



Office of  
Environment  
& Heritage

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

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**Volume 1: Regional vulnerabilities**

*'Identifying workable adaptation  
responses to climate change'*

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# Glossary

<b>Adaptation</b>	Action taken to avoid actual or anticipated impacts from climate change, or to attain potential benefits arising from climate change (IPCC 2007a).
<b>Adaptive capacity</b>	<p>The emergent property of a system to adjust its characteristics or behaviour to better cope with existing climate variability or future climate conditions. Adaptive capacity is expressed as actions that lead to adaptation that serve to enhance a system's coping capacity and increase its coping range, thereby reducing its vulnerability to climate hazards.</p> <p>Adaptive capacity also refers to the set of resources available for adaptation, and the ability of a system to deploy resources effectively in pursuit of adaptation (UNDP 2005).</p>
<b>Climate</b>	Average weather (or, more specifically, the mean and variability of variables such as temperature, precipitation and winds) over a time period ranging from months to thousands of years to millions of years.
<b>Climate change</b>	A statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.
<b>Exposure</b>	The degree to which a system or sector is exposed to climate factors, including in terms of the duration, frequency, and magnitude of changes in average climate and extremes.
<b>Impacts (climate)</b>	Consequences of climate change on natural and human systems.
<b>Integration</b>	The process by which separately produced components or assessments are combined, and incongruities in their interactions are considered and addressed.
<b>Maladaptation</b>	Any changes in natural or human systems that inadvertently increase vulnerability to climate variables; an adaptation that does not succeed in reducing vulnerability but instead increases it.
<b>Mitigation (emissions)</b>	An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.
<b>Mitigation (natural disasters)</b>	Measures to contain or reduce the severity of human and material damage caused by extreme weather events and natural hazards.
<b>Region</b>	The planning regions of NSW as depicted in <i>NSW2021: A plan to make NSW Number 1</i> (NSW Government 2011).
<b>Resilience</b>	The amount of change a system can undergo without changing state.
<b>Sector</b>	A part or division, as of the economy (e.g. the manufacturing sector, the services sector) or the environment (e.g. water resources, forestry).
<b>Sensitivity</b>	The degree to which a system is sensitive to change.
<b>System</b>	A population or ecosystem; or a grouping of natural resources, species, infrastructure or other assets.
<b>Vulnerability</b>	The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity.
<b>Weather</b>	Atmospheric conditions at a particular time, such as hours or days, as defined by variables such as temperature, precipitation and winds.
<b>Weather extremes</b>	Weather phenomena that are at the extremes of the historical distribution, especially severe or unseasonal weather.



## Preface

The climate is changing and global modelling indicates that further change is already locked-in. As a result there is a growing risk of climate related impacts on our state's natural, social and economic systems. Regional administrators, businesses and communities need to identify their strengths and weaknesses in the face of climate impacts – deciding how they will act together to minimise the impact of climate change on their local economy, environment and society.

Climate affects multiple systems and so risks from climate require a systemic, coordinated response. From a practical perspective, this requires input, agreement and collaboration of multiple stakeholders, amongst whom there may be no history of cooperation.

The Integrated Regional Vulnerability Assessment (IRVA) process allows the NSW regions the opportunity to engage stakeholders, gain a holistic view and plan a collaborative response to the emerging risks from a changing climate. A cross-agency initiative, this innovative and rigorous intervention helps a region to:

- **assess the situation**
  - identify local climate change vulnerabilities in vital sectors, and understand how these vulnerabilities influence other sectors
  - achieve a comprehensive understanding of the region's vulnerability resulting from the interaction of each sector's vulnerability
  - gauge a region's capacity to adapt to climate change
- **mobilise industries and communities**
  - increase stakeholder understanding of climate change issues and potential impacts – in the process boosting their capacity to respond appropriately
  - embed the importance of acting collectively – raising awareness that action by one sector may have adverse consequences in another
  - develop relationships among and within sectors to support collaborative action
- **start planning a workable adaptation strategy**
  - develop preliminary recommendations for reducing vulnerability in a systemic way
  - create a sound information base from which to prepare practical adaptation plans, in response to local priorities, using a region's existing management and planning structures.

This report demonstrates the IRVA process in action, charting its pilot implementation in South East NSW and reporting on the outcomes of the process. This includes outlining the six areas of regional vulnerability identified by regional participants: competition for water resources, economic sustainability, land-use change, ecosystem function and services, regional infrastructure, and community.

We hope this report provides an example and encouragement to other regions starting the vital work required to prepare our state for the impacts of climate change. This process has highlighted the depth and breadth of regional knowledge held by local officers and decision-makers. The IRVA process provides a system for accessing that wealth of information and capturing it in a way that allows effective and collaborative regional planning for a changing climate.



# 1 How the IRVA addresses the challenges of planning for climate change

## 1.1 Planning for climate change

The global climate is changing, and this change is occurring at a rapid rate (CSIRO & BoM 2012; IPCC 2007b). CSIRO projections indicate that by 2030, average temperatures in Australia will rise 0.6–1.5°C. The projections also indicate that extreme events such as heatwaves and droughts are likely to become more frequent and severe, and sea levels will continue to rise (CSIRO & BoM 2007).

In NSW these changes are projected to result in higher maximum and minimum temperatures, bringing about a range of impacts including:

- changes to the location and timing of rainfall resulting in drying in the south, particularly in the south-west, and the possibility of minor increases in rainfall in the north-east
- changes to bushfire regimes
- increased evaporation across much of the state (DECCW 2010).

Recent research indicates that even if global emissions were to cease immediately, climate change over the next 30 to 40 years is unavoidable (Solomon et al. 2009).

By planning for climate change, we can identify priority areas for early action and start to build coordination and cooperation between different groups and sectors. Ideally, this will result in climate risk being considered as a normal part of decision-making, allowing governments, businesses and individuals to reflect their risk preferences just as they would for other risk assessments (Allen Consulting Group 2005).

## 1.2 Why do we need an Integrated Regional Vulnerability Assessment?

Planning effective adaptation to climate change can be a complex task. Reducing vulnerability involves altering the context in which climate change occurs, so individuals and groups can better respond to changing conditions (O'Brien et al. 2007). Best practice adaptation involves taking into account all the contextual conditions influencing a region's exposure and sensitivity to climate change, as well as that community's ability to adapt. When considering adaptation in this way, it may emerge that those sectors or communities most vulnerable to climate impacts are not simply those most exposed to potential impacts (Brooks & Adger 2004). For example, two riverside communities may be exposed to similar flood impacts but due to differences in demographics, emergency preparedness, building types, etc., their respective vulnerabilities may be quite different.

The context of adaptation includes the multiple factors and processes which often interact to generate vulnerability to climate change. When planning adaptation it is important to recognise that sectoral systems do not exist in isolation, but are part of local, regional and national systems, with climate change impacts from one sector flowing on to another. Integrated planning allows regional decision-makers to identify priority systems whose operation or failure is likely to carry the most significant consequences, at the regional level.

Planning adaptive action for each sector in isolation is less effective, because different sectors see different aspects of their combined systems as important, and so will tend to favour differing solutions. Often these solutions have consequences for other areas, such as conflicting agendas or drawing on common and limited resources, including time and money. Solutions identified in isolation may not result in the best outcome for the whole

region, or may even exacerbate vulnerability. Establishing and fostering connections at the regional officials' level will ensure that adaptation approaches are conceived within their broader context and are integrated into management objectives.

Reducing vulnerability is also about developing a shared, regional understanding of climate change, so individuals and groups can better respond to changing conditions. Regional geographical features have a profound effect on regional climate and will continue to do so in the future; therefore, climate change impacts are best understood at the regional scale. Similarly, understanding the response and relative vulnerability of systems to climate change is best done by viewing them in a regional context. Therefore a regionally coordinated management response is the most effective for addressing challenges posed by climate change requires.

As the precursor to a climate change adaptation strategy, the IRVA process addresses all of these issues by:

- considering climate change vulnerability at a regional scale
- integrating the vulnerability of all sectors using a multi-sector systems approach
- creating forums where stakeholders can gain perspectives from other sectors
- forging intra- and inter-sectoral relationships that support cooperation and collaborative action
- acknowledging and targeting the existing management and planning structures in the region to facilitate ongoing discussion and action
- highlighting those areas where vulnerability to climate change will have the greatest impact for the region, and thus are most in need of adaptation action.

