support your choice?* (data)

The following sector summaries present the findings of these workshops.

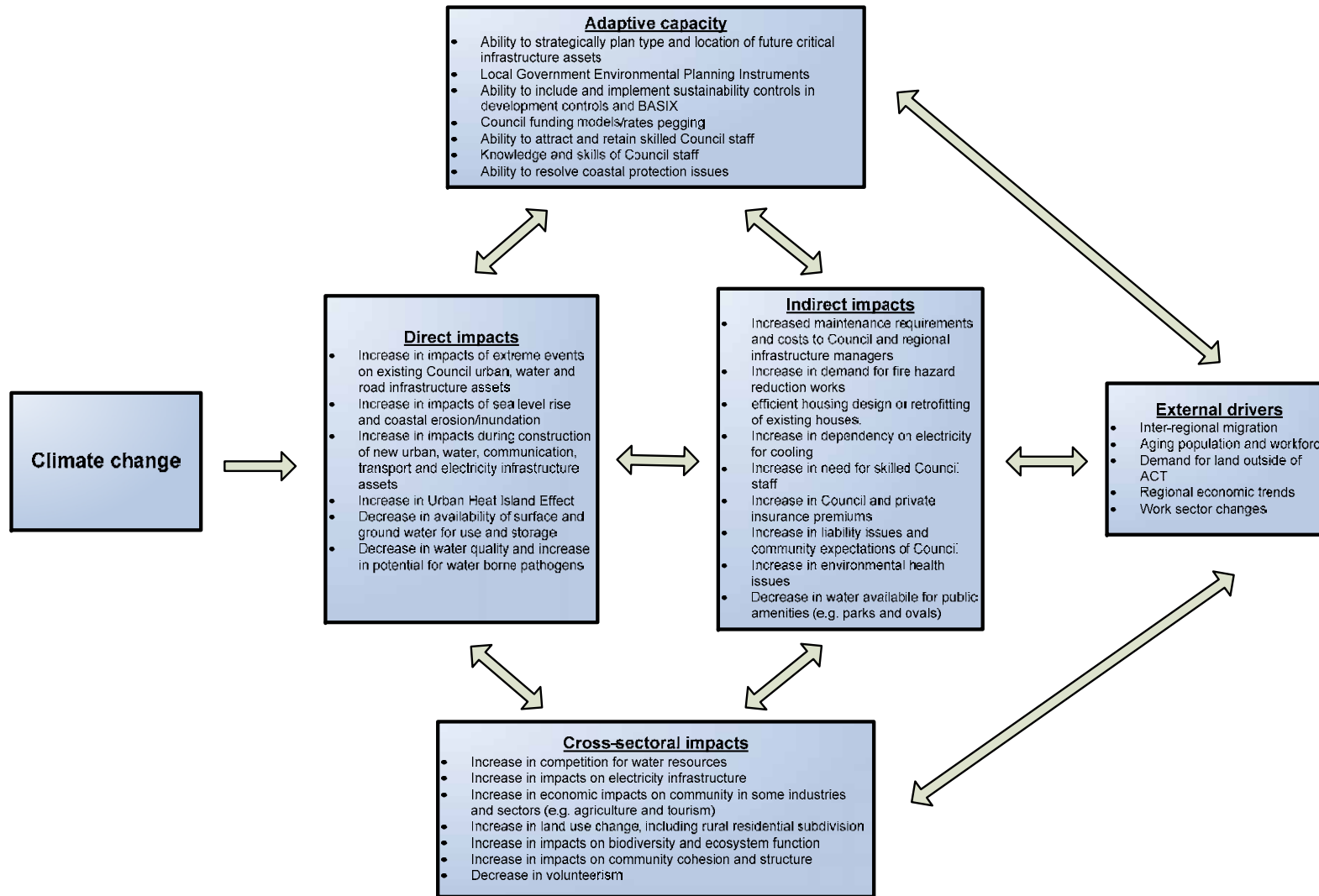


Figure 2.1: Human settlements sector vulnerability to climate change in the South East NSW region

2 Human settlements sector

2.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 2.1.

2.2 Background

The South East NSW region, as shown in Figure 2.2, incorporates the local government areas (LGAs) of:

- Bega Valley
- Bombala
- Boorowa
- Cooma–Monaro
- Eurobodalla
- Goulburn Mulwaree
- Harden
- Palerang
- Queanbeyan
- Snowy River
- Upper Lachlan
- Yass Valley
- Young.

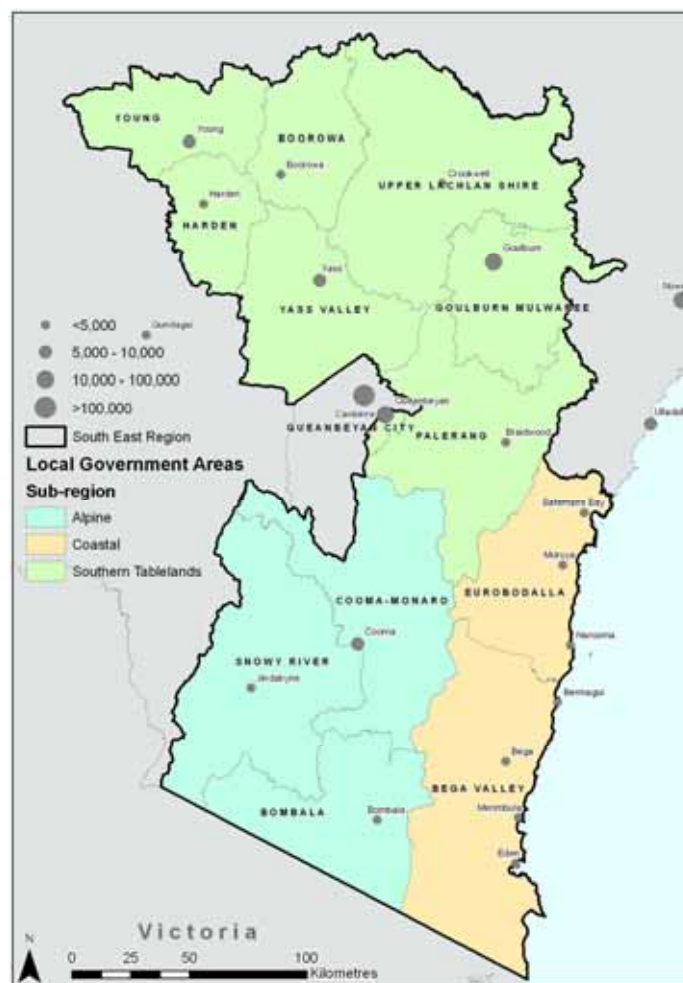


Figure 2.2: South East NSW region

The region's major regional centres are: Queanbeyan, Batemans Bay, Bega and Goulburn. Queanbeyan forms part of the larger Canberra–Queanbeyan metropolitan area. Other major centres include Cooma, Yass, Gundagai and Young. Strong relationships exist with the Illawarra, Shoalhaven and Riverina–Murray areas just outside the region.

The region's services are dominated by the ACT and depend on the availability of higher order health, education, commercial and retail functions in Canberra.

In 2011, the combined population of the region was approximately 208,000¹. Projections indicate an increase of 38% to 287,000 by 2036.² However, this increase is not uniform, as shown in Figure 2.3. Negative growth is projected in four LGAs (Bombala, Boorowa, Harden, Upper Lachlan), reflecting ageing populations.

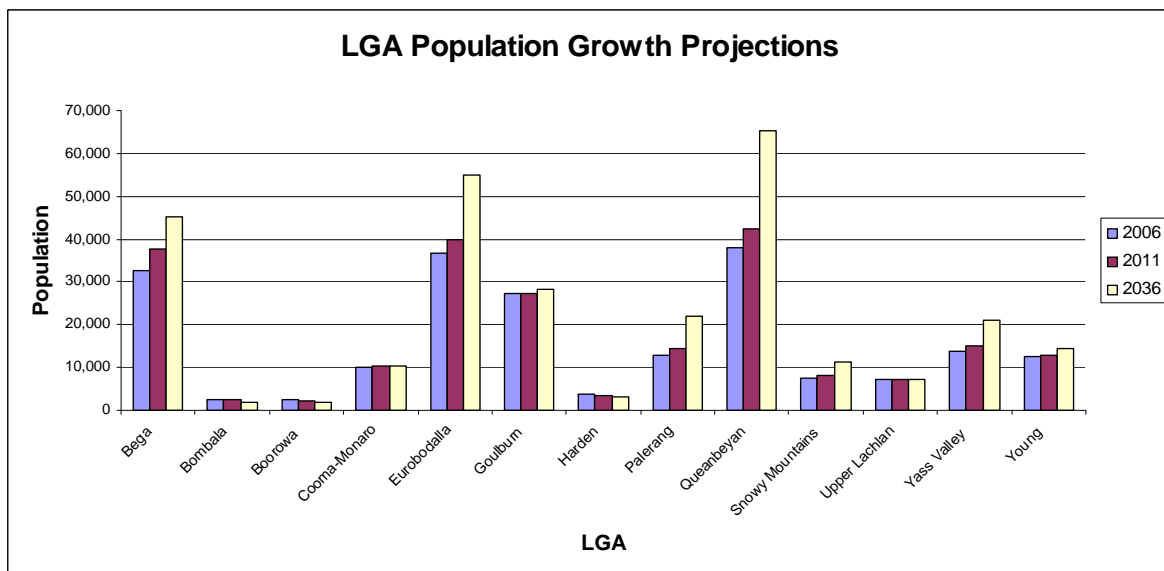


Figure 2.3: Projected population change per LGA from 2006–2036

2.3 Workshop participants

This workshop, held in Queanbeyan, NSW on 12 May 2010, was attended by representatives of the following NSW and ACT government agencies and local governments:

- NSW Department of Planning
- NSW Department of Housing
- Cooma–Monaro Shire Council
- Eurobodalla Shire Council
- Goulburn–Mulwaree Shire Council
- Harden Shire Council
- Queanbeyan City Council
- Yass Valley Council
- Young Regional Council
- NSW Department of Environment, Climate Change and Water
- ACT Planning and Land Authority
- Australian National University

Note: Some agency names have changed since the workshop.

¹ ABS 2012, *2011 Census QuickStats: All people – usual residents*, for all local government areas in the South East NSW region, Australian Bureau of Statistics, Canberra, viewed July 2012, www.abs.gov.au/websitedbs/censushome.nsf/home/quickstats?opendocument&navpos=220.

² Department of Planning 2008, *New South Wales State and Regional Population Projections, 2006–2036: 2008 release*, Department of Planning, Sydney.

2.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the human settlements sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Human settlements sector – key impacts

- Increasing impacts on infrastructure increasing maintenance costs and impacting on all other sectors that depend on them
- Increasing rural residential development exacerbating impacts on all other sectors
- Increasing impacts on the economy and community due to impacts on agriculture, infrastructure and tourism in light of existing economic and demographic change in the region
- Decreasing town water security and increase in potential water quality risks

2.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the human settlements sector. The discussion is summarised in Table 2.1.

Table 2.1: Summary of workshop findings about the adaptive capacity of the human settlements sector

Capital	Indicators of adaptive capacity	Findings
Human	Regional migration	The South East NSW region generally has lower income and higher unemployment than the NSW average. Inland LGAs (e.g. Harden) are finding it increasingly difficult to attract qualified planners/engineers without paying a substantial premium. The capacity of regional councils to pay such premiums for professional staff is being eroded by an ageing population, exacerbated by young people migrating from inland areas to the cities, constraining the rates base due to rebates.
Human	Community knowledge	The South East NSW region is demographically diverse. LGAs neighbouring the ACT have a higher density of skilled people compared with other parts of the region. Some locations within the region also have a higher skills-base than others.
Human	Councillor knowledge	Local government officials may not necessarily have the skills, values or knowledge necessary to understand complex issues such as climate change. In addition, as councillors live in the communities they represent, they are sensitive about making unpopular decisions. While education can help, for example bringing guest speakers on sea level rise to coastal areas, this knowledge is lost when new councillors are elected.
Social	Landholder rights	Existing property rights are likely to impede or limit climate change adaptation. For example, landholders on properties newly subdivided for 'lifestyle blocks' are granted stock and domestic water rights, while local government has restricted water supply. Establishing new stock and domestic bores may reduce resource availability to larger-scale primary production enterprises, particularly in a changing climate. The potential increase in coastal erosion and inundation from rising sea levels may impact on coastal properties, which may result in demand for protection. Foreign ownership of productive agricultural land could threaten regional food security, which is likely to be heavily impacted by rainfall changes under climate change.

Capital	Indicators of adaptive capacity	Findings
Social	Community cohesion	<p>In some areas, declining community cohesion may impede local collective action and stakeholder engagement to address climate change. In predominantly rural areas, such as Harden–Murrumbateman, Young and Goulburn, workshop participants felt the decline of agriculture had been mirrored by a general decline in social cohesion and increasing community apathy. This is often evidenced by a loss of community services, such as sporting clubs. In Yass, the decline was seen to be driven by a growing percentage of the population living in the community but commuting to Canberra for work, shopping and recreation, and becoming less interested in local community issues. In contrast, coastal areas such as Eurobodalla have a large membership base for clubs and high levels of volunteerism, reflecting relatively high levels of social capital.</p>
Social	Regional policy focus	<p>A focus on regional policy and the encouragement of community debate on regional issues will be critical to promoting action on climate change. Central to this is maintaining support for the South East Regional Organisation of Councils (SEROG), which is currently in its infancy. Developing SEROG would provide greater regional interaction, inclusion and collaboration and provide a mechanism for regional engagement with the NSW Government.</p> <p>Some councils believe there is potential for Catchment Management Authorities (CMAs), to work more closely with local government. This is especially important now that NRM funding is being rationalised, and given the likely impact of climate change on the NRM sector and its flow-on effects to regional economic sustainability.</p> <p>Eurobodalla Shire Council reported a good working relationship with Southern Rivers CMA, which could provide a model for other council–CMA relationships.</p>
Natural	Food security	<p>Uncertainty about food security is a global issue with consequences at the regional scale. Since agriculture is fundamental to local economies, its protection is critical to securing future food supplies and sustaining local economies. Yet, in some traditionally productive areas, there is increasing demand to use land for alternative land uses (such as mining and coal seam gas production).</p> <p>Productive agricultural land can also be lost when ‘greenfield sites’ are released for urban and rural residential development, particularly on the coast or close to existing urban centres. This increases pressure for agricultural production to take place on land of lesser capability.</p> <p>There is support for locally grown and consumed food, as evidenced by raised consumer awareness of concepts such as food miles.</p>

Capital	Indicators of adaptive capacity	Findings
Natural	Water policy	Water for Harden–Murrumburrah municipal supply comes from the neighbouring Murrumbidgee catchment, but accounts for less than 2% of total extractions. As municipal extraction is proportionally relatively small, investment in retrofitting houses for water efficiency may need to become part of a wider approach to cost effectively managing declining water availability across the catchment.
Natural	Landscape amenity	Policy to reduce greenhouse gases will likely bring increased demand for renewable energy sources. However, community views on wind farms vary between LGAs. Some believe installing wind turbines results in a loss of amenity. Others are supportive, recognising the benefits to the landholders, often farmers, who lease land to increase their income diversity and business viability.
Physical	Style of housing and development	The demand for rural residential properties in the region is growing, as more people seek ‘lifestyle’ properties on the coastal sub-region and rural residential properties within commuting distance of Canberra. ACT planning policies restrict rural residential subdivision, which places additional demand for this type of housing on adjacent NSW local government areas. These developments tend to accommodate large standard housing models, which may be more difficult to retrofit when adaptation is required. Recent urban developments such as Gungahlin have made limited provision for areas of open green space and trees, increasing the urban heat island effect.
Physical	Infrastructure maintenance	Local governments are currently struggling to maintain public infrastructure such as the extensive local road networks and storm water systems. Councils are adapting to the funding shortfall by reducing the frequency of infrastructure servicing, such as regrading unsealed roads. Local governments fear that if climate change results in more frequent and intense rainfall, the need for resurfacing unsealed roads will increase, further widening the gap between the funding available and the cost of routine infrastructure maintenance.
Financial	Regional economic sustainability	The likely impact of climate change on the sustainability and profitability of agricultural industries poses a significant risk to many inland communities. For example, the important regional town of Young may suffer irreversible economic damage if climate change reduces fruit production. Maintaining regional towns will require both adaptation support in primary industries and expanding the regional economic base.