### **1.2.1 How the IRVA process works**

Through research and workshops with multiple stakeholders, the IRVA creates a sound information base from which regional managers and decision-makers can prepare an adaptation strategy for government services in the region. Its findings include:

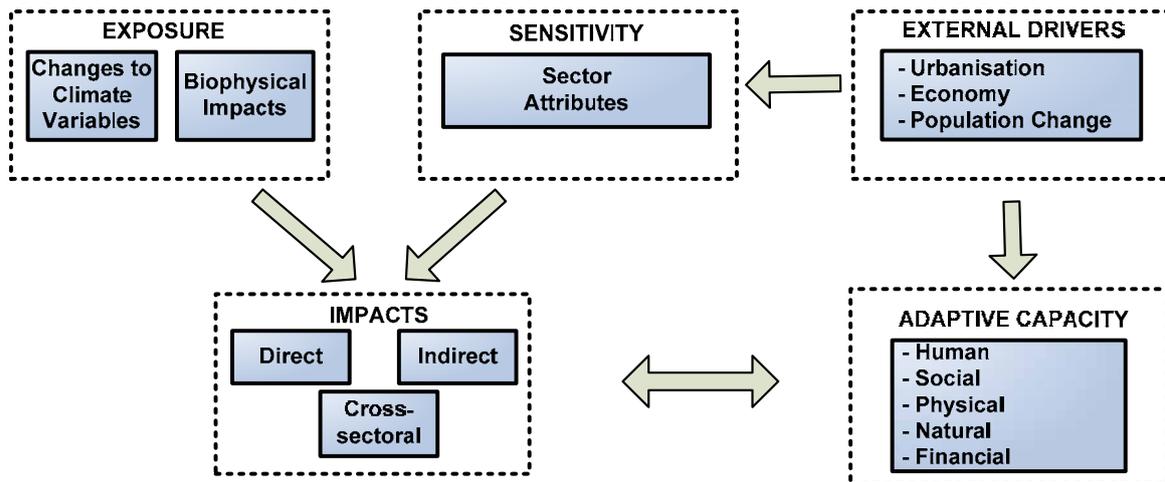
- the likely climate change impacts within key regional sectors
- how these impacts may influence other sectors
- what sector stakeholders already know about and do to adapt to climate change
- the extent of each sector's capacity to adapt to climate change
- the main areas of regional vulnerability
- options for reducing vulnerability.

In its simplest form, vulnerability of a system to climate change is a function of exposure to climate change impacts, sensitivity to those impacts and the capacity to adapt. Building on this approach, the IRVA process factors in demographic and economic influences to determine the vulnerability of multiple sectors, as shown in Figure 1. In this way the IRVA process uses the best available information, local knowledge and experience to develop a shared understanding of how a region's natural, social and economic systems are vulnerable to climate change.

The IRVA is a qualitative system impact assessment rather than a quantitative risk assessment. This approach has the capacity to acknowledge the uncertainty in climate change projections, while still allowing us to identify key areas of vulnerability on which to focus a regional adaptation strategy.

Importantly, the IRVA uses a participatory approach that promotes regional ownership of the assessment process and empowers stakeholders to act on the results, as well as to extend the assessment in the future if required. It ensures assessments:

- develop relationships between and within sectors in the region
- build capacity and understanding of climate change issues and potential impacts within sectors, rather than increasing dependence on expert scientists, economists or social scientists.



**Figure 1: Vulnerability model – integration of impacts and adaptive capacity for multiple sectors**

### 1.2.2 Why the South East region of NSW?

The South East region of NSW covers more than 60,000 square kilometres of the south-eastern corner of the state (see Figure 8). It was chosen for the pilot study because it includes a broad spectrum of climatic zones with diverse topography and demography, and because it encompasses an administrative state planning region which is serviced by a Regional Managers Network comprised of cross agency decision-makers and program managers.

The region can be divided into three sub-regions with different populations, environments and issues for government service delivery:

- Southern Tablelands
- alpine
- coastal.

The major urban centres in the region include Queanbeyan, Batemans Bay, Bega and Goulburn. The Australian Capital Territory (ACT) dominates the region's service delivery, with Queanbeyan forming part of the larger service centre of the Canberra–Queanbeyan metropolitan area. Other major urban centres include Cooma, Yass, Young, Moruya, Narooma, Merimbula and Eden.

## 2 IRVA process

The Integrated Regional Vulnerability Assessment (IRVA) in South East NSW region was a cross agency initiative, designed to help the Illawarra–South East Regional Managers Network (RMN) understand the vulnerability of the South East NSW region to climate change.

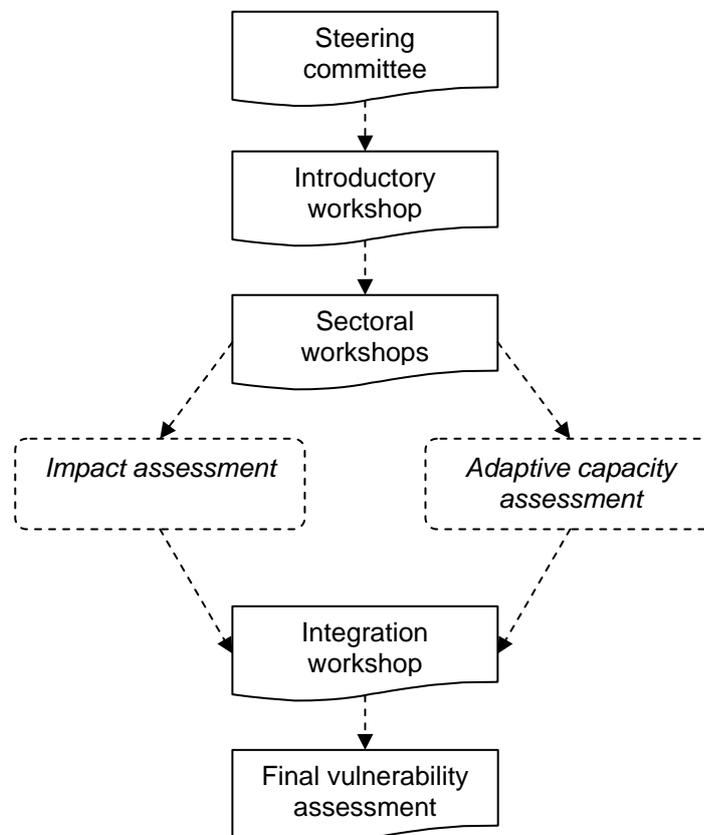
The IRVA process was developed with the assistance of researchers at the Australian National University Fenner School in Canberra, based on emerging research into the best ways to understand and manage climate change impacts.

The then NSW Department of Environment, Climate Change and Water (DECCW) (now the NSW Office of Environment and Heritage) commenced the South East Pilot IRVA in late 2009.

The process involved the following stages:

1. Project governance – establishment of steering committee
2. Collection and synthesis of regional climate change and socio-economic information
3. Introducing the methodology via a cross-agency workshop
4. Assessing sectoral impacts and adaptive capacity via sectoral workshops
5. Integrating assessment results through an integration workshop
6. Identifying regional vulnerability.

An overview of the process is provided in Figure 2.



**Figure 2: Overview of the South East NSW IRVA process**

## 2.1 Objectives

The main objectives of the South East NSW IRVA included:

- establishing an understanding of the climate change impacts within key regional sectors – tourism, water, primary industries, human settlements, emergency management, human health, infrastructure, and landscapes and ecosystems – and how these impacts may influence other sectors
- scoping what sector stakeholders already know about and do to adapt to climate change
- understanding the extent of each sector’s capacity to adapt to climate change
- identifying the main sources of regional vulnerability
- developing recommendations for reducing vulnerability
- refining a methodology to be applied in other NSW regions.

## 2.2 Project governance

A steering committee comprising regional representatives from a number of key government agencies was established to provide project governance and help to engage regional stakeholders.

Through consultation with the RMN and the project steering committee, priority sectors were identified to reflect planning and governance structures within the region. The eight priority sectors selected were:

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

## 2.3 Data collection and synthesis

To inform the assessment, regionally specific climate change information, developed for the NSW Climate Impact Profile (DECCW 2010), was presented at sector workshops (Appendix A). As the assessment was qualitative rather than quantitative, information on the trend of change was of most importance. Where this likely trend was unknown but change was likely, this was acknowledged.

Information on regional trends was also collated from socio-economic research, demographic data and other peer reviewed scientific research, to provide a snapshot of the current socio-economic and environmental conditions in the region (Section 4).

## 2.4 Workshops

### 2.4.1 Cross-agency workshop to introduce the methodology

An introductory workshop was held with representatives from multiple state agencies with core responsibilities in the eight regional sectors. The purpose of the workshop was to introduce the participants to the IRVA methodology and systems thinking approach and to start considering impacts and inter-relationships between sectors.

The workshop was facilitated by representatives of the Fenner School of the Australian National University. ACT and Victorian agencies also attended as observers.

### 2.4.2 Individual sector workshops to assess sectoral impacts and adaptive capacity

Next, eight sectors participated in separate workshops, using a systems approach to assess the impacts of climate change out to 2050. These workshops also examined the flow-on impacts arising between sectors, and the current facilitators and barriers to the capacity of sectors to adapt to those impacts.

The workshops were based on a participatory approach, with stakeholders invited from NSW government agencies, state-owned corporations and local governments, with ACT Government representatives attending all workshops as observers. See Appendix B for a list of participating agencies and organisations.

To identify climate change impacts, participants were first asked to collectively construct influence diagrams to show impact pathways and influence relationships with other sectors. An example of one of these influence diagrams, for the human health sector, is shown in Figure 3.

Participants then identified direct and indirect impacts from climate change, as well as cross-sectoral interdependencies.