Capital	Indicators of adaptive capacity	Findings
Financial	Local government funding model	<p>The local government funding model may be a barrier to adaptation.</p> <p>The funding base for local government is currently restricted by rate pegging and rate rebates for the over 65s. Many regional councils have a small population spread over large areas of land, requiring high expenditure per capita to maintain services.</p> <p>The NSW Government also levies property owners through land tax; councils felt there was potential for this revenue to be used to address some of these regional issues.</p> <p>Options considered, but rejected as unfeasible included:</p> <ul style="list-style-type: none"> • amalgamating poorly funded councils • increasing population in LGAs – rejected due to the cost of additional infrastructure (e.g. water supply, sewage treatment works, and roads) to service the enlarged population.
Financial	Depreciation and free value schedule	<p>The choice of indicator or criteria for allocating funding to local government level was seen as a critical issue. For example, allocating funding for local government infrastructure maintenance or replacement on the basis of depreciation value (rather than for replacement cost) of already heavily run down assets, would severely under fund council activities, particularly as climate change is likely to increase maintenance needs (e.g. unsealed roads).</p> <p>Standard indicators for all councils (e.g. for asset management) have been suggested to facilitate effective adaptation³</p>

³ Allen Consulting Group 2005, *Climate Change Risk and Vulnerability: promoting an efficient adaptation response in Australia*, report to the Australian Greenhouse Office, Department of the Environment and Heritage, Canberra.

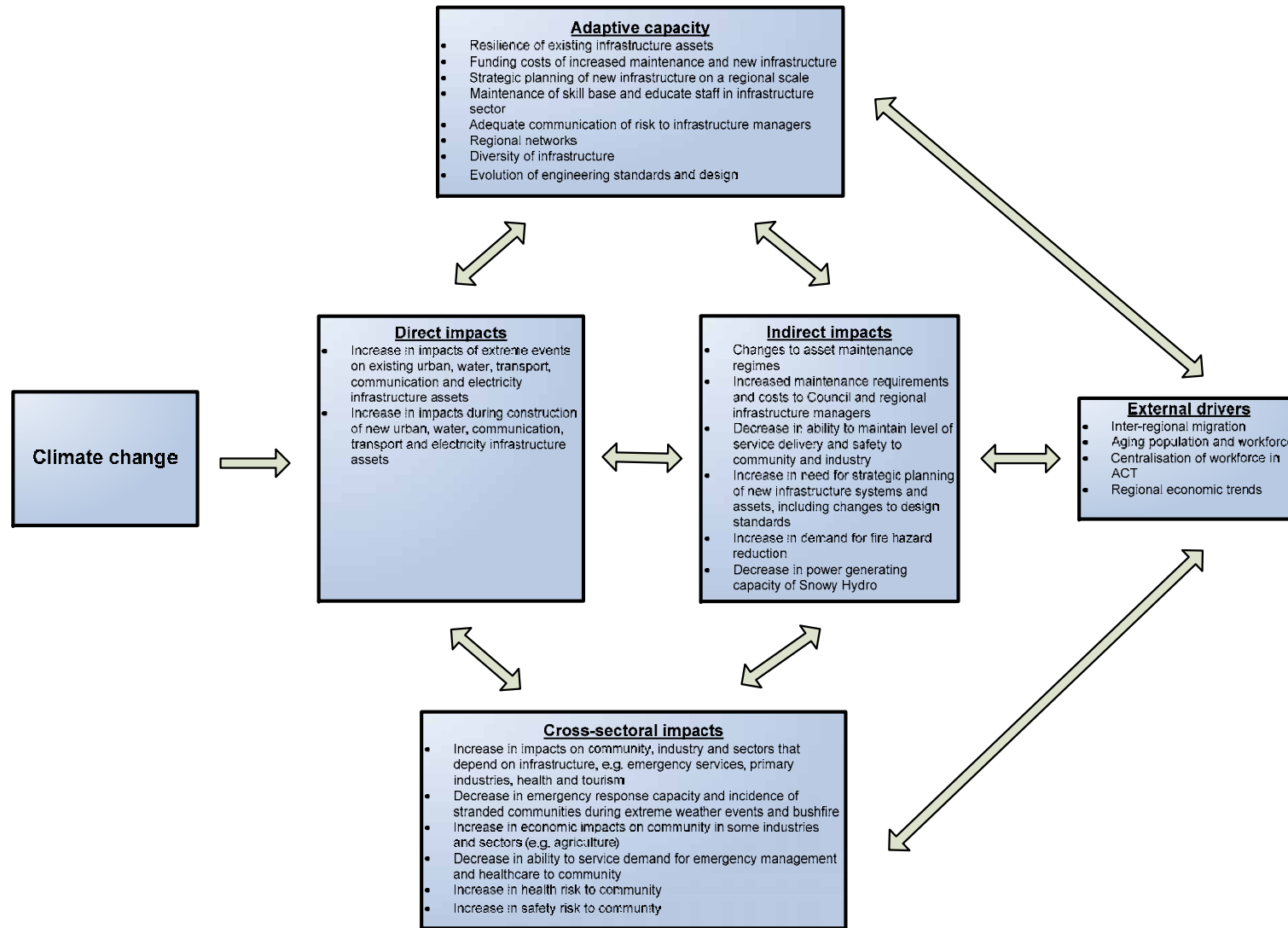


Figure 3.1: Infrastructure sector vulnerability to climate change in the South East NSW region

3 Infrastructure sector

3.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 3.1.

3.2 Background

The South East NSW region has a great diversity of infrastructure assets, including: transport, energy, communication, ports and water infrastructure. The major infrastructure of the region is shown in Figure 3.2.

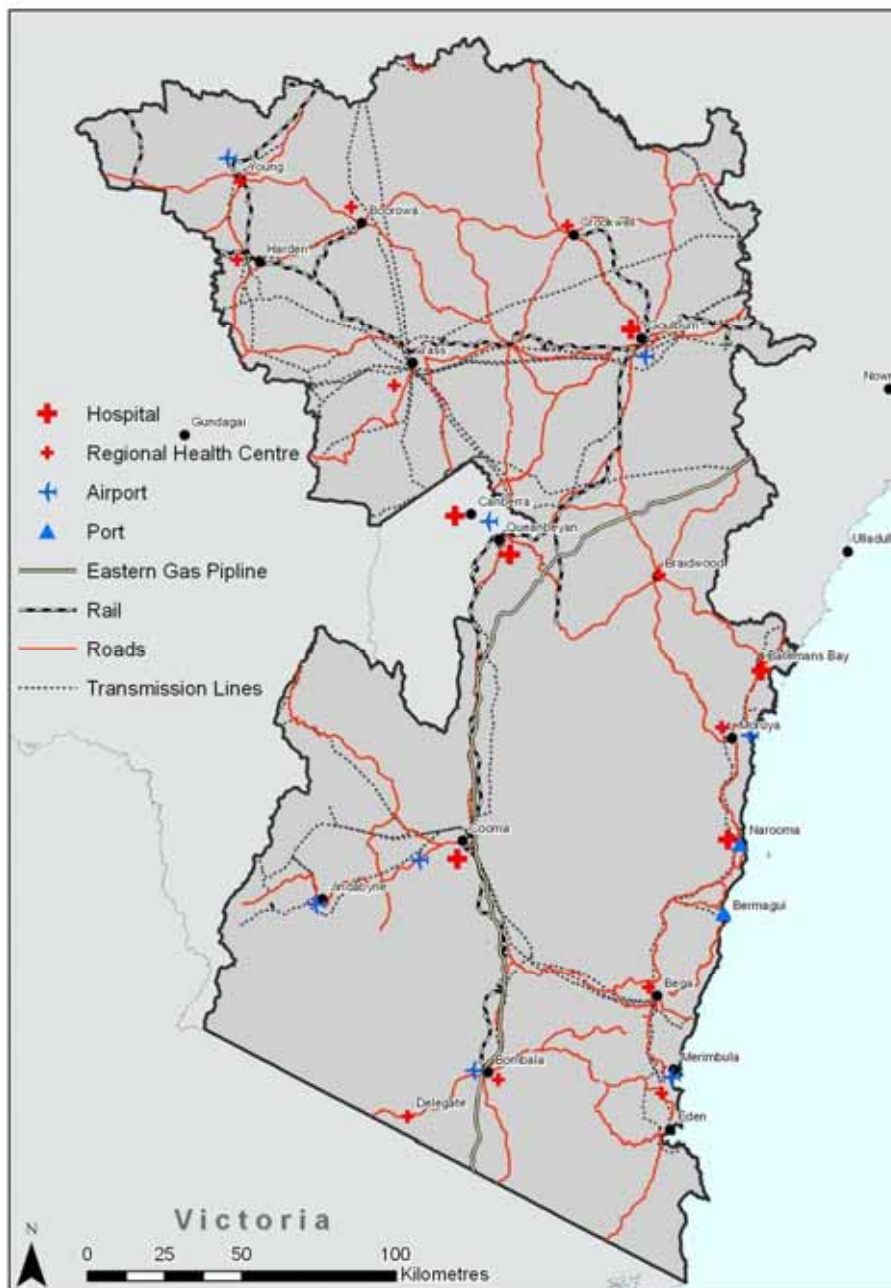


Figure 3.2: Major infrastructure of the South East NSW region

Other significant infrastructure of the region includes:

Transport

- Numerous highways maintained by the NSW Roads and Traffic Authority, including the Princess Highway between Sydney and the coastal sub-region, and the Hume and Federal highways between Sydney and Canberra, and the Kings Highway linking Canberra to the coastal sub-region.
- The Main Southern Railway Line from Sydney to Melbourne traverses part of the region and is maintained by Australian Rail Track Corporation. A spur line runs through Bungendore and Queanbeyan prior to termination in Canberra.
- The region is well serviced by airports catering to light aircraft (including Cootamundra, Young, Goulburn, Tumut, Merimbula, Moruya and Snowy Mountains) and Canberra airport provides commercial flights to the state capitals and international destinations.

Water

- There are 15 water storages in the region; three dams are used for regulating the river flows for extractors: Brogo, Burrinjuck and Wyangala.
- LGAs have considerable urban water infrastructure maintained by councils sourcing a mixture of regulated river supply, unregulated surface water, and groundwater.

Energy

- The Snowy Mountain Hydroelectric Scheme and associated infrastructure is located in the Alpine sub-region.
- Extensive electricity distribution network managed by Transgrid.
- Extensive electricity transmission network managed by Origin/Country Energy.
- The Eastern Gas Pipeline maintained by Jemena.
- The region has potential to be a centre for wind power generation, with a number of wind farms already established, including at Gunning and Crookwell.

Telecommunication

- Both fixed and mobile telecommunication infrastructure managed by Telstra.

3.3 Workshop participants

Held in Queanbeyan, NSW on 24 March 2010, the workshop was attended by representatives of the following NSW and ACT government agencies, and local governments:

- | | |
|--|---|
| • NSW Roads and Traffic Authority | • Yass Valley Council |
| • Country Energy | • Young Regional Council |
| • Commonwealth Attorney-General's Department | • Snowy River Shire Council |
| • ACT Chief Minister's Department | • Cooma–Monaro Shire Council |
| • Australian National University | • NSW Department of Environment, Climate Change and Water |
| • ACT Department of Territory and Municipal Services | |

Note: Some agency names have changed since the workshop.

3.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the infrastructure sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Infrastructure sector – key impacts

- Increasing impacts on infrastructure increasing maintenance costs and impacting on all other sectors that depend on it
- Increasing natural hazards leading to damage to roads and impacts on tourism in the region, which depends on the ability of people to travel from major population centres in Sydney and Melbourne, primarily by private transport, to and between regional tourism locations
- Increasing natural hazards causing impacts on infrastructure, resulting in an increased requirement for emergency response and healthcare services
- Damage to road infrastructure, increasing safety risks to the community

3.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the infrastructure sector. The discussion is summarised in Table 3.1.

Table 3.1: Summary of workshop findings about the adaptive capacity of the infrastructure sector

Capital	Indicators of adaptive capacity	Findings
Human	Recruitment of staff	Recruiting both professional and technical staff is difficult because of the nature of the work and remuneration offered. Recruitment difficulties will constrain the sector's ability to maintain and upgrade existing infrastructure in the future. Other sectors, such as the mining and private sectors, are able to pay more and compete strongly for staff. Infrastructure maintenance jobs are not seen as being attractive in the current job market and often those willing to do the jobs have insufficient training in maths and physics. This indicates that the secondary school curriculum may not be producing students with an appropriate knowledge or skills.
Human	Age of workforce	<p>An ageing workforce is a major constraint to maintaining energy, roads and council infrastructure. For example, staff operating RTA road maintenance machinery are nearing retirement and potential replacement operators are able to obtain better pay elsewhere. Older Snowy Mountains Scheme workers have been maintaining roads in the region for 40–50 years and these workers will soon be lost through retirements. Currently, the average age of Country Energy technical staff is 58.</p> <p>Retraining ageing workers can be difficult. In response, Country Energy has scaled up its intake of apprentices, who are now accepted twice a year. However, it takes 18 months before apprentices are sufficiently skilled to work on infrastructure. In addition, there is a cultural divide: older workers with experience but limited computer skills compete for positions with apprentices who have computer skills but no experience.</p> <p>The nature of the work in the infrastructure sector has changed and is now far more administrative. For example, in energy, new smart meters can be read remotely and the nature of maintenance is likely to continue to change as remote monitoring becomes more common. Moreover, councils report that even if they could find skilled staff, they don't have the funds to put people on.</p>
Social	Regional local government organisations and networks	<p>The benefits of networking do not always seem to flow down through local government administrative hierarchies.</p> <p>Continued support for regional organisations, such as the Regional Managers' Forum and ROCs (Regional Organisations of Councils) could help ensure the effectiveness of these networks for cooperation and information sharing across the region</p> <p>Introducing direct climate change communication to councillors (rather than to council employees) could also improve action on adaptation.</p>

Capital	Indicators of adaptive capacity	Findings
Social	Links to local government	<p>Regional energy and road infrastructure providers are well connected to local government, providing opportunities for planning regional infrastructure maintenance and sharing information. For example, good connections exist between the RTA and local government, facilitating maintenance agreements where council undertakes local road works under contract to RTA. Similarly, Country Energy works with councils to advise consumers on how to save money and energy, because the community is more likely to hear messages that come from a trusted local source. Country Energy also supports a regional advisory group and is working with local government in the Bega Shire on the Smart Metering Pilot Project.</p> <p>For other infrastructure, links tend to be by agreement rather than through formal arrangements.</p>
Social	Proximity to Canberra	<p>The region will benefit from its proximity to Canberra, which is being established as an R&D centre for intelligent energy networks. As the administrative centre for the federal government, Canberra also provides opportunities for social services and networking that are not available in other regions of NSW. These connections could be viewed as a driver of adaptation to climate change.</p>
Natural	Landscape amenity	<p>Underground energy infrastructure may become more cost-effective as climate change increases the severity or frequency of extreme weather events. Currently, infrastructure is being placed underground in greenfield developments as a result of community demands for improved landscape amenity in residential areas. This is 6–7 times more expensive to build per kilometre, but reduces the cost of maintenance over the life of the structures. Costs of retrofitting underground lines are considerably higher at brownfield sites than greenfield sites.</p>
Natural	Diversity of infrastructure	<p>The mix of environments and landscapes in the South East NSW region requires a diversity of infrastructure. The region encompasses a long coastline with roads and bridges required to span rivers and estuaries, snow in the Alpine sub-region and steep escarpments along the eastern edge of the Southern Tablelands.</p> <p>Managing regional infrastructure in these environments will need to adapt to a range of climate impacts across the region and may not always be negative. For example, less snow will likely make road maintenance easier, although the change may negatively impact alpine tourism, water security and water for irrigation.</p>

Capital	Indicators of adaptive capacity	Findings
Physical	Evolution of engineering standards	<p>While climate change is adding to the load existing structures are designed to bear, existing materials science and engineering standards are allowing safety margins to be incorporated into infrastructure, making it resilient to climatic extremes.</p> <p>However, this tolerance to climate varies between types of infrastructure. Energy infrastructure is highly resilient; whereas, for roads, construction and maintenance is seen as less resilient. Engineering standards in road construction may need to be reviewed to reflect changes in climate. For example, new rainfall and runoff coefficients for Australia will change road drainage design to improve performance and service life.</p>
Physical	Maintain and upgrade policy	<p>Country Energy's strategy for infrastructure replacement was previously 'replace with like'. The company has now adopted a 'replace with updated technology' strategy. This involves adding communications and smart technology (such as in-built data collectors) to improve monitoring and scheduling of infrastructure maintenance.</p> <p>This strategy supports climate change adaptation because it improves understanding of the impacts of climate change on infrastructure.</p>
Financial	Energy sector funding priorities	<p>Financial drivers of the energy business often mean that the worst performing 'feeders' do not attract most funding for maintenance and upgrading. Funding generally gravitates to feeders with the greatest number of people. This may impact negatively on the reliability of underperforming feeders in the region under extreme climatic events.</p>
Financial	Smart metering	<p>The Commonwealth's mandate to install and maintain 'smart metering' has accelerated the implementation of this technology. These meters show consumers the link between behaviour (energy consumption) and financial drivers (household energy costs), which is not currently supported by monthly energy billing.</p> <p>This initiative is being piloted in the Bega Shire of the South East NSW region as a major strategy to encourage household level adaptation to climate change. However, the sector may not recoup the costs of installation, especially in older houses with cotton sheath wiring.</p> <p>The industry currently operates on a five-yearly planning cycle for funding. However, the costs associated with smart metering are out of sync with this planning cycle and have not been accounted for in forward budgeting.</p>

Capital	Indicators of adaptive capacity	Findings
Financial	Local government funding model	<p>Local government is funded from two sources: rates and federal government grants. The local government rate base depends on industries such as tourism and primary production, which are reliant on natural resources. As these industries are highly vulnerable to climate change, local government rates may also be exposed.</p> <p>Moreover, the Independent Pricing and Regulatory Tribunal (IPART) estimated that government fees and charges should rise by 4.4% to keep pace with the CPI, but council rates are pegged and last rose by 2.8%. This funding shortfall may hamper local government's ability to respond to climate change.</p> <p>Although Australia is a wealthy nation, communities appear to be increasingly reluctant to apportion their wealth to maintain essential community infrastructure through council works programs, eroding the ability of regional communities to cope with climate change.</p> <p>To build regional resilience, the federal government through the Grants Commission should examine funding regions on the basis of climate change needs, to promote adaptation.</p> <p>Local government asset management plans should include an assessment of infrastructure adaptation needs.</p>

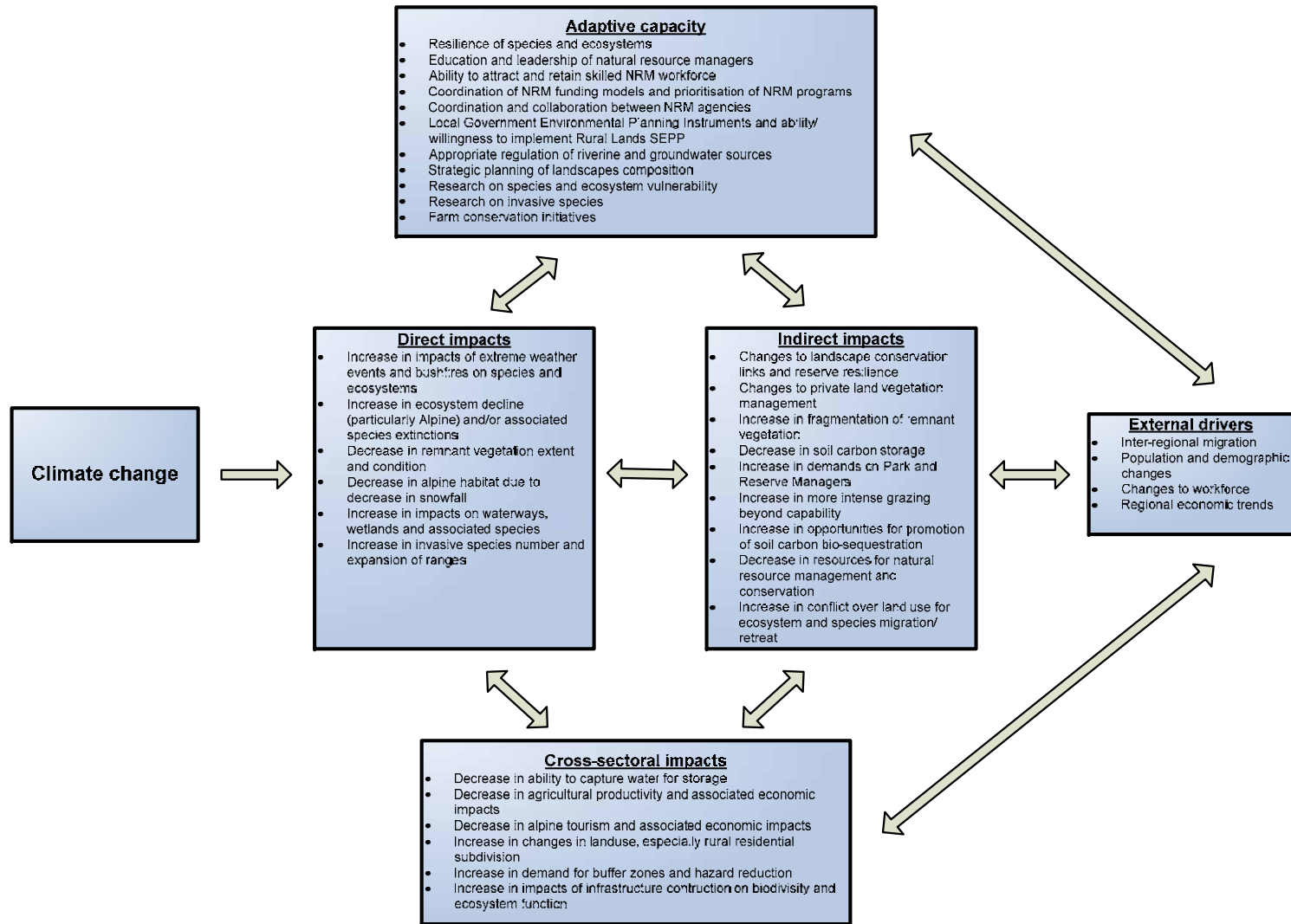


Figure 4.1: Landscapes and ecosystems sector vulnerability to climate change in the South East NSW region

4 Landscapes and ecosystems sector

4.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 4.1.

4.2 Background

Southern Tablelands sub-region

Pre-European settlement, the Southern Tablelands had a mosaic of dry forests, grassy woodlands and grassy plains. Large areas of the Monaro were occupied by native grasslands on upland basalt downs. Western sections of the region are part of the South-western Slopes, which is an extensive undulating landscape formerly occupied by box-gum woodlands on gentle slopes and flats, and dry forests on steeper, stony hills. While dry forest remnants still occupy many of the low ranges in the Southern Tablelands and South-western Slopes, agriculture (grazing) largely occupies land once covered with grassy woodlands and grasslands, such that few remnants are now retained in good condition. A relatively small proportion of the Southern Tablelands' vegetation and landscapes are protected within the state's reserve system. Most nature reserves on the Southern Tablelands protect the widespread dry forest systems, and only a tiny proportion of the region's formerly extensive grasslands and grassy woodlands are now in reserves.

Cropping is a minor land use, particularly on the South-western Slopes, but also in the Goulburn district and along the Murrumbidgee River valley. Other significant, though less extensive, land-use changes include pine plantations, vineyards (Yass, Murrumbateman and Bungendore) and olive plantations.

Coastal sub-region

Pre-European settlement, the southern coastal foothills largely supported dry sclerophyll forest. Smaller patches of heath were interspersed among the dry forests. In the north, the coastal foothills often supported wet sclerophyll forest. The escarpment supports a mosaic of dry and wet forest due to factors such as soil type and aspect. Rainforest occurred in small patches in most sheltered locations along the escarpment. Montane heaths and swamps occurred in localised patches along the escarpment. Grassy Woodlands were once extensive in valleys of the coastal plain. Forested wetlands were present along the major rivers and saline wetlands were present in most of the estuaries.

Clearing for agriculture is mainly restricted to more fertile soils along the coastal plain and foothills, formerly occupied by grassy woodlands and wetlands. Large areas of forest remain, though much of this is in state forests, which support logging for sawlogs and woodchips. Many of the forests and heathlands in the escarpment and ranges in the coastal sub-region are in conservation reserves; many of the forests had previously been logged within former state forests. Threats to ecosystems include weed invasions (bitou-bush is a major problem in coastal communities) and continuing clearing for infrastructure, urban and rural residential developments.

Alpine sub-region

Treeless plains, primarily frost hollow environments of cold air drainage, cover a significant portion of the sub-alpine and montane zones. The sub-alpine zone is dominated by snow gum woodlands, interspersed with treeless valleys where frost settles in winter. Below the snow gum woodlands, in the montane zone, tall forests of a variety of eucalypt species are found. Almost all the sub-alpine woodland in NSW occurs in this region.

Most of the flora and fauna of the alpine zone is endemic. Several vegetation communities, such as snowpatch vegetation, occur nowhere else in NSW. Other communities that occur more widely in NSW, such as montane peatlands, find their most extensive development in the alpine sub-region. There are fewer vegetation communities endemic to the alpine sub-region in the montane zone, but an important unique community is alpine ash. This species occupies about 110,000 ha in this region.

For over a century prior to reservation as the Kosciuszko National Park in 1967, the area was used by graziers for summer feed. By the 1950s, significant degradation had occurred, attributable to the long history of grazing. Over the following decades, in response to concerns over the impact of grazing on the vegetation and soils, the snow leases were withdrawn by government.

The only development in the alpine zone occurs in the higher parts of the Thredbo and Perisher-Blue ski resorts. On the margin of the national parks, on private property, sub-alpine woodlands, montane forests, and grasslands occur.

4.3 Workshop participants

Held in Queanbeyan, NSW on 4 May 2010, the workshop was attended by representatives of the following NSW and ACT government agencies and local governments:

- NSW Department of Environment, Climate Change and Water
- NSW Office of Water
- Hawkesbury–Nepean Catchment Management Authority
- Lachlan Catchment Management Authority
- Southern Rivers Catchment Management Authority
- Murrumbidgee Catchment Management Authority
- Bega Valley Shire Council
- Eurobodalla Shire Council
- Goulburn–Mulwaree Council
- Palerang Council
- Yass Valley Council
- ACT Department of Environment, Climate Change, Energy and Water
- Australian National University

Note: Some agency names have changed since the workshop.

4.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the landscapes and ecosystems sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Landscapes and ecosystems sector – key impacts

- Increasing impacts on terrestrial species, and ecosystems already at risk due to a range of threatening processes will be increasingly vulnerable due to climate change impacts, particularly in the Alpine sub-region.
- Increasing impacts from land-use change and more intensive agriculture.
- Increasing economic pressures on agricultural productivity impacting on uptake of conservation initiatives and land management practices.
- Decreasing availability of water in the landscape for allocation to the environment and associated impacts from changes to floodplains and groundwater systems.
- Changes to pasture species and growth affecting ground cover and grazing intensity.
- Increased frequency and severity of droughts and fires, and pressure for increased hazard reduction burns.
- Increased risk from existing and new weed species and a range of pests and diseases.
- Increased pressure and stress on remnant native vegetation, exacerbating existing impacts from fragmentation and other threats.
- Impacts on coastal ecosystems, including dunes, from coastal erosion.
- Impacts on fisheries, sea grasses, saltmarshes, mangroves and other sensitive ecosystems in estuarine/marine environments from sea level rise.
- Various impacts on riverine and estuarine ecology associated with upstream impacts

4.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the landscapes and ecosystems sector. The discussion is summarised in Table 4.1.

Table 4.1: Summary of workshop findings about the adaptive capacity of the landscapes and ecosystems sector

Capital	Indicators of adaptive capacity	Findings
Human	Environmental education	<p>Environmental education currently attracts considerable government resources; participants identified that adaptive capacity could be improved through focus on two main target groups:</p> <ol style="list-style-type: none"> 1. Educating the broader community to ensure the interrelationship between current lifestyles, climate change and NRM are understood. It was felt that children in particular are increasingly disconnected from the natural environment. 2. Educating natural resource managers about more sustainable land management practices across multiple tenures. Initiatives such as Conservation Management Networks, Kosciuszko to Coast and Prograze (sustainable grazing management) courses require continued support in the short term. In the longer term, priorities include: ensuring land managers understand climate change adaptation and developing a skill set to promote adaptation and transition in response to projected climate change. Also, while information to design better systems is currently available, transition pathways are yet to be mapped out.
Human	Community leaders	<p>Skills in leadership among natural resource managers, and the community generally, are central to promoting sustainability and adaptation to future climate change. Southern Rivers CMA has attempted to address this need by offering leadership training in the region. However, the difficulty has been in finding practical ways to support the leadership aspirations of those who completed the training and to allow time for leaders to develop.</p> <p>Different problems are faced by the sub-regions in developing potential leaders. In the Monaro area of the alpine sub-region for example, the economics of marginal primary production systems, coupled with persistent drought, mean that land managers are constrained and must focus foremost on profitability. In contrast, sectors of the community in the coastal sub-region are often passionate about high profile causes (e.g. conservation of the koala) but lack the interest to deal with more complex regional NRM issues. Also, vocal 'climate change sceptics' in local government and the broader community may discourage leadership on these issues.</p>
Human	Skilled workforce	<p>Actions to build the capacity of the NRM workforce currently concentrate on providing information and knowledge-building. However, the region is more constrained by the lack of workforce numbers. Local government finds it difficult to attract people to work in the NRM sector, in the face of a steadily growing need for skilled people in council. Instead, the Catchment Management Authorities (CMAs) and NSW environment agencies are relied upon for NRM information, assistance and expertise. Increasing the NRM workforce could boost regional adaptation of landscapes and ecosystems to climate change.</p>

Capital	Indicators of adaptive capacity	Findings
Social	Frameworks to promote social capital	<p>Although 'bottom-up' participatory processes lead to better adoption and community ownership of outcomes, building social capital is not a one-off process and it requires continued long-term support and maintenance to function effectively. However, CMAs noted the difficulty in ensuring that the federal government continues funding capacity-building programs in the long term, and there is a general trend for funding to be allocated on a year by year basis, making it challenging to develop ongoing programs.</p> <p>The region's three distinct sub-regions – coastal, Southern Tablelands, and alpine – differ significantly in community resilience. For example, small coastal villages have better established community networks, making them more resilient, compared with larger and wealthier coastal towns, where communities are more reliant on the provision of government services. However, the demographic changes taking place in coastal villages (i.e. ageing population) could reduce this self-reliance in the future.</p>
Social	Communication between institutions	<p>NSW state agencies, CMAs and local government need to better coordinate their efforts and resources to increase regional adaptive capacity. For example, using catchment action plans and native vegetation mapping to assist in developing their local environment plans.</p> <p>Some councils are not capable of engaging with other organisations on NRM issues due to resource restrictions. Despite this, organisations such as ROCs (although their success varied with location) have begun to emerge to fill communication gaps. The fact that the ACT and NSW governments were participating in the South East NSW IRVA is positive and likely to enhance resources available for adaptation. A good example of where government, non-government and community groups are cooperating is in such landscape projects as Kosciuszko to Coast.</p>
Social	Elected councillors	<p>Intransigence of some elected councillors is a barrier to adaptation. Traditionally, councils in regional areas include elected representatives with vested interests in the landscapes and ecosystems sector, such as developers, farmers and environmentalists.</p> <p>Environmentalists are generally supportive of action on climate change, and some industries recognise that climate change presents a real problem for local government. Private companies, in particular, are increasingly open to discussion about climate change, in contrast to elected representatives. For example, the real estate industry, which is currently adjusting to property valuation methods that incorporate climate change, is becoming more responsive.</p>