- **Direct impacts** can be directly attributed to climate change. For example, the Health Sector Workshop participants identified that an increase in frequency and intensity of bushfires could lead to an increase in safety risk to the community and emergency services volunteers.
- **Indirect impacts** are not immediately due to climate change, but are a consequence of both climate change and external regional drivers. For example, the Health Sector Workshop participants identified that this greater safety risk to the community and emergency services volunteers could potentially impact the region’s already stretched healthcare services and resources.
- **Cross-sectoral interdependencies** arise from common and flow-on impacts. For example, the Health Sector Workshop participants identified that climate change impacts on tourism could damage local economies, reducing the number of healthcare volunteers available.

Having identified climate change impacts, workshop participants discussed adaptive capacity. The IRVA approach used a framework to identify qualitative indicators of adaptive capacity under the ‘five capitals’ of sustainable development categories:

**Human                      Social                      Natural                      Physical                      Financial**

The 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:*

1. *What must change to service the community and why?*
2. *What is needed to enable change?*
3. *Where is change needed most/least?*
4. *What information is available to support your choice?*

In this way the discussion not only provided a measure of adaptive capacity for each sector, but also identified inhibitors of adaptive capacity and determined the scale at which the adaptive capacity operates, whether local, regional, and/or state/national.

The results of each sectoral assessment are summarised in Volume 2 of this report.

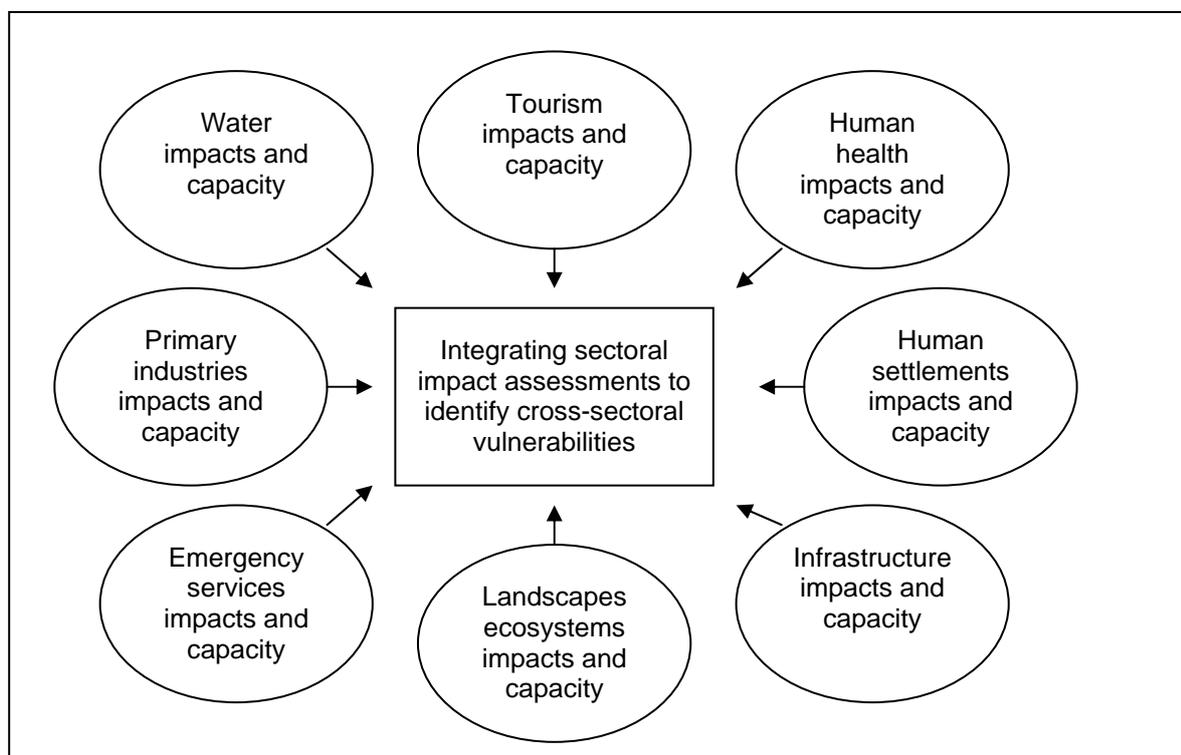


### 2.4.3 Integration workshop

At the integration workshop, approximately 50 participants discussed the results of each sectoral workshop to identify cross-sectoral or cross cutting impacts, providing a holistic assessment of the region's vulnerability to climate change.

The IRVA process then considered how cross-sectoral impacts could be collectively addressed. To identify key cross-sectoral areas of regional vulnerabilities, the workshop analysed the sectoral adaptive capacity assessment results, in conjunction with existing and projected regional dynamics. This supported the objective of achieving best value in adaptation, by collectively addressing impacts, as well as inhibitors to adapt to these impacts.

Figure 4 illustrates the integration process.



**Figure 4: Integration workshop process**

As a result of this analysis, six 'areas of regional vulnerability' to climate change were identified:

- competition for water resources
- economic sustainability
- land-use change
- ecosystem function and services
- regional infrastructure
- community.

## 3 Information gathered from the IRVA process

### 3.1 Issues and solutions

The following sections discuss the outcomes of the South East NSW IRVA process. The process allowed regional decision-makers to identify regional vulnerability in the following areas:

- competition for water resources
- economic sustainability
- land-use change
- ecosystem function and services
- regional infrastructure
- community.

The workshop discussions of vulnerability within these key areas are outlined in more detail below in terms of regional dynamics, considering:

- direct and indirect climate change impacts affecting multiple sectors
- external drivers within the region
- adaptive capacity of affected sectors.

The information below represents the collated knowledge of regional officers and decision-makers. This is their informed understanding of the impacts and adaptive capacity issues of their region. The information summarised here is intended as an information base that can be used to inform future planning for adaptation action. As such, the workshop participants also identified options for potential adaptation actions to target these components of vulnerability. These potential options are also presented below to encourage discussion and provide a foundation for collaborative intervention in the region.

#### 3.1.1 Competition for water resources

IRVA participants identified that the impact of climate change on water availability is of particular significance to the region, with water supply security being discussed and planned for across all sub-regions.

##### Climate change impacts

The workshops led to the identification of a range of impacts of climate change on water resources:

- 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 an increase in more intense rainfall events, increased soil erosion, decreased vegetation growth, increased frequency of bushfire and increased incidence of algal growth
- increasing impacts on existing water infrastructure assets and operations (dams, stormwater, sewage treatment plants), due to more intense rainfall events and sea level rise.

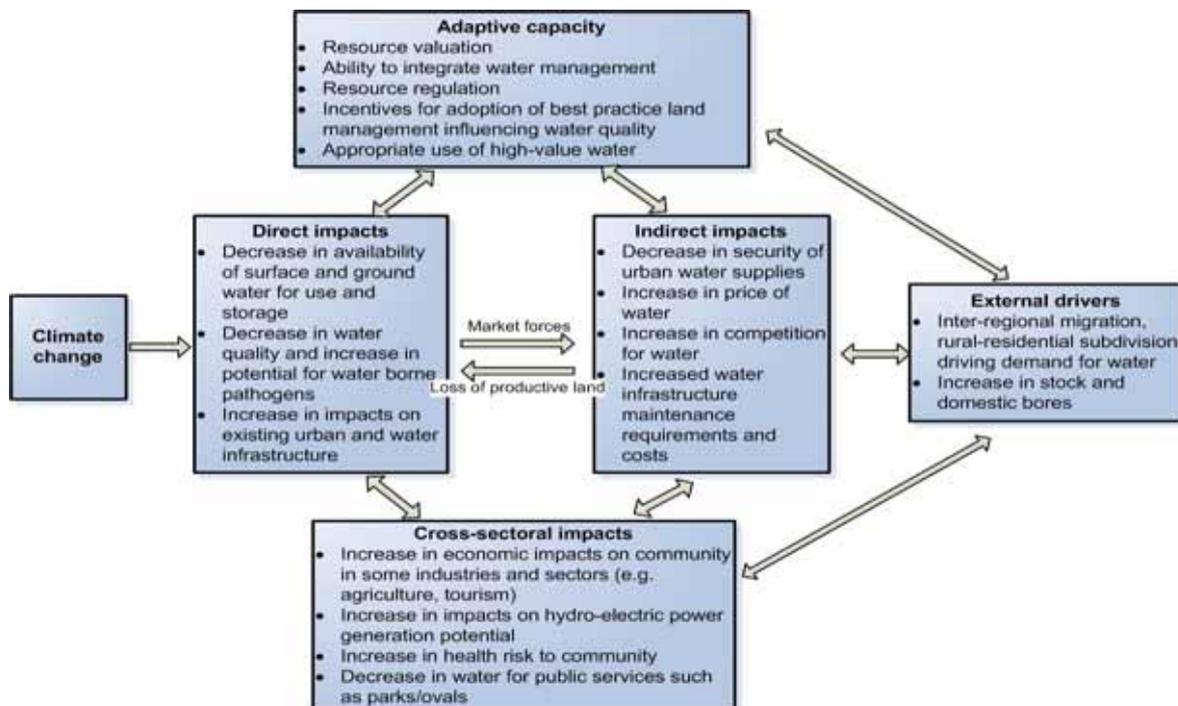
## Cross-sectoral impacts

Discussion highlighted that climate change impacts on water resources are likely to result in far-ranging indirect impacts on all sectors in the region, shown schematically in Figure 5, including:

- decreasing water security for town water supplies, particularly for smaller isolated communities
- impacts on local government provision of water services, through increased maintenance and repair of existing water infrastructure, or the need to replace with new infrastructure
- impacts on farm productivity due to competition for water resources
- impacts on generation capacity of hydro-electric power generation from Snowy Hydro, due to decreased water availability.