Capital	Indicators of adaptive capacity	Findings
Natural	Maintenance of existing investment	The South East NSW region attracts significant public investment in nature conservation. However, this is concentrated on the coastal sub-region and has not been matched in the Southern Tablelands. Although it is relatively easy to create conservation areas, the issue is maintaining them. Climate change may make it hard to maintain even past public investment. This raises questions about the resources to manage existing and additional areas.
Natural	Water availability	While climate change is expected to impact on catchment hydrology, the current and future growth of users extracting water from river systems is likely to have an even greater influence on water availability. Changes to harvestable rights cause downstream flow-on effects, irrespective of the reasons for the change. Demand for water from large urban communities will have priority, making it difficult to integrate environmental flows into water planning.
Natural	Shift in primary production	Climate change may adversely impact the biophysical and economic drivers of primary production, meaning that some areas will become more marginal and even unproductive. This may be exacerbated by the increase in rural subdivision. The way former agricultural land is managed can impact significantly on biodiversity. For example, subdividing farm land may improve its biodiversity value as new owners rehabilitate their land to enhance biodiversity values. However, this does not necessarily lead to permanent improvement, as lifestyle properties tend to be resold within 15 years and subsequent owners may remove conservation measures.
Natural	Weeds	Research into weed ecology, in particular population dynamics under climate change, is critical to adaptation in natural landscapes. Issues to research include identifying 'sleeper' species within regional ecosystems, which may be favoured by changes in climate and emerge as serious weed threats.
Natural	Landscape composition	Climate change may significantly alter natural landscapes and ecosystems, including snow-dependent alpine communities. Local government needs to consider the appropriate composition of the landscape to ensure resilience and protect environmental assets with the greatest chance of conservation. Models using landscape configuration and habitat matrices (such as those formulated by CSIRO) may support effective conservation in the face of landscape change.

Capital	Indicators of adaptive capacity	Findings
Physical	Public transport corridors	Constructing new forms of public transport infrastructure such as a Very Fast Train (VFT), particularly along the Sydney–Canberra–Melbourne corridor, may be an adaptation response to higher fossil fuel prices. However, the VFT may have implications for areas of remnant vegetation along its route.
Physical	Future functionality of infrastructure	Infrastructure has had considerable impacts on biodiversity. Coastal protection measures need to be carefully considered, as they may limit the capacity of coastal ecosystems to adapt.
Physical	Low fragmentation rural settlement	Developing new human settlements in rural areas could consider fragmentation of vegetation and reduce impacts on natural landscape function to ensure the resilience of surrounding areas. This is particularly critical because of the increased risk of bushfire under climate change, and the subsequent increased demand for hazard reduction burning and asset protection zones, which both impact biodiversity.
Physical	Rural fencing	The configuration of rural fencing is important to conserve remnant vegetation and biodiversity corridors on farms and to improve stock management.
Financial	Funding models	New funding models could assist in building the adaptive capacity of biodiversity and ecosystems. New approaches could be explored including establishing a ‘carbon bank’ to offset electricity generation or making greater use of philanthropic funds or establishing a lottery to fund landscape restoration.
Financial	NRM investment tools	The Kosciuszko to Coast project is an example of an effective stakeholder partnership involving improved communication, less duplication of effort and inter-agency and inter-group competition, break down of silos, improved landscape investment focus, and a redirection of current funding for mutual benefit. Tools are required to cover a whole spectrum of NRM activities to ensure participation by the greatest number of landholders. These tools could range across incentives, stewardship payments and ecosystem service payments covering activities from improved grazing management to private vegetation conservation. Long-term funding cycles could help to achieve meaningful and lasting landscape change.

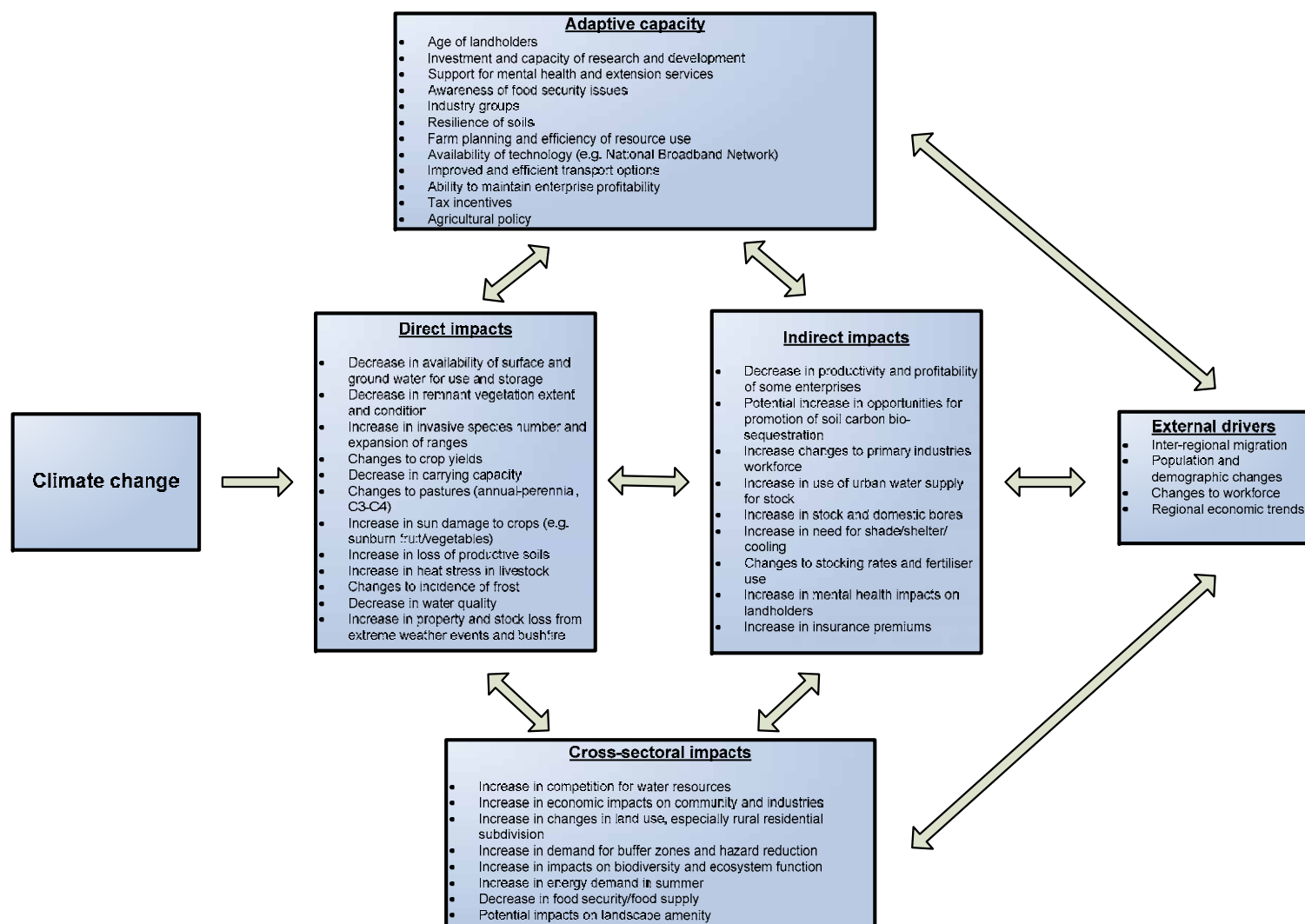


Figure 5.1: Primary industries sector (agriculture and forestry industries) vulnerability to climate change in the South East NSW region

5 Primary industries sector

5.1 Summary

The dynamics contributing to vulnerability in the agriculture and forestry, and fisheries industries are represented schematically in Figure 5.1 and Figure 5.3 (overleaf) respectively.

5.2 Background

The South East NSW region is one of the state's more diverse agricultural regions. It encompasses a wide range of landscapes and primary production systems, the main being agriculture, fisheries and forestry.

The main agricultural industries include dairying, beef production, sheep for wool and prime lambs, with cropping of increasing importance further west, along with fruit and vegetables growing in some areas. Emerging industries include: cool climate wines, olives, alpacas, nuts and goats.

The distribution of agricultural industries within the region is shown in Figure 5.2.

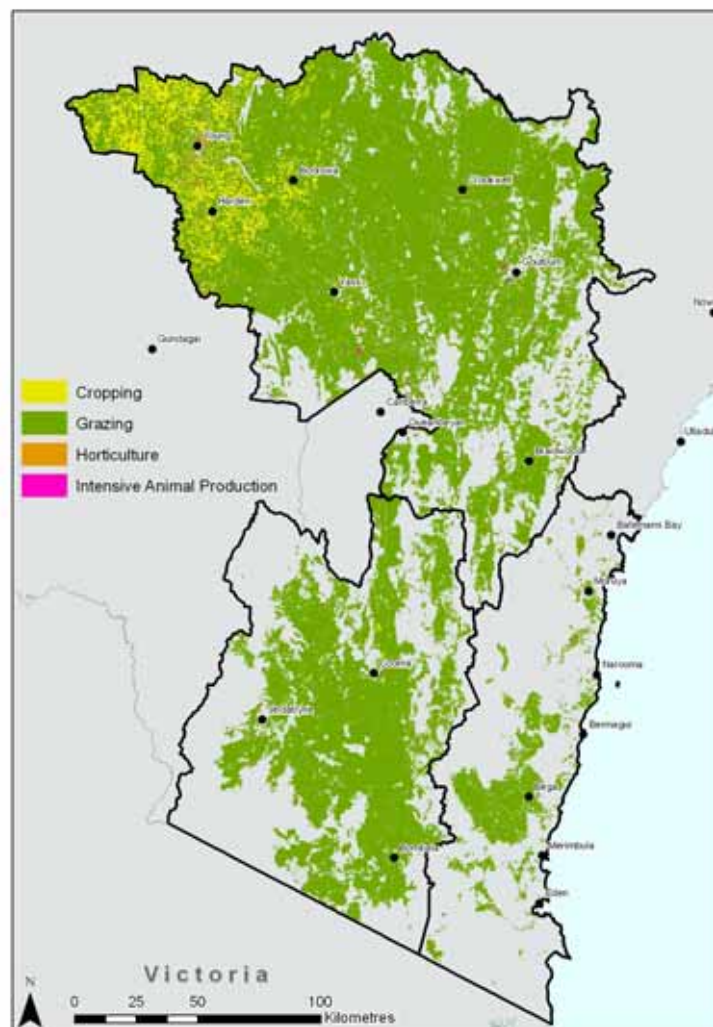


Figure 5.2: Agricultural enterprises within the South East NSW region

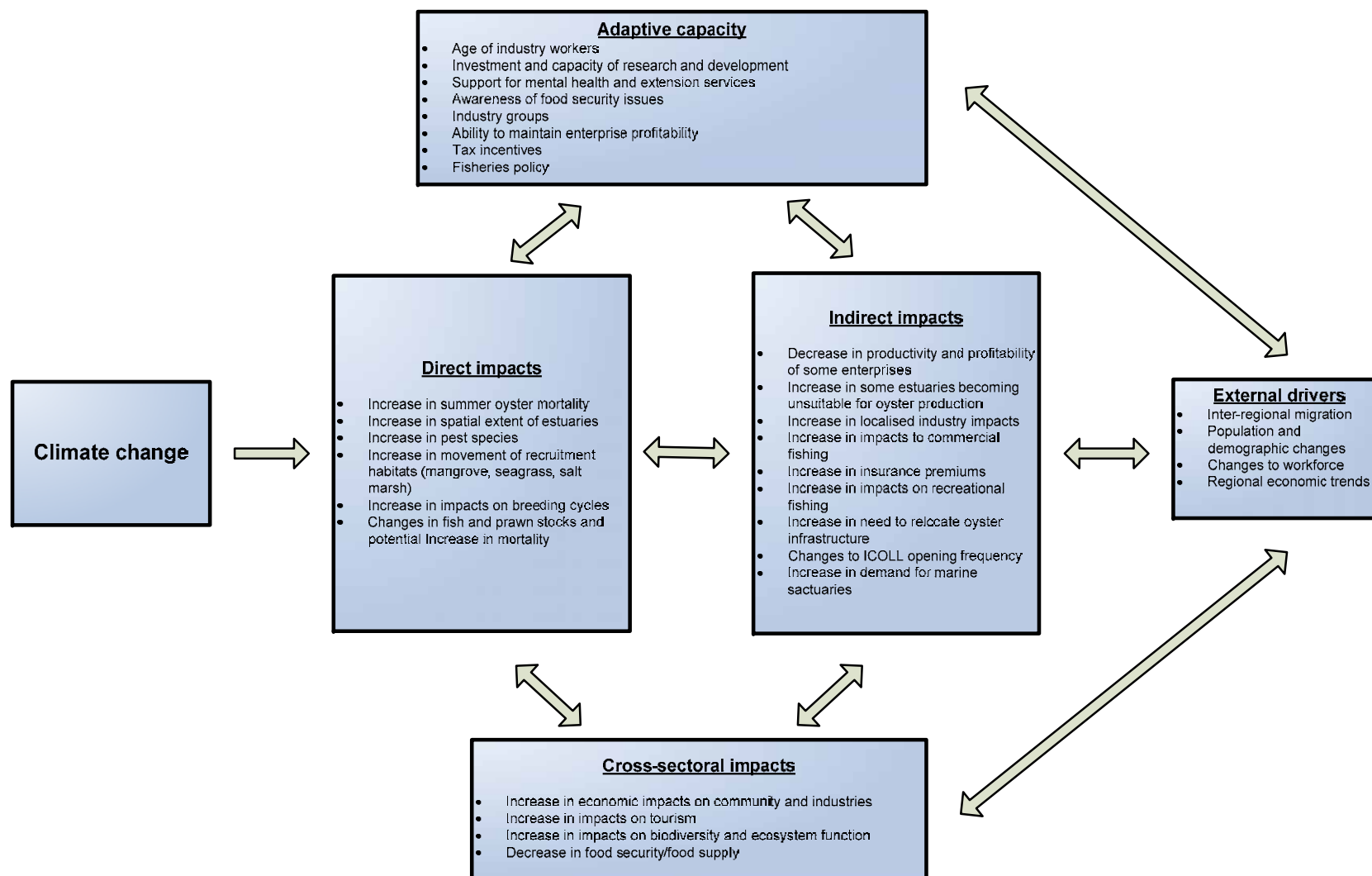


Figure 5.3: Primary industries sector (fisheries industry) vulnerability to climate change in the South East NSW region

Agricultural industries have been, and continue to be, a major source of regional employment and income. These industries have all experienced wide fluctuations in market price and significant production impacts, largely due to drought.

Regional primary industries statistics for South East NSW

Area of agricultural holdings in the region (ha)	2,767,113
Total number of enterprises with an agricultural activity	4,436
Agricultural commodities by value (top 7):	
Wool	\$128,791,182
Cereals for grain	\$111,613,651
Cattle & calves (meat)	\$94,866,033
Sheep & lambs (meat)	\$63,752,263
Milk	\$45,016,041
Fruit, excl. grapes	\$42,623,365
Vegetables (total)	\$7,116,959

Source: Australian Bureau of Statistics 2006

Fisheries, both ocean and estuary catch, and aquaculture, are also significant contributors to the regional economy. In 2008–09 the value of commercial fishing and aquaculture exceeded \$23M (sourced from Industry and Investment NSW).

5.3 Workshop participants

Held in Goulburn, NSW on 17 and 18 May 2010, the workshop was attended by representatives of the following NSW and ACT government agencies:

- Industry & Investment NSW
- Hawkesbury–Nepean Catchment Management Authority
- Lachlan Catchment Management Authority
- Murrumbidgee Catchment Management Authority
- Southern Rivers Catchment Management Authority
- NSW Office of Water
- NSW Department of Environment, Climate Change and Water
- Australian National University
- ACT Department of Environment, Climate Change, Energy and Water

Note: Some agency names have changed since the workshop.

5.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the industries sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Primary industries sector – key impacts

- Changes to rainfall seasonality, increased incidence of drought and increased soil erosion impacting on the productivity of primary production systems
- Decreasing ecosystem function and services impacting on the productivity of primary production systems
- Increasing number and extent of pest species and diseases impacting on primary production systems
- Increasing fragmentation of high value agricultural land, and increasing competition for water resources
- Decreasing primary production leading to impacts on dependent industries and services
- Decreasing primary production, leading to further emigration from rural towns where agriculture is the dominant industry, leading to multiple flow-on effects including health and community cohesion impacts

5.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the primary industries sector. The discussion is summarised in Table 5.1.

Table 5.1: Summary of workshop findings about the adaptive capacity of the primary industries sector

Capital	Indicators of adaptive capacity	Findings
Human	Age of landholders	<p>The age of landholders is strongly linked to climate change adaptive capacity as landholders close to retirement age are less inclined to take risks associated with change.</p> <p>Landholder age varies by geography and industry. For example, farmers towards the west of the region are generally younger, coastal dairy farmers are of mixed age, and graziers tend to be older than crop farmers. Age changes the risk perspective of landholders. Older farmers are more likely to be planning for retirement, often through subdividing the farm to provide financial security.</p> <p>The next generation may not return to the farm business but, where it does, younger landholders often have different values and formal training in business skills. They may be more willing to plan business around adaptation.</p>
Human	Research and development capacity	<p>The capacity for primary industry to understand how to adapt to a changing climate is being diminished by the eroding research and development capacity. Government agency scientists are critical to driving adaptation by translating global and national scientific findings into a relevant regional context.</p>
Human	Mental health and health services	<p>Access to health services is critical to local rural communities being able to adapt to climate change. The mental health of landholders was a serious issue during the recent drought, when financial impacts caused significant hardship, most frequently for crop producers. Many landholders exited agriculture because they felt hopeless about their industry, but not necessarily about their personal future.</p> <p>Today, mental wellbeing is more openly appreciated as an important component of general health – a positive change in the community. Extension services played a role in supporting mental health, because they provided an avenue for discussion that builds social networks and skills to cope with adversity.</p>
Human	Food security	<p>Regional awareness of the impact of climate change on food production and food security in NSW is needed to assist in the planning for the future of agricultural in the region. The likely retreat of the cropping zone from the west of the state, due to projected seasonal rainfall shift, might mean a greater dependency on agricultural production from less impacted areas, such as the Southern Tablelands and coastal sub-regions.</p> <p>It was felt the region could identify what the likely changes mean for local agricultural systems, to assist in food security planning for all regions across NSW.</p>

Capital	Indicators of adaptive capacity	Findings
Social	Industry groups	<p>Lack of strong industry bodies is likely to impede climate change adaptation. Industry groups are important in fostering adaptation by allowing landholders to participate in national forums and facilitating access to information locally. However, industries vary in the maturity and strength of their stakeholder organisations. A good model for an effective industry group is one where a small number of corporate players provide influence and strength and drive communication for a large number of stakeholders.</p> <p>Of the important regional industries, dairying is well connected, assisting coastal sub-region producers to adapt to climate change by disseminating information. For example, the findings from the north coast industry research on milk production under heat stress was disseminated to the coastal sub-region industry. Many other industries, including viticulture and intensive animal industries (e.g. poultry and pigs), are effectively organised. However, the industry organisations for wool are now relatively fragmented and those for the extensive grazing industry are largely ad hoc. The wheat industry was impacted by the loss of Australian Wheat Board and connectivity to national policy processes.</p>
Social	Demographic change	<p>Demographic change in the South East NSW region and the subdivision of farms has brought social change to the region. Many of the new landholders are only partially engaged in agriculture and generally supported by off-farm employment. Newer landholders are unlikely to commit the time to sustainably improving farm management, as required in a changing climate. Newer landholders tend to see agriculture as a lifestyle, rather than a business, and may have unrealistic expectations of what can be achieved on a property.</p> <p>The breakdown of social cohesion, including issues of identity and concepts of normal behaviour, is limiting the ability of communities to cooperate in addressing climate change. Traditional expectations of the right to farm conflict with the values of newer landholders. Long-time landholders link their identity with their industry, viewing off-farm work as losing their identity, whereas newer landholders tend not to follow traditional ways. They are often less inclusive (although this is changing over time), property ownership turns over more frequently and off-farm employment limits their contribution to local activities, for example the Rural Fire Service and volunteerism. They are also changing modes of communication between neighbours, complaining to local government over issues of conflict rather than discussing with neighbours.</p>

Capital	Indicators of adaptive capacity	Findings
Social	Local communities of practice (CoPs)	The formation of communities of practice is a positive aspect of farming communities in the region. Traditional groups such as the Rural Fire Service and Landcare are continuing to support positive social networks. In addition, holistic management groups, such as Carbon Farmers Network (at the national scale) and Monaro Farming Systems (at the sub-regional scale), are being established to promote change in agricultural systems, including climate change adaptation. However, the role of individual community champions in driving the formation and persistence of local CoPs is fundamental to promote adaptation.
Natural	Value of water	The headwaters of a number of significant water catchments are located in the South East NSW region. Rivers originating in the region feed into the Murray–Darling Basin in the west, supply water to Sydney in the north and large coastal populations in the east. Farming takes place throughout these catchments, but there is little recognition of the role landholders play in influencing water quality through agricultural practices. Given the value of water is likely to rise under climate change, ecosystem service payments for water quality could help to ensure a viable agriculture sector and influence adoption of best practice land management.
Natural	Loss of agricultural land	High agricultural land values on the coast, and particularly along the Sydney–Canberra corridor, are fragmenting valuable farmland. Climate change scenarios for the region suggest the need for fewer farms of a larger size to ensure a viable agriculture sector, but land values make it difficult to consolidate farm lots. Subdivision controls within some local environmental plans (LEPs) could ensure subdivision accounts for the needs of future farming systems and food security. This will require recognition of the value of agricultural production and availability of higher density housing options to reduce impacts on agricultural land.
Natural	Landscape amenity	Tourism has some potential for growth, particularly in the Southern Tablelands sub-region, as it is sited in the Canberra–Sydney corridor. Sealing the road between Boorowa and Crookwell is benefiting tourism in that part of the region. Establishing wind farms has the multiple advantages of providing renewable energy and employment in the region, and acting as a local tourism attraction.

Capital	Indicators of adaptive capacity	Findings
Natural	Soils	<p>The capability of the land on the Southern Tablelands to support diversification of agricultural systems is a major limit to climate change adaptation. Initiatives such as Carbon Farmers Network are likely to develop new management practices, which would drive successful local adaptation of farming systems. However, the extent of diversification may be insufficient to include the large proportion of the regional grazing industry which would be required to adapt its systems.</p> <p>The need to maintain groundcover to protect highly vulnerable soils under reduced future pasture growth should drive stocking rates. However, lowering stocking rates would be detrimental to farm businesses already struggling to remain viable.</p> <p>Changes to frost regimes projected under future climate may allow some expansion of cropping, however only to the limit of soil capability.</p>
Physical	Broadband network	The recent availability of broadband internet access means that time-poor landholders are able to use social networking more effectively, and are beginning to take advantage of electronic information sources such as industry webinars. This is likely to be an increasingly effective conduit for dissemination of climate change information.
Physical	Improved transport	This indicator has both pros and cons. Improved transport ensures the region is better connected, allowing better access to regional centres for service provision. However, as transport options become better, smaller communities will tend to decline because people can shop and get services outside of the region.
Physical	Farm dams	Farm dams were considered important on-farm infrastructure, however their sizing and location may need to change under future climate. Dams that don't fill effectively are likely to be removed, while the capacity of useful dams will be augmented. Investment in water supply is ongoing, improving the efficiency of water infrastructure. Big properties are not currently collecting anywhere near their legal limit. Constructing new dams to increase supply is likely to be limited by the small number of remaining good sites.
Financial	Disincentives in the tax system	<p>The tax system may be impeding farm amalgamations, thereby providing disincentives to landholders to generate income from managing other properties. At the same time, the distorted values applied to agricultural land through the residential property market precludes landholders from buying extra properties (difficult to 'get big or get out').</p> <p>Increased property sizes could help landholders to cope with the risks of an uncertain and variable future climate.</p>

Capital	Indicators of adaptive capacity	Findings
Financial	Under-insurance	<p>One way for landholders to offset the risk of climate change is to insure their assets. However, landholders are currently under-insuring. For example, graziers no longer insure livestock and only insure about 10–15% of their property’s fences, because farm profitability can’t support the cash outlay required for full insurance. Older infrastructure, such as farm sheds, are not insured, even where an insurance company would take on the policy. Similarly for cropping, farmers can’t afford to insure for all risks, while for horticulture the cost of insurance is too expensive for returns from production. The inability to insure private assets may put greater pressure on public funds for compensation in the event of floods and bushfires, which tend to damage these assets.</p>
Financial	Return on investment	<p>Return on investment to agriculture was viewed as being at a tipping point. Landholders have adopted a number of strategies to offset poor farm returns, such as raising capital for improvements by gaining approval to subdivide their land without intending to proceed with development (agricultural loans generally attract a risk loading from financial institutions).</p> <p>Others resort to off-farm employment, minimising the reliance of household viability on farm business viability. However, the opportunity to seek off-farm employment depends on location (greater opportunities closer to regional population centres) and industry (because of the daily scheduling of milking operations dairy farmers have little capacity to generate off-farm income). Some landholders have resorted to selling off small blocks of their land for lifestyle blocks to raise capital.</p> <p>Many of these strategies enhance the coping range of farm businesses, but will not maintain a viable agriculture sector in the region.</p>
Financial	Agricultural policy	<p>The agriculture sector currently benefits from a number of schemes that bring money into the industry and help to maintain farmers on the land. Many of these schemes are currently under review (e.g. drought assistance policy) and most will change over the next 50 years. Landholder views on many of these policies are mixed, some believing they entrench poverty and stifle adjustment. In addition, some industries (e.g. grazing) fear they will be vulnerable to climate change mitigation policies, such as a price on carbon, and that they will increase pressure on already marginal production systems. An uncertain policy environment will likely affect adaptation by not providing clear signals to the sector that could drive restructuring under climate change.</p>

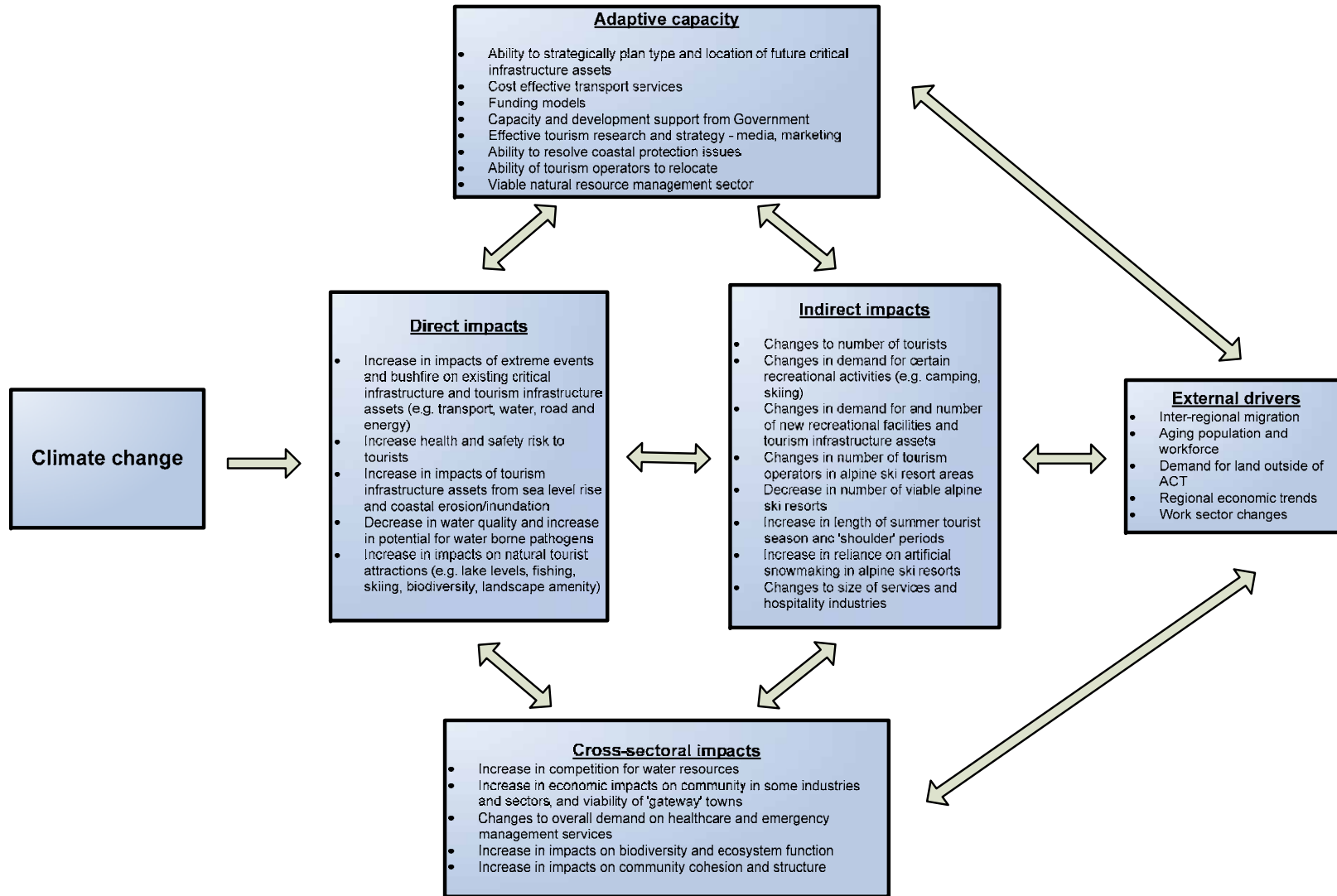


Figure 6.1: Tourism sector vulnerability to climate change in the South East NSW region

6 Tourism sector

6.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 6.1.