The vulnerability of the region to these impacts is heavily influenced by socio-economic conditions and other regional dynamics. Projected population growth in some urban settlements, particularly in the coastal sub-region, and the current trend of increasing rural residential subdivisions is likely to increase demand for water. Increased competition for water will also be exacerbated by an increasing demand within the primary industries sector, particularly on the region's coastal plains.

*'Resource conflicts are likely to occur either through competition for the use of natural resources or through changes to the management of natural assets.'*  
Tourism sector workshop



**Figure 5: Vulnerability to increased competition for water resources**

## Factors affecting adaptive capacity

- **Valuing water resources**, including their amenity values – Water’s current value depends on whether there is a market and doesn’t take into account that rivers, lakes and dams are often a focus of local tourist activity, which is a major contributor to the regional economy. Regional officers thought that these factors are also placing unnecessary burdens on municipal water supplies and treatment facilities. Examples of inefficient water use include:
  - extractions from the region’s unregulated rivers for irrigation and aquifers for stock and domestic use
  - high-value drinking water in some major urban centres being used for low-grade purposes such as toilet flushing and domestic gardening.
- **Integration of water management** – Current practice considers the management of different water sources separately (dam storage, aquifers, storm water, recycled water), rather than treating all sources of water as a single resource. Workshop participants felt this reduced the effectiveness of water management, particularly during extended periods of low or variable rainfall.
- **Incentives for farmers to employ water efficiency practices** – Recognition of the role that landholders (farmers) play in influencing water quality is needed. Currently in many rural catchments (such as Harden), where residential water use is proportionally low, efforts by local government to increase household efficiency would be better focused on the agricultural sector.

### Potential regional strategies to reduce vulnerability

A range of options to address competition for water resources were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Provide incentives for best practice land management for water quality.
- Explore mechanisms to value water appropriately, including better acknowledging water’s amenity value.
- Establish intra-governmental partnerships to facilitate collaborative management of water from various sources.
- Develop approaches to match water quality to end use in urban areas.
- Explore options to more efficiently manage use of the region’s unregulated rivers and groundwater sources.
- Map all aquifers.
- Analyse water usage to focus water saving measures on areas where the greatest benefit can be achieved.
- Drive collaboration between state agencies and local governments around projections of climate change impacts on water availability and sources to input into water sharing plans.

### 3.1.2 Economic sustainability

IRVA participants identified that projected climate change is likely to have a significant impact on primary production systems and tourism assets in the South East NSW region. The IRVA process identified that these direct impacts lead to indirect impacts on the downstream economy and affect multiple sectors. Ultimately, these impacts are likely to increase economic stress in the region.

#### **Agriculture**

##### **Climate change impacts**

Workshop discussions highlighted that the economic sustainability of the primary industries sector within the region is sensitive to climate change through:

- changes to rainfall seasonality, increased incidence of drought and increased soil erosion impacting directly on the productivity of primary production systems
- decreased ecosystem function and services impacting directly on the productivity of primary production systems
- increased number and change in extent of pest species, including feral animals and weeds
- erosion of the production base through fragmentation of high value agricultural land and increasing competition for water resources.

##### **Cross-sectoral impacts**

The workshop participants identified several ways that the impacts on the agriculture sector could flow-on to tourism and the broader regional economy, and community including:

- decrease in primary production leading to lower levels of productivity for dependent manufacturing and processing industries
- decrease in economic viability of primary producers reducing demand for other regional services and products
- decrease in 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 (discussed further in Section 3.1.6).

##### **Factors affecting adaptive capacity**

- **Subdivision of agricultural lots** – Agricultural lots are increasingly being subdivided and are often sold as lifestyle blocks to raise farm capital (discussed further in Section 3.1.3). The discussion identified that this increasing fragmentation of lot sizes may reduce resilience, by reducing overall production capacity of the agricultural industry. In addition smaller farm lots may have a poor adaptive capacity, compared to larger farms, because they cannot undertake primary production at a sufficient scale. Note: Anecdotal evidence suggests that landholders sometimes gain approval to subdivide their land without intending to proceed with development in a bid to avoid the risk loading that financial institutions generally attach to agricultural loans.
- **Changes in regional demographics** – IRVA participants reported that with the population ageing and many young people moving away, there are fewer people of working age able to keep farms running, which reduces the adaptive capacity of the primary industries sector. Increasingly, participants thought the inability of the agricultural sector to compete with salaries offered in other sectors (especially mining) hinders the sector's ability to attract workers.

- **Uncertainty surrounding climate and agricultural policy** (discussed further in Section 3.2.2) – Uncertainty about the future climate, due to climate change, undermines confidence in the primary industries sector, both for those directly engaged in agriculture (farmers) and potential investors.
- **Cost of insuring agricultural assets** against an increase in extreme weather events – Landholders are currently under-insuring due to increased cost pressures on production. Declining numbers of graziers are insuring livestock and a lower percentage of farm assets are being covered. Often older infrastructure such as farm sheds is not insured at all, even where an insurance company would take on the policy. Similarly, for cropping, some farmers cannot afford to insure for all risks, and for horticulture, the cost of insurance is often unjustifiable against returns of production.

### **Potential regional strategies to reduce vulnerability**

A range of options to address agricultural economic sustainability were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Understand the dynamics of business viability to identify ‘tipping points’ for business closure in order to assist planning to avoid loss of viability.
- Work with farmers to ensure that natural industry adjustment processes have the best possible long-term outcomes.
- Assist farmers to take advantage of new opportunities arising from changing climate and policy environments.

## **Tourism**

### **Climate change impacts**

The tourism workshop participants identified that the sector’s economic sustainability, particularly in the alpine and coastal sub-regions, is sensitive to climate change through:

- increased average temperatures resulting in declining extent and duration of snow cover in the alpine sub-region, directly on the ski/winter tourism sector and the highly dependent local economies
- increased average temperatures extending the shoulder season along the South Coast for summer recreation (a positive impact)
- sea level rise impacting the natural assets on which tourism in the coastal sub-region depends, including beaches and estuaries
- increased extreme weather related hazards, including intense storm events, flooding and bushfires, directly impacting on tourists and tourist facilities such as camping areas, caravan parks, beachside resorts and other tourist accommodation in exposed areas
- increased extreme weather related hazards directly impacting on transport infrastructure, including roads, bridges, rail and airports, and preventing tourists from accessing the region at critical times of the year
- increased motor vehicle fuel costs arising from climate change mitigation policies and peak oil impacts may make tourists prefer less distant destinations.

## Factors affecting adaptive capacity

- **Growing difficulty insuring private assets against flooding and bushfire –** With the potential for increases in extreme events under climate change, local experts identified that insurance premiums may rise, or insurance may no longer be available for private assets. This could lead to changing expectations about the role of the state government in providing disaster recovery support.

Stakeholders also identified the negative impacts on local towns and villages from NSW residents working in the ACT. Workers use the services and shopping facilities in Canberra, thereby challenging the long-term economic sustainability and social wellbeing of these towns.

### Potential regional strategies to reduce vulnerability

A range of options to address economic sustainability were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Understand the dynamics of business viability to identify ‘tipping points’ for business closure in order to assist planning and avoid loss of viability.
- Build regional tourism resilience by exploring ways to reduce dependence on a single season, by changing focus to whole of season tourism to promote and market regional diversity and broaden regional appeal both in the alpine and coastal sub-regions.

## Workforce

### Climate change impacts

Five sectors (tourism, infrastructure, water, primary industries, and landscapes and ecosystems) identified a diversely skilled, regional workforce of sufficient size as critical to adapting to the impacts of climate change. However, since sectors vary in the extent to which their current workforce matches these criteria, workforce planning to adapt to climate change might need to be sector specific.

Sector specific issues are outlined below.