6.2 Background

NSW Government strategic investment management and marketing of tourism in the South East NSW region is administered in three planning regions: the coastal sub-region (including the Illawarra), Snowy Mountains, and Capital Country. The region has some significant tourist attractions. Most notable are: the snowfields within the Snowy Mountains; the national parks and marine parks of the coastal sub-region; and the history, culture and rural landscapes of the Capital Country. Tourism contributes considerably to the regional economy, with a number of local communities highly dependent on the viability of the industry. Comparative contributions of each planning region to tourism in the South East NSW region for the year ending March 2010 are shown below:

	Coastal sub-region (including Illawarra)	Snowy Mountains	Capital Country
Total visitors (per annum)	8,000,000	1,078,000	2,836,000
Market share (% of visitors to regional NSW)	17.4%	3.8%	5.8%
Major purpose of visit to region	<ul style="list-style-type: none"> • 65.7% holiday or leisure • 27.1% visiting friends/relatives 	<ul style="list-style-type: none"> • 75.6% holiday or leisure • 12.2% visiting friends/relatives 	<ul style="list-style-type: none"> • 41.4% holiday or leisure • 36.1% visiting friends/relatives
Travel mindsets	<ul style="list-style-type: none"> • 34% compatriots * • 24% wanderers # 	<ul style="list-style-type: none"> • 30% parents with young children • 19.3% young or mid-life singles 	<ul style="list-style-type: none"> • 40% compatriots* • 22% wanderers #
Origin of domestic visitors	<ul style="list-style-type: none"> • 46.5% Sydney • 29.5% regional NSW 	<ul style="list-style-type: none"> • 37.4% regional NSW • 35.3% Sydney 	<ul style="list-style-type: none"> • 42% Sydney • 33.9% regional NSW
Tourist expenditure (per annum)	\$1.8 billion	\$639 million	\$456 million
Tourism's share of total regional employment	8%	13.8%	6.0%

* Compatriots – mostly families

Wanderers – taking time to explore and discover

Source: National Visitor Survey, Year Ending March 2010, Tourism Research Australia

6.3 Workshop participants

Held in Jindabyne, NSW on 3 March 2010, the workshop was attended by representatives of the following NSW and ACT government agencies and local governments:

- NSW Industry & Investment (Tourism)
- Regional Development Australia
- Snowy River Shire Council
- Bombala Council
- Eurobodalla Shire Council
- NSW Department of Environment, Climate Change and Water
- ACT Department of Environment, Climate Change, Energy and Water
- Australian National University

Note: Some agency names have changed since the workshop.

6.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the tourism sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Tourism sector – key impacts

- Increasing average temperatures resulting in declining extent and duration of snow cover in the Alpine sub-region, impacting the ski/winter tourism and the highly dependent local economies
- Sea level rise impacting the natural assets upon which the tourism in the coastal sub-region depends, including beaches and estuaries
- Increasing extreme weather related hazards, including intense storms, flooding and bushfires, impacting tourists and tourist facilities including camping areas, caravan parks, beachside resorts and other tourist accommodation in exposed areas
- Increasing extreme weather related hazards impacting transport infrastructure, including roads, bridges, rail, airports and impacting on tourists accessing the region at critical times of the year

6.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the tourism sector. The discussion is summarised in Table 6.1.

Table 6.1: Summary of workshop findings about the adaptive capacity of the tourism sector

Capital	Indicators of adaptive capacity	Findings
Human	Transferable skills of operators	Operators of tourism sector businesses can relocate to regions where their skills are in demand. However, their ability to adapt to climate change will depend on the liquidity of their business assets. Small operators, with liquid or mobile assets, can relocate relatively easily. Larger resorts, with assets consisting of buildings in discrete geographically-important locations have little scope to relocate assets. Resort operators in alpine locations are likely to be geographically anchored, even though snow-based tourism may decline.
Human	Training in OH&S for climate variability & change	Most good operators in nature-based tourism should be aware of potentially life threatening extreme weather events. Some specific OH&S training may be required in future to keep abreast of the developing early warning systems used by the Rural Fire Service, the State Emergency Management Service and the Bureau of Meteorology.
Human	Transferable skills of employees	The capacity of the tourism workforce to relocate to regions where demand is high, or conditions better, will allow individual employees to adapt to any industry changes climate change may bring. However, it may lead to local shortages of labour for tourism operators remaining in impacted locations. Skewed demographics in many localities result in a shortage of 18–28 year olds and ageing populations, particularly in coastal towns, further intensify workforce shortages.
Social	Resource conflicts	Climate change is likely to increase competition for natural resources such as water, resulting in conflicts such as: snow-making versus lake water levels and power generation; and bushfire hazard control burning versus high season tourism. Resolving such resource conflicts will likely require a capacity to link social capital between diverse agents: resort operators, hydro-power generators, national park and state forest managers, tourism business operators and regional tourism organisations. An Alpine Climate Change Working Group could help to build linkages between natural resource stakeholders, to minimise future resource conflicts. Modifying management plans for public assets, such as national parks, to account for climate change, needs to recognise the need for the tourism sector to maintain access to quality natural resource assets, and to take advantage of emerging trends in tourism (e.g. mountain biking).
Social	Support for Regional Tourism Organisations (RTOs)	Maintaining support for the activities of RTOs is a critical strategy for adaptation to climate change. RTOs are a conduit for information on issues that individual operators do not necessarily have the time or skills to access.

Capital	Indicators of adaptive capacity	Findings
Social	Role of tourism in the community	<p>This indicator operates on two levels.</p> <p>The sector has a responsibility to operate sustainably even if this is not yet demanded by consumers.</p> <p>Regional communities need to be better aware and supportive of the role tourism plays in defining a regional identity and in contributing economic and employment diversity to regions often heavily dependent on the natural resource-based industry. In many regional towns, most families have members employed in the tourism sector in some capacity.</p>
Social	Cross-jurisdictional opportunities	<p>Tourists do not necessarily recognise state borders in pursuing tourist experiences and many activities cross state boundaries.</p> <p>A source of adaptation might be found in exploring synergies between neighbouring local government areas in developing tourism products. For example, Bombala (NSW) and East Gippsland shires (Vic) jointly promote a motorcycle route that takes advantage of the existing pathway followed by bike riders between the population centre of Melbourne and the Alpine sub-region.</p>
Natural	Viable NR sector	<p>This indicator recognises the importance of existing natural resource-based industries (agriculture, forestry, fisheries) to the continued survival and adaptability of other sectors of the regional economy to climate change. The NR sector forms the mainstay of many local economies through its need for products and services supplied by local business operators. These local businesses also support tourism. Changes in climate that undermine the viability of the NR sector will result in declining profitability of local businesses and business closures, with flow-on effects for tourism.</p>
Natural	Seasonal tourism shift	<p>Climate change will likely result in adaptations to the timing of use of natural resource-based tourism assets. For example, reduced snow cover may require a shift from winter- to summer-based tourism for the alpine sub-region and/or changes in demand during traditional shoulder periods, such as in coastal areas where rising sea/air temperatures may extend the swimming season.</p>
Natural	Tourism landscapes	<p>An increased focus on whole of landscape tourism, rather than single landscape features, could promote regional diversity and broaden the region's appeal. This would build regional tourism resilience by reducing dependence on potentially vulnerable natural assets. It would also improve the viability of tourism operators through increased tourist numbers and longer regional stays.</p>

Capital	Indicators of adaptive capacity	Findings
Physical	Cost effective transport	This indicator recognises that tourism in the South East NSW region depends on people being able to travel from major population centres in Sydney and Melbourne, primarily by private transport, to and between regional tourism locations. Climate change mitigation actions that increase energy costs, particularly the cost of fuel for motor vehicles, may result in tourists giving preference to more accessible destinations.
Physical	Additional infrastructure	The possible shift of the seasonality of tourism from winter- to summer-based activities in the alpine sub-region will require new infrastructure. Funding bodies could assist by recognising that anticipating and proactively supporting tourism trends, may be more efficient than restructuring after a trend has become apparent. For example, appropriate design and construction of bike paths around alpine lakes would be expected to help maintain tourist numbers and business viability in some regional towns.
Physical	Modified infrastructure	Adaptation of buildings may be needed to cope with changes in climate. Buildings on the coast may need to be constructed to cope with increased intensity and frequency of storms; while those in alpine areas, built for low temperatures and winter conditions, may need to be adapted to cater for summer occupancy. In addition, improvements in energy and water efficiency of buildings will maintain the competitiveness of tourism businesses by keeping running costs down.
Financial	Financial properties of tourism assets	Developers and investors need to factor the impacts of climate change on potential return on investment when developing new tourism assets. Continuing uncertainty around climate change impacts will make it harder for tourism developers/operators to attract funding from financial institutions. This is particularly a problem for alpine resorts, which are critical drivers of regional prosperity and employment, because of the limited liquidity and high capital cost of building infrastructure.
Financial	Thresholds of business viability	Changes to climate that reduce tourist numbers (e.g. loss of snow in alpine areas) will limit the viability of local businesses, driving tourism workforce migration and business closures. A better understanding of the dynamics of business viability would help to identify 'tipping points' for business closure, enabling the region to plan adaptation to avoid the cascading effects that loss of services have on local and regional economies.

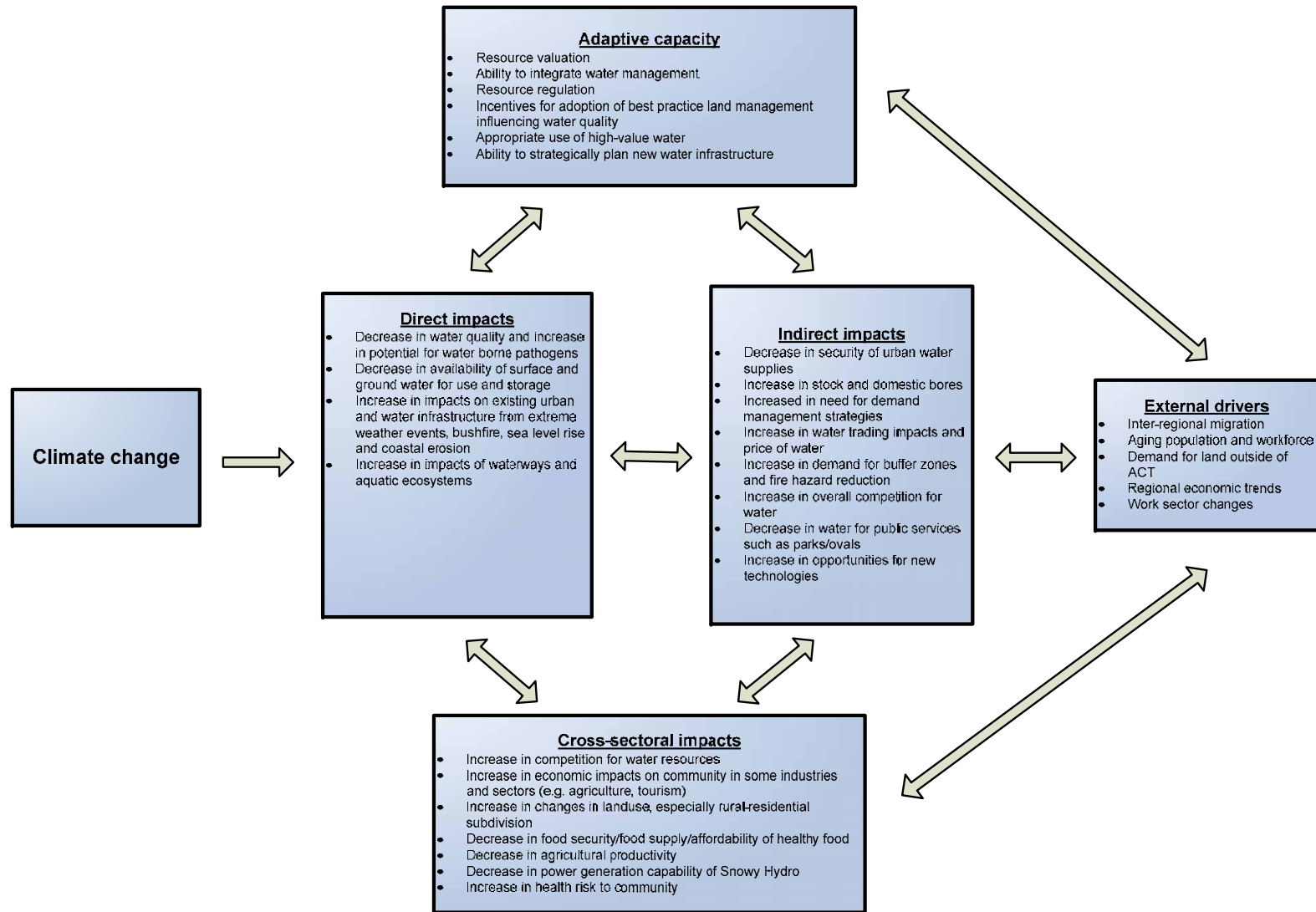


Figure 7.1: Water sector vulnerability to climate change in the South East NSW region

7 Water sector

7.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 7.1.

7.2 Background

Water sources

The South East NSW region experiences varied rainfall trends across its sub-regions:

Sub-region	Average annual rainfall
Alpine sub-region	Snow Mountains – over 2000 mm falling and snow usually lasting 3–4 months per year
	Monaro – 530 mm
Coastal sub-region	800–900 mm
Southern Tablelands sub-region	600 mm

Currently, around 36,000,000 ML is precipitated onto the region, with the water lost to evapotranspiration, converted to runoff and streamflow, and recharged into groundwater^{4&5} as shown in Figure 7.2.

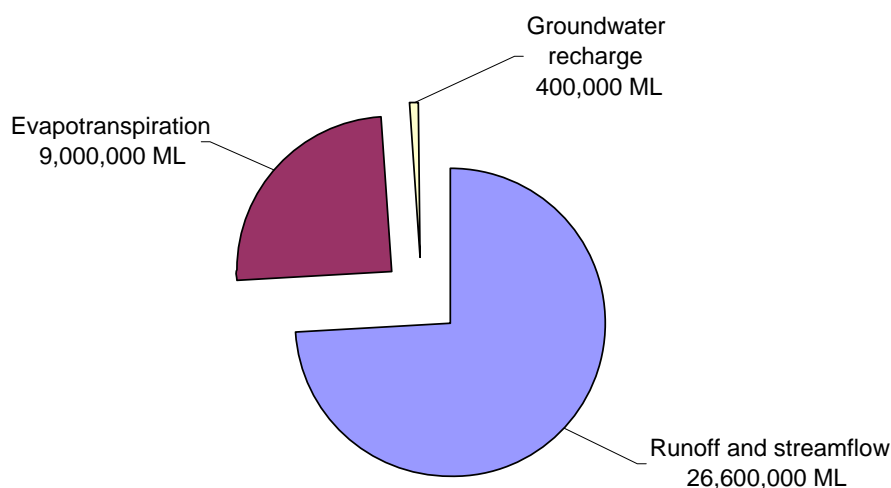


Figure 7.2: South East NSW region water balance

⁴ Millar, K 1994, *Surface Water: NSW South East region water management strategy: water planning for the future*, NSW Water Resources Council, Parramatta.

⁵ McKibbin, D, Little, WA 1994, *Groundwater: NSW South East region water management strategy: water planning for the future*, NSW Water Resources Council, Parramatta.

There are 18 major rivers in the region (including the Lachlan, Murrumbidgee and Shoalhaven rivers) and 15 water storages. Most of the region's rivers are unregulated (do not incorporate a dam to regulate flows for downstream extractions). Three dams are used for regulating river flows (not including the Snowy-Hydro storages). On the coast, the Brogo Dam (9000 ML capacity) in the Bega Valley regulates flows in the Brogo and Lower Bega rivers. Inland, two larger dams, Burrinjuck (1,026,000 ML capacity) and Wyangala (1,220,000 ML capacity), regulate flows on the Murrumbidgee and Lachlan rivers respectively. Small farm dams on small unregulated water courses, usually ephemeral or highly intermittent, also provide a captured water supply.

Most surface water bodies with licences for extraction are rivers. In total there are 1865 licences, 95% of these are on unregulated rivers. Regulated river licences, while few in number, are significant in the Bega Valley LGA, where approximately 30% of the region's surface water licences are held.

Water in the region is also sourced from groundwater aquifers through bores. There are currently more than 9300 bore licences in the South East NSW region. Of these, approximately 90% are used solely for stock and domestic purposes. The remainder are used diversely for town water supply and irrigation where water yields are sufficiently high. On the coastal sub-region, high volume aquifers are located in areas of alluvial soils. Inland, the high volume aquifers are Bungendore Alluvium, Goulburn Fractured Rock, Yass Catchment Fractured Rock, and Young Granite Fractured Rock. Monitoring of the groundwater network is currently patchy, with limited bore surveys.

Extensive unlicensed extraction occurs through Basic Water Rights for stock watering and domestic water use. Many rural properties use tank water for domestic use, although they may change to other sources, such as bores or tanker-transported water, during periods of drought.