*‘Regions generally have lower income and higher unemployment than the state average. It is increasingly difficult for local government areas away from the coast to attract qualified planners/engineers without paying a substantial premium. However, the capacity of regional communities to pay such premiums is being eroded by an ageing population.’*

Human settlements sector workshop

- **Tourism** – Seasonal snow-tourism workers and some service related businesses are generally well adapted to changing seasonal work demands, with transferable skills and mobile assets that allow them to relocate to other areas outside the snow-season. In contrast, resort businesses were identified as being relatively more vulnerable, because they are tied, not only to climatic conditions, but also to high-value, location-based physical assets.
- **Natural resource management (NRM)** – Workforce capacity is constrained by the ability to attract professionals, particularly employed in local government. The landscapes and ecosystems sector and water sector both identified sub-regional differences in the workforce and leadership skills of landholders as significant contributors to vulnerability to climate change.
- **Agriculture** – The impacts of an ageing population, economic viability of farming and prolonged droughts also have implications for the adaptive capacity of the agriculture workforce.
- **Water** – The region’s current skills-base appears to be well placed to adapt to the impacts of climate change, due to an availability of skilled staff across the region. However, the ACT and surrounding local government areas have a higher density of skilled people compared with other more rural parts of the region. In other locations, for example Eurobodalla, the skills-base is enhanced by retired professionals being involved in the community engagement process.
- **Infrastructure** – Workforce issues are a key factor contributing to regional vulnerability of infrastructure to climate change. An ageing workforce and low staff retention are major constraints for maintaining energy and road infrastructure, the need for which will grow as the impacts of climate change become more profound. Specific areas of vulnerability include:
  - **Road maintenance** – A large proportion of council road maintenance plant and machinery operators are ageing. In addition, council and the region must compete against the mining industry when recruiting staff. Similarly, Snowy Mountains Hydro-electric Scheme workers have been maintaining roads in the region for 40–50 years, and their experience will soon be lost through retirements.
  - **Energy** – The average age of Country Energy technical staff is 58 and increasing. Retraining of ageing workers to fill vacancies is difficult and gives rise to a generational divide in regional areas: older workers with experience but limited computer skills compete for positions with apprentices who have computer skills but lack experience. In addition, the nature of the work in the infrastructure sector has changed and is now seen as ‘grossly administrative’ rather than hands-on, further reducing the attractiveness of employment in the infrastructure sector and the capacity to adapt to increasing impacts on infrastructure maintenance.
- **Health** – The health sector finds it hard to attract skilled health professionals to the more remote parts of the region, in particular the smaller towns in the Southern Tablelands.

### Potential regional strategies to reduce vulnerability

A range of options to address economic sustainability were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Explore ways to pool council resources to compete in the skilled workforce market.
- Increase the intake and retention of the workforce in the region. Incentives may include lifestyle promotion, tax concessions and education and sponsorship opportunities.
- Expand communication of NRM issues and policy to the community and elected local government representatives to build understanding of the need to adequately resource the area with skilled staff.
- Facilitate leadership training for landholders and primary producers and provide greater opportunities to employ these leadership skills in regional communities.

### 3.1.3 Land-use change

Changing land use was a significant theme cutting across discussions in all the sector workshops, and driven by factors beyond climate change. For example, changing demographics are influencing settlements and housing design, as well as the economic sustainability of employment areas and local and regional infrastructure servicing communities.

One of the biggest change drivers is the growing demand for rural residential properties in the region, as more people seek 'lifestyle' properties on the South Coast and rural residential properties within commuting distance of Canberra. Since ACT planning policies restrict rural residential subdivision, the burden of demand for this type of housing falls on adjacent NSW local government areas. The resulting fragmentation of rural lands creates pressures on rural landscapes and agricultural land uses.

Part of this issue is that subdividing agricultural land is an attractive option for farmers seeking to fund retirement or a cash injection to continue operating. This is likely to increase as an indirect response to climate change, as the economic pressures associated with prolonged or more frequent drought amplifies the ongoing processes of structural adjustment in agriculture.

As a result, current and future land-use planning strategies, particularly relating to rural residential subdivision, have significant influence on regional vulnerability to climate change, with significant impacts across multiple sectors.

*'High agricultural land values on the coast and along the Sydney–Canberra corridor are resulting in fragmentation of valuable farmland. Climate change scenarios for the region suggest the need for fewer farms that are of increased size to ensure a viable agriculture sector, but land value works against this type of restructuring.'*

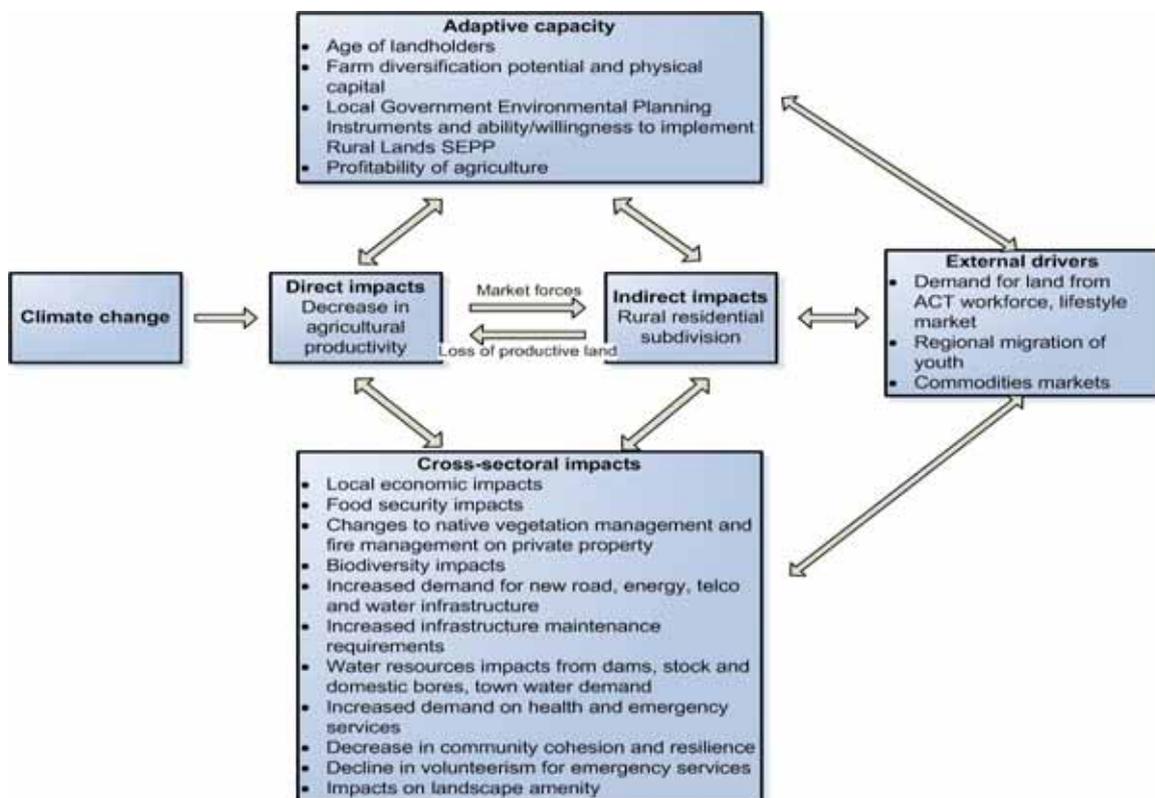
Primary industries sector workshop

## Climate change impacts

IRVA participants identified that rural residential subdivision, driven by climate change and other pressures, has multiple indirect or flow-on impacts, including:

- decreasing land used for agricultural production, affecting the regional economy
- decreasing the local fresh food security/supply
- changes to vegetation management on private land and in the extent and condition of remnant vegetation (not always viewed as negative)
- increasing pressure on groundwater aquifers (many unmapped) from a large increase in the number of stock and domestic bores, since each property has landholder water access rights
- greater need for buffer zones and hazard reduction to protect a greater number and density of residential dwellings and associated infrastructure from the projected increase in frequency of bushfires
- increasing need to construct and maintain new infrastructure to service rural residential subdivision at cost to local government
- increasing demand for health and emergency services, due to increased development
- a potential decrease in tourism, as visitor-attracting rural landscapes change to less scenic peri-urban landscapes.

Figure 6 shows the dynamics between the direct and indirect impacts outlined above and adaptive capacity, which is discussed below.



**Figure 6: Direct, indirect and cross-sectoral impacts due to land-use changes**

## Factors affecting adaptive capacity

- **High land values** – Participants identified that high land values could work against restructuring to form the larger farms needed to make agriculture viable, because of the difficulty in financing land purchases for agriculture. Continued rural residential subdivision has the potential to exacerbate the impact of climate change on the agricultural productivity of the region.
- **Current land subdivision planning tools** – Currently there are issues implementing land subdivision and planning tools including Local Environment Plans, the Minimum Lot Size Framework and the Rural Lands State Environmental Planning Policy. Representatives of multiple sectors agreed that there could be a role for the NSW Government to assist local government in applying land-use planning policies relating to rural residential, including through provision of information articulating the full impact of subdivision on natural resources and food production.
- **Rural residential subdivisions create a larger standard housing model** – There is less incentive for developers to promote more efficient house design, because of the higher cost of altering standard housing designs to incorporate sustainability. In addition, while newly constructed homes may comply with environmental standards, the sheer size of the homes and the subsequent alterations and additions may undo sustainability gains and reduce sustainability. These houses may therefore make communities more vulnerable to the impacts of climate change, relying on electricity for heating and cooling, which may become increasingly unaffordable.

## Potential regional strategies to reduce vulnerability

A range of options to address vulnerability arising from land-use change were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Create more opportunities for communication and engagement in the planning process between state and local government on NRM issues.
- Review the scope to account for primary production when deciding on LGA minimum lot size planning in a given locality (such as Upper Lachlan LGA is currently undertaking).
- Further incorporate natural hazard risk and emergency management needs into planning of land use and construction of infrastructure.
- Raise regional awareness of the impact of climate change on food resources and food security in NSW, to assist in holistic planning for the region.
- Work to enhance the capacity to undertake planning that balances natural and social capitals, to help chart a future course for adaptation.
- Commission research into the impacts of rural residential development on the region's natural resources and primary production.
- NSW Government or local government create regional and local development scenarios to assist in planning the region's adaptive capacity and inform future growth plans.
- Encourage climate change impacts and adaptation measures to be incorporated into long-term regional planning and strategies.