7.3 Workshop participants

Held in Queanbeyan, NSW on 12 May 2010, the workshop was attended by representatives of the following NSW and ACT government agencies and local governments:

- NSW Office of Water
- Industry & Investment NSW
- Southern Rivers Catchment Management Authority
- Cooma–Monaro Shire Council
- Queanbeyan City Council
- Snowy River Shire Council
- Yass Valley Council
- Young Regional Council
- NSW Department of Environment, Climate Change and Water
- ActewAGL (ACT)
- ACT Department of Environment, Climate Change, Energy and Water
- Australian National University

Note: Some agency names have changed since the workshop.

7.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the water sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Water sector – key impacts

- Decreasing availability of regional surface and groundwater resources in the Southern Tablelands and alpine sub-regions due to a trend of declining seasonal rainfall
- Decreasing surface water quality due to increasing extreme rainfall events, soil erosion and algal growth exacerbated by loss of vegetation and increasing frequency of bushfire
- Increasing impacts on existing water infrastructure assets and operations (dams, stormwater, sewage treatment plants) due to increasing extreme rainfall events and sea level rise
- Decreasing water security for town water supplies, particularly for smaller isolated communities
- Impacts on local government provision of water services through the increasing requirements for maintenance, repair and replacement of water infrastructure, systems and assets
- Impacts on profitability of primary production systems due to increasing competition for water resources
- Impacts on profitability of hydro-electric power generation from Snowy Hydro due to increasing competition for water resources

7.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the water sector. The discussion is summarised in Table 7.1.

Table 7.1: Summary of workshop findings about the adaptive capacity of the water sector

Capital	Indicators of adaptive capacity	Findings
Human	Access to skilled workforce	<p>The changes to water availability induced by climate change will increase the need for people with skills in all aspects of water management. This would increase the need to access a larger skills base and to offset the increased pressure on existing staff. The existing skills base is diverse and covers all aspects of the water sector; however, the South East region represents only a small fraction of the sector state-wide and, consequently, is not generally a priority area for agency support. Local government reported difficulty in attracting skilled people to the South East NSW region. Cuts to the funding of skilled jobs in water, planning and engineering in local government reduces the available regional skills base. Within the region, skills are unevenly distributed, with a concentration of skills around the Bega area (where the NSW Office of Water (NOW) and the dairy industry are based).</p> <p>Strategies to make better use of the skills available in the ACT could be of assistance.</p>
Human	Water education	<p>The region needs to understand all of its water resources in greater detail to improve water management under climate change. The size, quality and location of groundwater and its interrelationship with surface water is a particular issue, because groundwater is increasingly being substituted for surface and reticulated water supplies (particularly under water restrictions). There also needs to be greater knowledge about unregulated rivers as the focus is currently on regulated rivers.</p> <p>Current education programs could be better integrated, focused on two target groups:</p> <p>Elected local government representatives – for example, to develop understanding of the possible future limitations on water availability</p> <p>Community – about the value of all sources of water. For example, in the Eurobodalla Shire moderation of the demand drivers for reticulated water usage has been very successful, with a 30% reduction being sustained in a period when there was over 10 years of growth in population. Today, the community in the Eurobodalla Shire understands dam store levels and the implications for water restrictions, and are fully engaged in the process.</p>

Capital	Indicators of adaptive capacity	Findings
Human	Water policy and management practices	<p>Participants reported that a holistic approach to managing water from all sources, could assist in maximising the use of the whole water resource.</p> <p>Water policy and security needs to consider a range of water sources and mitigation strategies, backed up by services. For example, because of the health and social issues associated with water reuse (particularly potable reuse), policy and management practices need to reflect these differences.</p> <p>Stormwater and effluent reuse require different management approaches; for example, planning for stormwater reuse should consider the impact on stream flows of harvesting large amounts of storm water.</p>
Human	Regional academic institutions	<p>The South East NSW region is well endowed with academic institutions (CSIRO, ANU and Uni of Canberra) that could be an enabling factor for adaptation, because they enhance the region's intellectual capacity. However, this capacity is not at present focused on local issues, with CSIRO and ANU in particular pursuing a national science agenda. There is considerable scope for these regional institutions to work more closely with state and local government on regional issues.</p>
Social	Cross-agency regional planning	<p>Structured engagement between local governments and with the state and ACT governments is required. Currently this is restricted by funding, political and management issues.</p> <p>The impetus of climate change could be used to encourage a holistic process for water planning, using a collective regional approach from NSW, ACT and local governments. This could also improve engagement with the Department of Planning to ensure that water availability is factored into decisions about population growth in the region.</p> <p>CMAs also have a significant role to play in supporting regional water planning with vulnerability assessments.</p> <p>If planning is undertaken in this way it may allow innovation to drive change. For example, in Bega, cheese production increased despite the drought.</p>
Social	Water issues in remainder of the state	<p>The critical nature of and priority given to water issues in the remainder of the state is constraining the focus on water issues within the region, and hence the region's capacity to adapt to climate change.</p>

Capital	Indicators of adaptive capacity	Findings
Social	Water allocation to town water supplies	The legislated priority of town water supply (only to a reasonable amount of water) is a constraint on climate change adaptation, particularly with increasing urbanisation in the region.
Natural	Natural Resource Management (NRM) practices	<p>NRM practices, such as retaining groundcover in agricultural production systems, have a short-term influence on the amount of surface water runoff, and change the landscape's water retention time following rainfall. In the longer term, once the soil profile is at field capacity, steady flows to surface water bodies would likely resume. NRM practices can also influence the time taken to recharge groundwater aquifers. Any changes to evapotranspiration under altered climatic regimes will affect soil moisture and, in turn, influence the water available as ground and surface water. The retention of soil moisture is linked to soil organic carbon levels, which are linked to groundcover and influenced by changes in land use.</p> <p>The relationship between soil health, storage of moisture in the soil profile and runoff into rivers also needs to be better and more widely understood by land managers and water professionals.</p>
Physical	'Networked' town water supplies	Investigate networking town water supplies to enable more flexibility in water delivery and facilitate better regional management of water resources.
Physical	Coastal aquifers	Workshop participants considered that the recharge of coastal aquifers as water storages in lieu of constructing major new dams could assist in adaptation in two ways. Firstly by reducing water storage costs and secondly, by reducing the potential for saline water intrusion, which could result from over use of groundwater by unregulated domestic bores, coupled with future sea level rise.
Financial	True water valuing	<p>Giving true value to all water sources should enable efficient water use and adaptation to climate change. This will also ensure water savings are not made in one location, only to have water wasted from another source or in another location. It will also remove financial barriers to reusing water. For example, using tank water in toilets is not currently cost effective, because water is not priced properly.</p> <p>For this to happen, funding will be needed to improve unregulated river management.</p>

Capital	Indicators of adaptive capacity	Findings
Financial	Market-based approaches	<p>The sector could make better use of market-based approaches being trialled in the energy sector.</p> <p>The water distribution model could enable or constrain climate change adaptation. The current model is centralised, but alternatives such as a distributed scheme for the use of grey water (facilitated by a market approach or the use of subsidies) could assist climate change adaptation.</p>
Financial	Funding for water planning	<p>The current funding model for water was seen as a constraint. The model is based on the amount of water sold, rather than on water related issues that need to be addressed. It also assesses the water security of the region as less of an issue than for major population centres such as Sydney.</p> <p>Water planning at local government level may be inhibited by concerns that such arrangements may lead to separate water utilities and a consequent loss of income. This is of particular concern since water charges, unlike property charges, are not pegged in NSW. Also, investment in water planning in the region is unlikely to be sourced from the National Water Initiative given the priorities for water management elsewhere in the nation.</p>

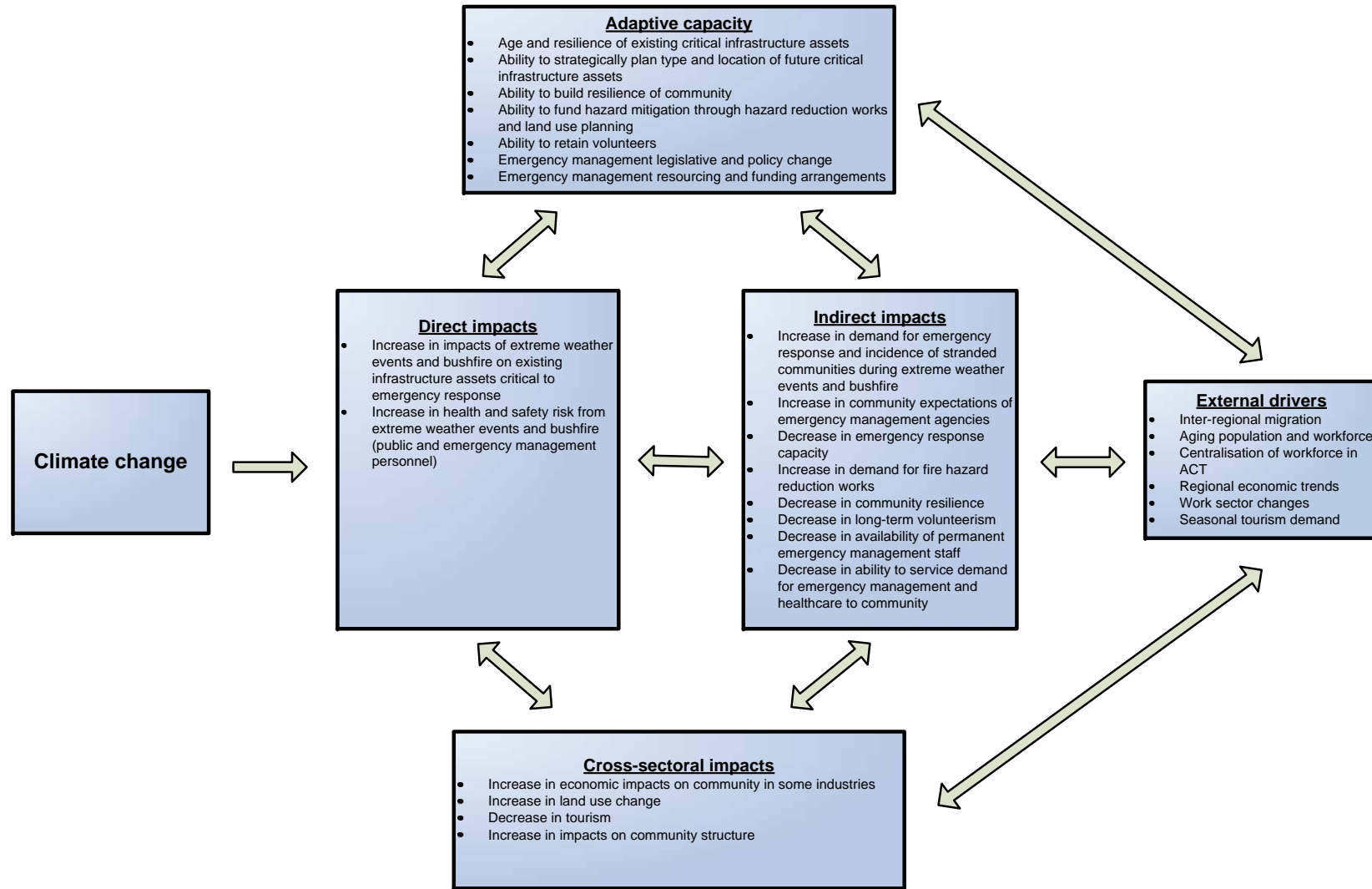


Figure 8.1: Emergency management sector vulnerability to climate change in the South East NSW region

8 Emergency management sector

8.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 8.1.

8.2 Background

The South East NSW region traverses two of the state's 11 Emergency Management Districts (EMDs): the South East and Illawarra/coastal sub-region (Figure 8.2).

Emergency management arrangements are established under the *State Emergency and Rescue Management Act 1989* (SERM Act). The SERM Act covers the prevention of, preparation for, response to and recovery from emergencies. The SERM Act establishes the State Disaster Plan (DISPLAN), which identifies combat agencies to control the response to particular emergencies and details other response and support coordination arrangements.

Each EMD is represented by a District Emergency Management Committee (DEMC). The DEMC is responsible for preparing plans for the prevention of, preparation for, response to and recovery from emergencies within the district. The DEMC is responsible to the State Emergency Management Committee.



Figure 8.2: Emergency Management Districts within the South East NSW region

8.3 Workshop participants

Held in Queanbeyan, NSW on 28 April 2010, the workshop was attended by representatives of the following NSW and ACT government agencies and local governments:

- NSW Police**
- NSW Rural Fire Service**
- NSW Fire Brigades**
- NSW Ambulance Service**
- NSW State Emergency Service**
- NSW Department of Premier and Cabinet
- NSW Department of Environment, Climate Change and Water**
- Industry & Investment NSW**
- NSW Department of Services, Technology and Administration (Public Works)
- Transport NSW**
- Bega Valley Shire Council**
- Goulburn–Mulwaree Council**
- Snowy River Shire Council**
- Yass Valley Council**
- ACT Department of Environment, Climate Change, Energy and Water
- Australian National University

Note: Some agency names have changed since the workshop.

** These agencies are members of the DEMC.

8.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the emergency management sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Emergency services sector – key impacts

- Increasing requirement for mitigation due to increases in frequency and intensity of natural hazards
- Increasing risks to critical infrastructure upon which emergency management depends, and the need for strategic planning to reduce risk to these assets
- Increasing exposure of community to hazards due to inappropriate land-use planning
- Decreasing ability of council to fund mitigation with current resourcing arrangements
- Decreasing resilience of community due to economic and demographic trends in the region
- Decreasing volunteerism and risks to volunteers hampering ability of emergency management agencies to effectively respond to emergencies
- Increasing demand on emergency management agencies to respond, with response hampered by increased risks to critical infrastructure
- Decreasing ability to adequately provide emergency services to small, remote and declining communities

8.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the emergency management sector. The discussion is summarised in Table 8.1.