### 3.1.4 Ecosystem functions and services

The region's ecosystems' functions and services are vital in supporting the environmental, social and economic viability of the region. The IRVA process identified a range of climate change impacts affecting ecosystems that may contribute to regional vulnerability to climate change.

#### Climate change impacts

Those identified included:

- changes to hydrological functioning due to changes in rainfall intensity and seasonality affecting wetlands and rivers, decreasing aquatic and wetland biodiversity and ecosystem function
- increasing soil erosion due to greater rainfall intensity compromising the health of the region's soils and waterways
- changes in the climate leading to changes to terrestrial species and their habitats/ranges
- changes to remnant native vegetation extent and condition, changes in bushfire regimes and longer-term impacts of weed invasion affecting biodiversity and ecosystem function
- increasing saltwater intrusion into estuaries and groundwater and associated salinity issues, decreasing terrestrial biodiversity and ecosystem function, with the potential for species extinction
- increasing frequency and intensity of bushfire putting natural resource managers under pressure
- increasing frequency and intensity of bushfire leading to land managers clearing vegetation buffer zones; this in turn affects the extent and condition of remnant vegetation
- diminishing availability of water in the landscape for allocation to the environment, leading to increased competition for water resources
- changes to pasture species and growth affecting agricultural productivity, leading to increased grazing intensity, loss of ground cover and decreasing terrestrial biodiversity and ecosystem function.

#### Cross-sectoral impacts

- **Threats to natural resource-based industries** including the agriculture, forestry, fisheries and tourism sectors (discussed in Section 3.1.2) as a result of some ecosystems being diminished, for example the snow-dependent alpine ecosystems, or coastal lakes inundated by sea level rise. The natural resources sector forms the mainstay of several local economies in the region both directly, and through its need for products and services supplied by local business operators, for example, the alpine and coastal sub-regions' tourism economy. Thus, changes in climate that impact on ecosystems may reduce the profitability of local businesses via the impacts on natural resource-based industries.
- **Weed threats** – Some exotic species in regional ecosystems may be favoured by changes in climate and emerge as serious weed threats. Fragmentation of the landscape also inhibits adaptive capacity, by reducing the options for species to migrate in response to changing climate conditions.

Note: The interactions between impacts on biodiversity and ecosystem function and the agriculture sector are highly complex. A better understanding of the resulting indirect impacts and what they mean for local agricultural systems will assist in adaptation planning and ensure biodiversity values are protected. For example, understanding how NRM practices (such as retention of ground cover in agricultural production systems), soil health (in particular soil organic matter) and catchment hydrology interact is essential for adaptation in the primary industries sector.

*'Climate change may result in alteration of natural landscapes, culminating in the loss of some ecosystems. Consideration needs to be given to what the appropriate composition of the landscape should be to ensure resilience and protect environmental assets with the greatest chance of survival.'*

Landscapes and ecosystems sector workshop

### Factors affecting adaptive capacity

- **Economic pressures on agricultural productivity** – This limits the time and resource available for conservation initiatives and improved land management practices.
- **Configuration of rural fencing** – The appropriate configuration of rural fencing can be vital to conserve remnant vegetation and biodiversity corridors on farm and to improve stock management.
- **Profile of climate change issues** – Where climate change issues have a low profile, workshop participants identified that leadership and action are less likely. For example, in the coastal sub-region, the community is passionate about conservation issues such as the koala, but lack the interest and skills to deal with other natural resource issues.
- **Stakeholder coordination** – Government agencies need to coordinate efforts and resources. For example, biodiversity conservation could be improved through a whole of government approach and incorporation of natural resource information into land-use and development decision-making.
- **Funding and investment models** – Funding and investment models should be assessed with a view to protecting ecosystems by prioritising funding to stakeholders across the region. For example, CMA resources are being shared with local government in some areas of the region, but this needs to be increased.

### Potential regional strategies to reduce vulnerability

A range of options to address vulnerability due to ecosystem function and service loss were identified in the workshop. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Develop better understanding of the impact of the combined effects of ecosystem change and the potential retreat to the east of the NSW cropping zone for local agricultural systems.
- Make greater use of models using landscape configuration and habitat matrices to help ensure effective conservation in the face of landscape change.

- Conduct research into weed ecology, in particular population dynamics under changed climatic regimes.
- Build regional tourism resilience by shifting focus to whole of landscape tourism to promote regional diversity and broaden regional appeal.
- Develop improved understanding by land managers and water professionals of the relationship between soil health, storage of moisture in the soil profile and runoff into rivers.
- When planning new human settlements, consider vegetation fragmentation to help reduce impacts on natural landscape function.
- Encourage expansion of the period of use of natural resource-based tourism assets, such as a expanding from winter- to summer-based tourism for alpine areas.
- Encourage further research into the region's ecosystems, for example alpine species and saltmarsh communities on the South Coast.

### 3.1.5 Regional infrastructure

The region has a great diversity of infrastructure assets, including water, transport, energy and telecommunications, which are particularly sensitive to changes in natural hazards. All sectors depend on the regional infrastructure assets, with dependency likely to increase as population growth increases the demand for energy, roads and water infrastructure.

The region's infrastructure assets include transport (roads, rail and bridges), energy (the Snowy Mountains Hydro-electric scheme, substations and powerlines), communication, emergency services and water infrastructure (e.g. pipes and dams). While these assets have been designed, built and operated in a variable climate, climate change is likely to cause more frequent and intense natural hazards, increasing the risks to the region's infrastructure.

Adaptation planning must take into account the fact that sensitivity to climate change varies between types of infrastructure. For example, energy infrastructure has processes to address vulnerability in the region; whereas, sensitivity is relatively high for roads, which have a long asset lifetime and less flexibility in construction and design.

#### Climate change impacts

Workshop participants identified that climate change may make asset and system failure more likely, expand infrastructure maintenance requirements, and increase costs to infrastructure owners and managers. All aspects of infrastructure management could be affected, from planning, through construction, routine maintenance regimes and resources and upgrade frequency. Assets and maintenance regimes are likely to be primarily exposed through:

- changes to rainfall seasonality, intensity and runoff
- increasing extreme weather related natural hazards, particularly flooding and storm damage on the South Coast
- increasing coastal erosion and inundation as a result of sea level rise
- increasing frequency and intensity of bushfires
- increasing storm and flood damage to road assets (short term)

- heatwaves affecting rail infrastructure
- sea level rise inundating assets (long term)
- increasing drought reducing the power generation capability of Snowy Hydro, with potential flow-on economic impacts to the community.

### **Cross-sectoral impacts**

Across the IRVA process multiple flow-on impacts for potential damage to infrastructure were noted. These include:

- 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 and resulting in a greater requirement for emergency response and healthcare services
- damage to road infrastructure increasing safety risks to community.

*‘Community transport services in regional areas are very poor. This can lead to logistical issues in the event of an evacuation of aged care or sick people during an emergency. Inaccessibility of some buildings and lack of volunteers to drive transport vehicles compounds this situation.’*

Emergency management sector workshop

### **Factors affecting adaptive capacity**

- **Placement of infrastructure assets** – The placement of infrastructure assets has the potential to increase pressure on emergency management infrastructure. For example, housing development in flood or fire prone locations may contribute to regional vulnerability.
- **Placement of emergency management infrastructure** – For example, many emergency control centres are currently sited in areas exposed to natural hazards, with this exposure projected to increase due to climate change. They also have limited access and communications, inhibiting the sector’s capacity to adapt to increasing demand. For example, mobile phone coverage at the Yass emergency communications centre is poor, potentially hampering operations.
- **Adequacy of infrastructure for current and future conditions**
- **Resources and funding to upgrade or retrofit assets** – Local councils struggle to find resources in their works programs to maintain critical emergency management infrastructure, particularly in the more isolated parts of the region. For example, many important regional roads are unsealed. While the extent of the local road network remains intact, frequency of council resurfacing/grading is being reduced due to inadequate funding. Councils fear that extreme rainfall events likely to occur under climate change will increase the need for maintaining and resurfacing unsealed roads, further widening the gap between the funding available and the cost of routine infrastructure maintenance.

- **Emergency services infrastructure** – Workshop participants identified instances where emergency services face difficulties getting access and communications coverage. Roads and bridges provide access to regional towns for emergency services; however, this infrastructure may be inadequate for current or future conditions. For example, the main route into the township of Dalgety is currently via a single bridge with a restricted weight loading, which would be exceeded by heavy fire-fighting vehicles.
- **Beach protection** – There is potential for ineffective coastal protection infrastructure such as breakwaters to be constructed in response to erosion threats. Such structures cannot withstand the impacts of sea level rise, hampering the adaptation of coastal ecosystems.

*'Local government rate pegging ensures a funding shortfall that will increasingly affect the ability of local government to respond to climate change. Communities appear to be increasingly reluctant to apportion their wealth to the maintenance of essential public infrastructure through council works programs, so that a regional community's ability to cope with climate change is being eroded.'*

Infrastructure sector workshop

### **Potential regional strategies to reduce vulnerability**

A range of options to address vulnerability of regional infrastructure were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Strategically plan for local and regional infrastructure based on best available climate change data. Infrastructure plans could consider emergency service requirements and existing tolerance of structures and materials. These considerations can reduce regional vulnerability to climate change into the future.
- Undertake a strategic audit of infrastructure assets to assess the exposure/risk to climate change impacts and importance of service to the community. These assessments can then be reflected in reviews of asset management plans and budgets.
- Use existing networks between regional infrastructure providers and councils to encourage undertaking strategic planning.
- Ensure the design of future aged care facilities considers easy access of emergency services vehicles for both evacuation and response teams.
- Consider the implications for emergency management to service new housing developments exposed to natural hazards, such as flooding or bushfire, at the strategic planning stage.
- Assess the direct and indirect impacts on ecosystems of investing in new infrastructure.
- Ensure adequate redundancy in communications systems (mobile phone networks) to cope in the event of increasingly severe natural disasters.

### Potential regional strategies to reduce vulnerability (continued)

- Leverage the close connections between regional energy and road infrastructure providers and local government to plan infrastructure maintenance and share information. For example, the Regional Asset Managers in state agencies and local government have maintenance agreements for local road works, and Country Energy supports a regional advisory group and is working with local government in the Bega Shire on the Smart Metering Pilot Project.
- Continue working with communities on savings programs to decrease overall demand for energy and water.
- Ensure local and state governments incorporate consideration of emergency management access in new developments, particularly aged care facilities or those likely to be affected by flooding.
- Support the continued evolution of engineering standards to incorporate tolerance of future climate in developing new or retrofitting existing infrastructure.

## 3.1.6 Community

### Climate change impacts

The IRVA process identified that current trends in both the population and the age structure of communities are exacerbating the declining resilience of the community, and ultimately increasing regional vulnerability to climate change.

As the population ages, it increases pressure for health care services, reduces social cohesion, decreases the paid workforce available for health and emergency responses and limits the number of emergency service volunteers, decreasing the community's ability to cope with extreme weather events. An ageing population is also more likely to be more vulnerable to injury in the face of extreme weather events such as heatwaves and bushfires.

### *Emergency management*

#### Factors affecting adaptive capacity

A number of factors are limiting the ability of emergency management agencies to effectively respond to the increasing frequency of natural hazards expected under climate change. They include:

- **Short-term coping skills** – Individual households are less experienced at coping without assistance for short periods (up to 3 days) following an emergency situation. This may leave the region vulnerable to the increase in extreme weather events projected under climate change. The community needs to build understanding of the importance of basic levels of self-reliance in emergency preparedness.
- **Social networks within agricultural communities** – Driven by increasing economic pressures on agricultural productivity and declining populations of inland farming communities, social networks are becoming less robust.
- **Community cohesion** – Changes in demographic and community structure are leading to a loss of community memory around the impact of hazards or extreme events as well as ways to manage those events.

- **Higher expectations of emergency service provision** – Increasing numbers of people relocating to the region from well-served urban locations can increase expectations of emergency service provision.
- **Emergency management volunteer base** – Emergency managers are facing growing difficulties in attracting a volunteer base, which is increasing the risk to existing volunteers and ongoing service provision.
- **Cross-service planning** – There is potential to improve the sharing of resources across the different services. Sharing information and resources has improved significantly since the 2003 Canberra bush fires. In general, the operational response of the sector is increasingly better coordinated, but future increases in the frequency and intensity of extreme weather events projected under climate change will place extra burdens on these services.

Note: 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 government services. However, in coastal villages the ageing population could reduce local self-reliance in the future.

#### **Potential regional strategies to reduce vulnerability**

A range of options to address community vulnerability were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Run regional community awareness programs about emergency preparedness and the need for local community cooperation, with a variety of stakeholders.
- Design awareness or education programs to increase the community's short-term coping ability in the face of weather related extreme events.
- Consider the impact of land-use planning decisions on the ability of emergency management to service these new communities.
- Encourage a regional focus with a variety of stakeholders on emergency management preparedness.
- Emphasise benefits of preventative care in the community to decrease reliance on emergency services.
- Provide incentives to employers to support their employees to volunteer for emergency and community services.

## Health

### Climate change impacts

The workshop participants identified a range of impacts on health that may result from climate change:

- increasing mental health issues associated with coping with greater extremes in climatic conditions
- more frequent heatwave events will increase the incidence of heat-related illness/heatstroke, particularly for the most vulnerable in the community
- more frequent natural hazards will make injuries in the community more likely, increasing demands on healthcare and emergency services and for volunteers
- climate change impacts reducing the economic viability of agricultural production could raise the incidence of anxiety/depression, mental health impacts, or substance abuse, particularly among farmers.

*'Fundamental to community resilience in health are a prevention health care strategy and improvements in social cohesion to ensure people take responsibility for their own health and that of vulnerable members of the community. Recognition of the connectedness between health and other regional issues such as schools, housing and water is central to adaptation. Improving community resilience in health can reduce pressure on emergency health services during extreme climate events.'*

Health sector workshop

### Factors affecting adaptive capacity

- **'Creeping' health impacts** – Examples are rising levels of obesity, diabetes and declining fitness, especially affecting the elderly and disadvantaged.
- **Personal responsibility** – The ability of individuals to take responsibility for their health and care for vulnerable community members will make a significant difference to the degree of impact that climate change has.
- **Patient flow to the ACT** – Canberra provides a significant level of health services to communities from across the South East NSW region. Areas close to the ACT have advantages of proximity to these services as Canberra is well serviced with specialist health professionals. However, these services may not be as readily available in other parts of regional NSW. This leads to patient flow from the region to the ACT, with funding following the flow of patients. In addition, although transport to Canberra for specialist care involves long travel times, in many cases this is not sufficient for patients to qualify for financial support to cover their travel costs.
- **Data sharing between ACT and NSW government agencies** – Formalised information sharing protocols on patient flow and servicing between the ACT and NSW governments would assist planning in the health sector.
- **Integrated resources** – Integration between departments could assist small communities to access a greater range of services. For example, the NSW Department of Family and Community Services has responsibility for providing ageing, disability and home care services. However, in some small communities NSW Health may be the only local service provider.

### **Potential regional strategies to reduce vulnerability**

A range of options to address vulnerability in the health sector were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Employ indicators of health sector performance that report improvements to primary health care rather than acute care, to demonstrate the importance of healthy lifestyles in reducing the demand on health services.
- Expand prevention health care strategies and programs to help increase acceptance of personal responsibility for one's own health and that of vulnerable members of the community.
- Integrate health care services into scenario planning for extreme events, involving a variety of stakeholders.
- Explore opportunities for collaboration to facilitate a holistic services network providing multipurpose services drawn from the pooled resources of a number of human service agencies.
- Establish formalised information sharing protocols on patient flow and servicing between the ACT and NSW governments.

## **3.2 Existing management and planning structures**

Across all sectors, issues associated with governance and institutions emerged as critical to managing cross-regional vulnerability and adaptive capacity. These issues included:

- resource sharing among the ACT and NSW governments and within the NSW government
- support for regional institutions that focus on regional issues and policy
- policy settings required to facilitate change in the primary industries and health sectors
- organisational and sectoral funding models
- the need to value the role and involvement of community- and industry-based organisations
- need for regionally focused research and development.

The fact that both ACT and NSW government agencies participated in the South East IRVA was seen as positive and likely to enhance resources available for adaptation.

### **3.2.1 Regional institutions**

#### **Factors affecting adaptive capacity**

Factors identified included:

- the level of focus on regional policy and encouragement of community debate on regional issues, not simply local issues
- the benefits of networking need to flow down through local government administrative hierarchies
- lack of knowledge and differing views in relation to climate change of elected local government officials, which could hamper planning and action on adaptation.

### Potential regional strategies to reduce vulnerability

A range of options to address vulnerability in existing management and planning structures were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Support the establishment of Regional Organisations of Councils, for example South East Regional Organisation of Councils (SEROC), as required. Developing SEROC will provide greater regional interaction, inclusion and collaboration. In addition, regional policy could be discussed collectively.
- Develop and promote cross-sectoral and multi-level governance for information and resource sharing.
- Explore scope for regional resource and development institutions to work more closely with state and local government on priority local issues.

## 3.2.2 Policy

### Factors affecting adaptive capacity

- **Agriculture funding schemes** – Many of these schemes are currently under review (e.g. drought assistance policy) and schemes may change over the next 50 years. Farmers hold mixed views on many of these policies, some believing they entrench poverty and stifle industry adjustment. In addition, some industries (e.g. livestock) fear they will be vulnerable to climate change mitigation policies such as the Clean Energy Legislation, which could act to increase pressure on already marginal production systems.
- **The tax system** – By impeding farm amalgamations and discouraging landholders from generating income by managing other properties, the current taxation system was identified as being a possible barrier to industry adjustment. In addition, tax disincentives, coupled with land values inflated by rural residential subdivision, preclude landholders from buying extra properties.
- **Regional planning** – Decision-makers need to better understand the full range of benefits from natural ecosystems for social and economic systems within the region; for example, the need to preserve the landscape and its flow-on benefits for tourism and lifestyle values.
- **Ongoing government recognition of the importance of building social capital** – Building social capital was seen as being similar to maintaining other assets as it requires continued long-term support and maintenance to function effectively. For example, CMAs noted the difficulty in ensuring that the federal government continues funding capacity-building programs over the long term.