Table 8.1: Summary of workshop findings about the adaptive capacity of the emergency management sector

Capital	Indicators of adaptive capacity	Findings
Human	Changed demographics	<p>With an ageing population, communities in the South East NSW region will be increasingly less able to care for themselves in future and become more vulnerable to climate change.</p> <p>In addition, those seeking lifestyle change in the region often relocate from well serviced urban locations, bringing higher expectations of service provision. These people may be unwilling or ineffective in contributing to emergency management (EM).</p> <p>Better communication with the community about EM would increase individual awareness and resilience in coping with emergency situations arising from increased climate variability and change.</p>
Human	Rural decline	<p>The increase in corporate plantation forestry is driving depopulation of some rural areas. As traditional farming communities are lost, so are custodianship and historical knowledge of the land. Losing this knowledge, which previously assisted in understanding landscape responses to bushfires and floods, will diminish the district's capacity to deal with emergencies. Also, fewer people residing in the landscape generally equates to greater risk of natural disaster.</p> <p>Recognising this, in some areas, forestry companies are supporting local EM by developing agreements with the RFS to allow company fire fighting crews to operate off-plantation in emergencies. However, such agreements are not uniform across the sector.</p> <p>In other areas, fragmentation of agricultural land for lifestyle blocks and tourism has led to 'tripling of the population' in the tourist season; for example, there may be up to 200 coaches per day in Snowy Mountains National Park during peak times. Out of season, absentee ownership of properties is increasing.</p> <p>Such transient population changes reduce the effectiveness of EM warnings and make EM response more difficult.</p>
Human	Community preparedness	<p>As part of a general community education program on emergency management, the community could be encouraged to focus on emergency preparedness. For example, a program implemented in New Zealand has increased community resilience to the point where it can cope without assistance for up to three days following a natural disaster.</p>

Capital	Indicators of adaptive capacity	Findings
Human	Recruitment of skilled personnel	<p>Lack of skilled personnel with knowledge of natural resources (in some areas of the region) is a major impediment to the sector's capacity to cope with climate change. In particular, the loss of young people (18–24 year olds) from areas such as Bega makes recruitment difficult.</p> <p>There may be scope for tapping into neighbouring LGAs to share resources where expertise exists. Some additional training may also be required to meet local needs.</p>
Social	Volunteerism	<p>The EM sector depends on the sense of community that drives volunteerism, which is in decline in the region. The extent of decline in numbers of volunteers may be hidden because many individuals are counted in more than one EM group.</p> <p>This decline is occurring for a number of reasons: unwillingness of employers to release staff from work to volunteer; volunteers not having the personal resources (time/financial/family commitments) to be active in EM; and people being unwilling to do the 'paper work' now deemed a 'necessary' part of volunteering. Volunteerism is also cyclical, with community willingness and enthusiasm being highest immediately following a disaster but declining thereafter. This means it is always lowest just before the next event.</p> <p>At the same time, demand for EM services is increasing. A general loss of community 'fabric' which supports self sufficiency especially in small settlements, and influx of urban dwellers, has led to more calls for assistance where people would previously assist themselves.</p> <p>Institutional and legislative changes offering tax incentives for volunteerism (for individuals and their employers) may help to improve the continued effectiveness of the EM sector.</p>
Social	Legislative/policy changes	<p>Several legislative issues are impeding adaptation to climate change:</p> <p>Under the Constitution, EM is a state responsibility. This impedes federal government involvement in the sector, despite the federal government's willingness to assist.</p> <p>Under legislation, 'combat' agencies are prohibited from certain activities outside of their responsibility if responding as an emergency support. This results in multiple services being dispatched to deal with an event, because the legislative restrictions mean one service can't deal with the whole problem.</p> <p>The red tape around bushfire hazard reduction means essential work can be stopped by a single objection. The resulting lack of hazard reduction accumulates bushfire risk and endangers the community and natural landscapes.</p> <p>Suggestion: As the coordinating body, Emergency Management NSW could have a heightened role in pressing for policy change through the State Emergency Management Committee.</p>

Capital	Indicators of adaptive capacity	Findings
Social	Cross-sectoral planning	Discussions between EM agencies and the Department of Planning and Infrastructure in relation to these incorporating EM into land-use planning have begun and need to be actively pursued and resolved. For example, aged care facility design must allow for easy access of emergency services vehicles for both evacuation and response teams. As the demand for these facilities may be greater in the future, these design considerations should be an integral part of the development process.
Social	Sharing of info/resources	Resources could be better used across the different services in the EM sector. There have been big improvements in sharing information and resources since the 2003 Canberra bushfires, but these improvements had been driven by necessity rather than enhanced cross-service planning. In general, the operational response of the sector is being increasingly better coordinated; however, EM issues are becoming more complicated and therefore responses are more difficult to plan for. Sharing resources can create other issues, such as who pays for the use of equipment. For example, there are often high demands placed on NSW Ambulance Service across the ACT border.
Natural	Seasonal demand	Tourism increases demands on EM resources during the high season. The South East NSW region is unusual in having two seasonal peaks in demand: alpine tourism in the snow season and coastal tourism in the summer holiday season.
Natural	Multiple events	Climatic extremes under climate change may result in multiple emergency events within the region, increasing pressure on emergency response capacity. This means EM must be prepared to respond to, for example, multiple bushfires in discrete geographical areas.
Natural	Snow falls	Climate change may reduce snow cover; however, variations in weather extremes mean that occasional snow falls will continue to pose problems for the EM sector, by blocking roads and impeding transport routes and access for EM response vehicles.

Capital	Indicators of adaptive capacity	Findings
Physical	Emergency control centres	<p>Many emergency control centres are sited in potential disaster zones, have poor access and poor communications. For example, mobile phone coverage at the Yass emergency communications centre is poor, with the potential to hamper operations. This issue is being addressed and flexible alternatives have been identified and are available.</p> <p>The sector can relocate operations centres, but all sites are dependent on technology – if it fails the systems fails. Redundancy has been built into the power supply system, but its effectiveness will depend on the scale of the emergency event.</p> <p>Location of emergency centres is often at the mercy of electricity suppliers because EM centres and other critical infrastructure are covered by supply agreements that require maintenance of supply in emergency situations.</p>
Physical	Transport services	<p>Community transport services in regional areas are very poor. This can lead to logistical issues in the event of evacuating aged care or sick people during an emergency. This situation is compounded by inaccessibility of some buildings and lack of volunteers to drive transport vehicles.</p>
Physical	Regional communications	<p>Media and mobile phone coverage in many parts of the South East NSW region is considered poor. Adequate redundancy in communications systems should be encouraged in order to cope in the event of a disaster.</p>
Physical	Ageing infrastructure	<p>Councils are finding it increasingly difficult to assign resources in works programs to maintain infrastructure such as roads and bridges in more isolated parts of the region. This can hamper EM access to regional towns. For example, the main route into the township of Dalgety is via a single bridge which currently has a restricted weight loading that would be exceeded by heavy fire-fighting appliances.</p>
Financial	Council funding model	<p>Increased demands on financial resources, coupled with capping of various forms of revenue raising, mean that many councils are unable to contribute to emergency services. Councils can't use funding from rates, roads and rubbish for EM.</p> <p>In addition, councils are required to have a LEMO (Local Emergency Management Officer), but these are not dedicated positions and the requirements of the position vary.</p>

Capital	Indicators of adaptive capacity	Findings
Financial	Financial resources for mitigation	<p>Funding is dedicated for disasters but not for reducing vulnerability before an event. Lack of funding means mitigation strategies tend to be partial instead of the comprehensive approach that is needed.</p> <p>A future focus on funding mitigation could allow the sector to avoid problems rather than just respond to them. Commonwealth funding has been available to promote mitigation planning for some time. The availability of such funding could be better publicised, and application assessment should be risk based rather than judged on the quality of the proposal.</p>

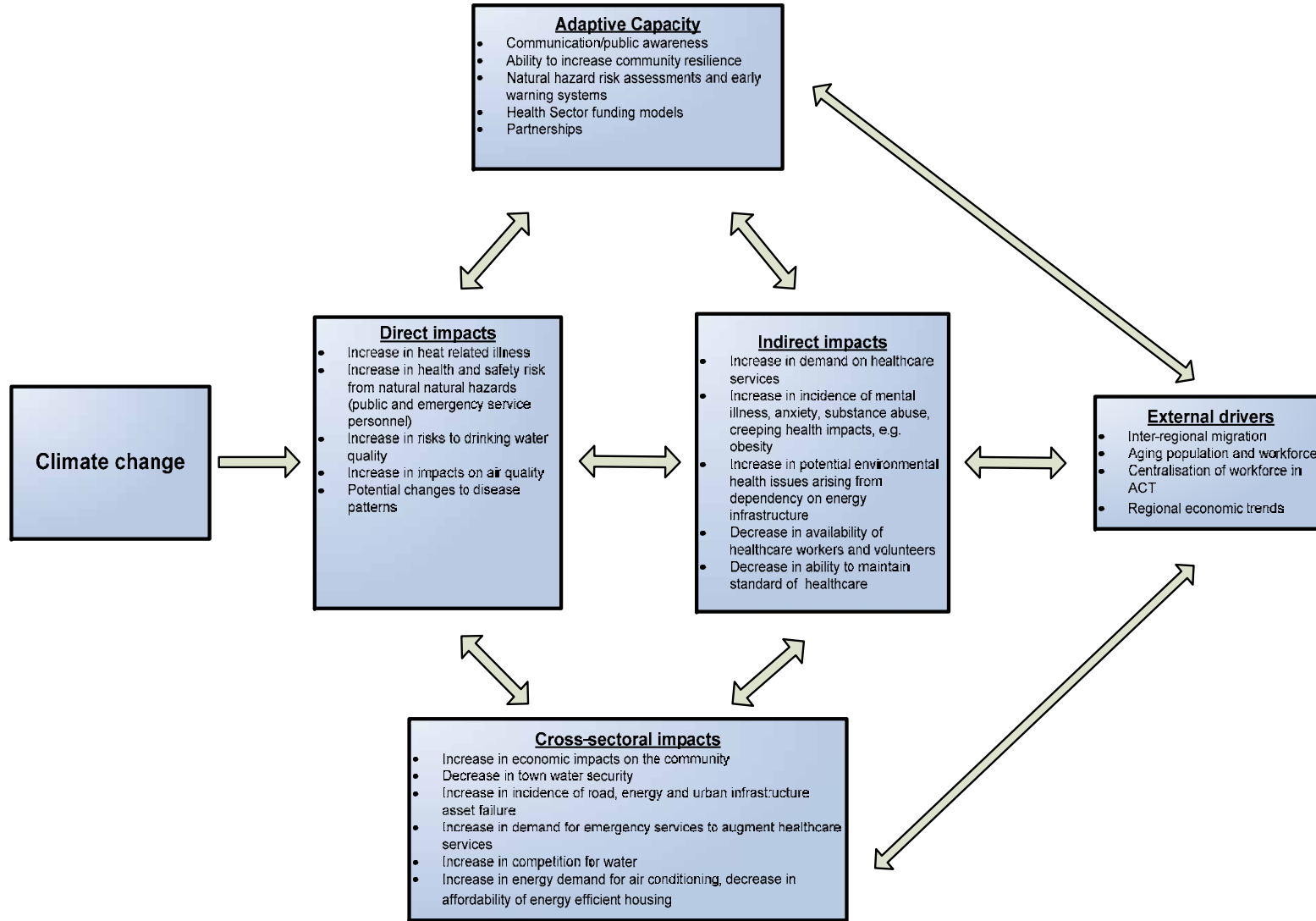


Figure 9.1: Human health sector vulnerability to climate change in the South East NSW region

9 Human health sector

9.1 Summary

The dynamics contributing to vulnerability in the sector are represented schematically in Figure 9.1.

9.2 Background

The South East NSW region overlaps two of the seven Local Health Districts (LHDs) in NSW: the Southern NSW LHD and the Murrumbidgee LHD (shown in Figure 9.2). These two LHDs replaced the former Greater Southern Area Health Service on 1 January 2011. Young and Boorowa LGAs lie within the Murrumbidgee LHD, and the remaining LGAs in the region lie within the Southern NSW LHD.



Figure 9.2: Murrumbidgee LHD and the Southern NSW LHD⁶

The primary hospitals and regional health centres in the region are located at:

Hospitals	Regional health centres
<ul style="list-style-type: none"> • Batemans Bay • Cooma • Goulburn • Narooma • Queanbeyan 	<ul style="list-style-type: none"> • Bega • Bombala • Boorowa • Delegate • Crookwell • Moruya • Karabar • Murrumburrah–Harden • Braidwood • Pambula • Yass • Young

⁶ Source: NSW Health 2011, *Local Health Districts*, NSW Health, North Sydney, updated October 2011, viewed September 2012, www.health.nsw.gov.au/services/lhn/index.asp.

9.3 Workshop participants

Held in Queanbeyan, NSW on 12 February 2010, the workshop was attended by representatives of the following NSW and ACT government agencies and local governments:

- NSW Health – Greater Southern Area Health Service
- NSW Department of Human Services – Aging, Disability and Home Care
- NSW Department of Environment, Climate Change and Water
- ACT Health
- Australian National University

Note: Some agency names have changed since the workshop.

9.4 Findings: Key impacts

Participants in the workshop identified a range of possible impacts from climate change on the human health sector. Key impacts are summarised below. Key impacts are those that:

- resulted in a large number of flow-on impacts
- were the result of a large number of impacts and therefore were likely to be particularly sensitive to the impacts of climate change, or
- resulted in significant flow-on impacts to other sectors.

Human health sector – key impacts

- Increasing risks to community health, increasing demand on healthcare services and affecting their ability to service that demand
- Declining community resilience in light of economic and demographic change increasing indirect health impacts, increasing demand on healthcare services and affecting their ability to service that demand
- Increasing indirect health impacts due to decreased community resilience to impacts on infrastructure and critical assets
- Decreasing ability to deliver adequate healthcare service in light of economic and demographic change in the region decreasing volunteers and skilled workers

9.5 Findings: Adaptive capacity

Workshop participants discussed the adaptive capacity of the human health sector. The discussion is summarised in Table 9.1.

Table 9.1: Summary of workshop findings about the adaptive capacity of the human health sector

Capital	Indicators of adaptive capacity	Findings
Human	Extreme weather related events	Climate change is likely to directly impact community health through more extreme weather related natural hazards. However, at present there is limited understanding of these specific changes at the community scale. Better resolution modelling of climate change could determine sub-regional effects and assist in formulation of local adaptation strategies.
Human	Demographic change	Changes in population and the flow-on effects of these changes vary across the region and are already evident. For example, superannuated retirees have relocated to coastal areas, resulting in changes in demand and ability to pay for health services. In contrast, many rural towns show declining population trends, with those remaining often requiring increased health services. These trends are likely to accelerate under climate change. Adaptation strategies in the health sector will need to account for effects of demographic trends on future demands for health care.
Human	Local health information	The ACT provides much of the broadcast media (TV and radio) for most of the South East NSW region. As a consequence, most of the health messages and health advertising are Canberra-centric, with little news about local health campaigns for NSW residents. Better coordination of advertising and collaboration on messages between NSW and ACT could assist regional adaptation to climate change.
Social	Governance of health services	Current negotiation between state and federal government's over national health policy needs to be resolved to improve health sector management and provide funding certainty.
Social	Community resilience	Increasing community resilience in health is an important adaptive response to climate change in the South East NSW region. Fundamental to community resilience in health is having a preventative health care strategy and improving social cohesion through programs such as 'Know your Neighbour', to ensure people take responsibility for not only their own health, but also that of vulnerable members of the community. Increasing resilience also relies on a better general understanding of the central tenets of primary health care and a commitment to fostering primary health care. Recognition of the interdependency between health and other sectors such as human settlements and water is also central to adaptation; for example, the relationship between potential decreases in water quality and potential increase in community health risk. By improving community resilience in health, demand on emergency services during extreme weather related events could be reduced.

Capital	Indicators of adaptive capacity	Findings
Social	Integrated service provision	Health is often used as a proxy for all human service provision. Other agencies also play a role in the sector; for example, the Department of Family and Community Services has responsibility and receives government funding for provision of ageing, disability and home care services. However, in some small communities the Department of Health may be the only local service provider. The federal government provides funding to a range of organisations in the health sector; for example, general practitioners for drought and family support services. Currently, resources and care are not integrated across tiers of government or state departments. Developing a holistic services network, providing multipurpose services from the pooled resources of a number of human service agencies, would ensure better use of scarce resources throughout the region and better outcomes for vulnerable regional communities.
Social	Information sharing	Canberra is a major health hub servicing not just the ACT, but communities from across the South East NSW region. Formalised information sharing protocols on patient flow and servicing between the ACT and NSW governments could assist in health care and therefore climate change adaptation planning.
Natural	Proximity to Canberra	Canberra is well serviced with specialist health professionals who are either not available or in limited supply in the South East NSW region. Consequently, patient flow is from regional NSW to the ACT and funding follows the flow of patients. This has negative consequences for ongoing funding of existing facilities in NSW communities. Transport to Canberra for specialist care involves long travel times from parts of the region. However, the travel distances are often insufficient for patients to qualify for government financial support. There seems to be a widening disparity between health care provision in NSW local government areas close to the ACT and those of more remote parts of the South East NSW region which do not have the same access to health care services. This also increases the socioeconomic division between sub-regions.
Physical	Health sector performance indicators	Currently, the indicators used to report on health sector performance are selected from data on acute health care. These are viewed as being better indicators of accounting outcomes than sectoral performance. Indicators to report on improvements to primary health care are currently either not available or not well connected to reporting requirements. To promote adaptation to climate change in the community, greater focus on preventative and primary health care could be encouraged and data needs to be collected to support this changed emphasis.
Financial	Health funding model	The current model of funding for health service provision focuses on 'who pays for what services'. Focusing funding towards community health care outcomes should promote resilience in community health and support adaptation to climate change.