### Potential regional strategies to reduce vulnerability

A range of options to address policy issues were identified in the workshops. These could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Provide clear policy signals to the primary industries sector to allow industry structural adjustment for climate change.

- Ensure land-use planning policies encourage preservation of the natural features of the landscape where possible.
- Make capacity building programs long-term and strategic.
- Lobby the federal government for funding dedicated to establishing and maintaining community engagement processes to build social capital over the long term.

### 3.2.3 Funding models

#### Factors affecting adaptive capacity

The IRVA participants identified a range of issues in the way funding models for adaptation currently operate, particularly in relation to resources for local government actions. These issues include:

- **Funding for disaster mitigation planning** – Funding from both state and federal governments is available to promote mitigation planning for reducing vulnerability to extreme events. However, this funding can be difficult to obtain if the organisation does not have the skills or resources to access it.
- **Disaster mitigation strategies** – A change in focus to prioritise funding for emergency planning could allow the sector to avoid problems. Making funding equitable across the region may not provide the best value but rather lead to partial or patchy strategies.
- **Local councils' contribution to emergency services** – Councils are required to have a LEMO (Local Emergency Management Officer), but as a result of increased demands on financial resources coupled with revenue-raising caps, they are often not dedicated positions and their capacity may be limited.
- **Health funding** – Some stakeholders believe health funding should focus on funding for community health care outcomes, which would promote resilience in community health and support adaptation to climate change.
- **Natural resource investment tools** – Tools are needed to cover a whole spectrum of natural resource activities and ensure participation by the greatest number of landholders, including: incentives, stewardship payments and ecosystem service payments covering activities from improved grazing management to private vegetation conservation. Short funding cycles (i.e. one year), are reducing the capacity to adapt to the impacts of climate change on biodiversity and ecosystem function. The Kosciuszko to Coast project (a component of the Great Eastern Ranges project) is an example of an effective stakeholder partnership involving long-term funding horizons. It has led to improved communication, less duplication of effort and inter-agency/group competition, and a landscape investment focus that redirects funding for mutual benefit.
- **The water funding model** – The current model is based on the amount of water sold rather than on the direct costs of water planning, maintenance and security. Water planning at local government level may be inhibited by concerns that such arrangements may lead to water utilities being separated from local government administration, with a consequent loss of revenue from water sales. This is of particular concern since water rates, unlike property rates, are not currently pegged in NSW.

### **Potential regional strategies to reduce vulnerability**

A range of options to address vulnerability due to funding issues were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Encourage the federal government through the Grants Commission to examine funding regions based on climate change needs, to promote adaptation.
- Better publicise funding opportunities in emergency management and infrastructure and support risk-based assessment of applications.
- Assess potential for current emergency management and NRM funding models to incorporate vulnerability reduction and promote climate change adaptation.
- Assist local government in emergency planning, with training and support for staff dedicated to emergency services.
- Implement the recommendations of the recently released National Disaster Resilience Strategy to build community resilience and regional assets from the ground up.
- Consider innovative funding models for the design and implementation of landscape repair (e.g. establishing a 'carbon bank' to offset electricity generation in the ACT) to reduce sectoral vulnerability to climate change.
- Consider use of philanthropic funds or a lottery to fund environmental remediation.
- Encourage the incorporation of an assessment of infrastructure adaptation needs in local government asset management plans.
- Use the State Natural Hazard Risk Assessment to prioritise funding for emergency management.

### **3.2.4 Community and industry organisations**

#### **Factors affecting adaptive capacity**

- **Recognition and support for community and industry organisations** – Groups such as Landcare and churches are important in helping to manage climate change impacts. In addition, these groups develop a region's social capital. This contribution may not be properly valued, leading to insufficient resources being available to develop and maintain regional social connections.
- **Variable strength of industry organisations** – NSW Farmers is important in fostering adaptation to climate change by allowing landholders to participate in national forums and processes and facilitating access to information locally. Similarly, dairying is well connected, with its industry body disseminating findings from the North Coast industry on milk production under heat stress to benefit South Coast producers. Other industries, such as viticulture and intensive livestock (e.g. poultry and pigs), were also viewed as effectively organised. However the wool industry, extensive grazing industry and wheat industry may be more vulnerable to climate change due to less structured or extensive industry organisations.

### **Potential regional strategies to reduce vulnerability**

A range of options to support community and industry organisations to adapt were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Work with industry bodies to increase their capacity to support their farmers, to reduce the overall regional vulnerability to climate change.
- Maintain support for the activities of Regional Tourism Organisations (RTOs), which are a conduit for information on issues that individual operators do not necessarily have the time or skills to access.

### **3.2.5 Research and development**

*'The South East NSW region is well endowed with academic institutions (CSIRO, ANU and University 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 regional issues.'*

Water sector workshop

#### **Factors affecting adaptive capacity**

- **Research and development capability within government agencies** – Government agency scientists have traditionally driven the adaptation and diffusion of global and national scientific findings for the regional environment and context.
- **A nationally-focused science agenda** – Research capacity is not focused on regional issues.

### **Potential regional strategies to reduce vulnerability**

A range of options to improve research and development in relation to climate change adaptation were identified in the workshops. These suggestions could be considered in an adaptation plan, where their appropriateness would be assessed in the context of other initiatives and priorities. Suggestions included:

- Ensure data from the NSW and ACT Climate Modelling Project is made available for regional stakeholders.
- Leverage the region's well established academic institutions (CSIRO, ANU and University of Canberra) to provide regionally relevant knowledge generation.

## 4 South East NSW regional context

The South East NSW region is one of 13 planning regions within the state. It covers an area of more than 60,000 square kilometres of the south-eastern corner of NSW (Figure 8).

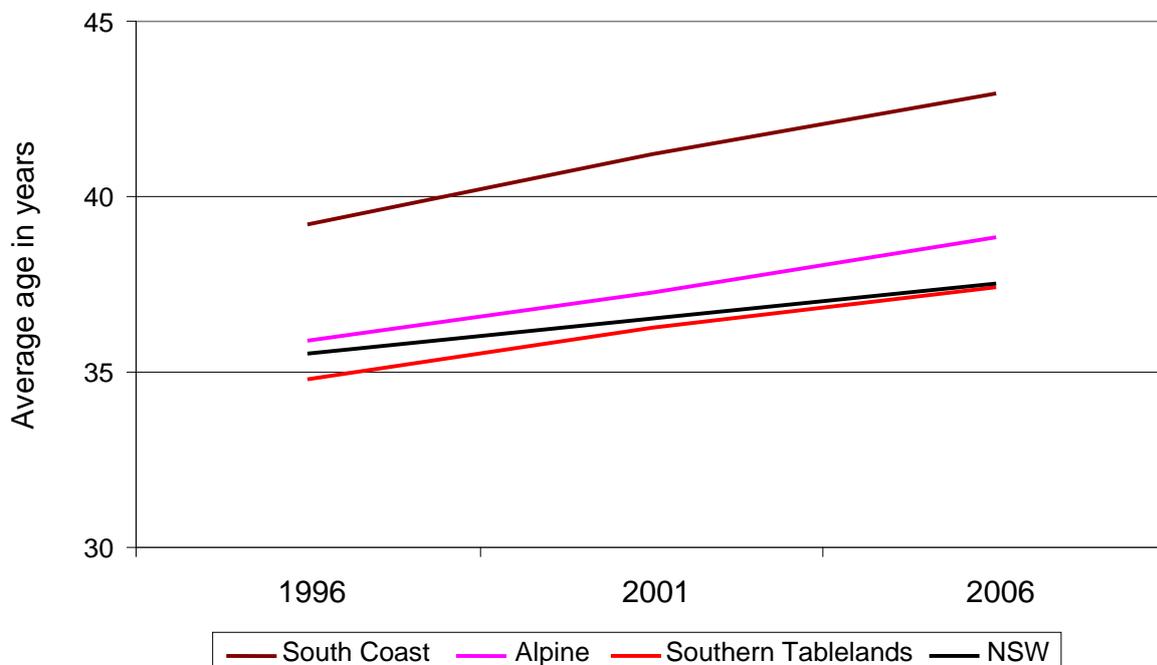
The major urban centres in the region include Queanbeyan, Batemans Bay, Bega and Goulburn. The Australian Capital Territory (ACT) dominates the region's service delivery, with Queanbeyan forming part of the larger service centre of the Canberra–Queanbeyan metropolitan area. Other major urban centres include Cooma, Yass, Young, Moruya, Narooma, Merimbula and Eden.

The region can be divided into three sub-regions with different populations, environments and issues for government service delivery:

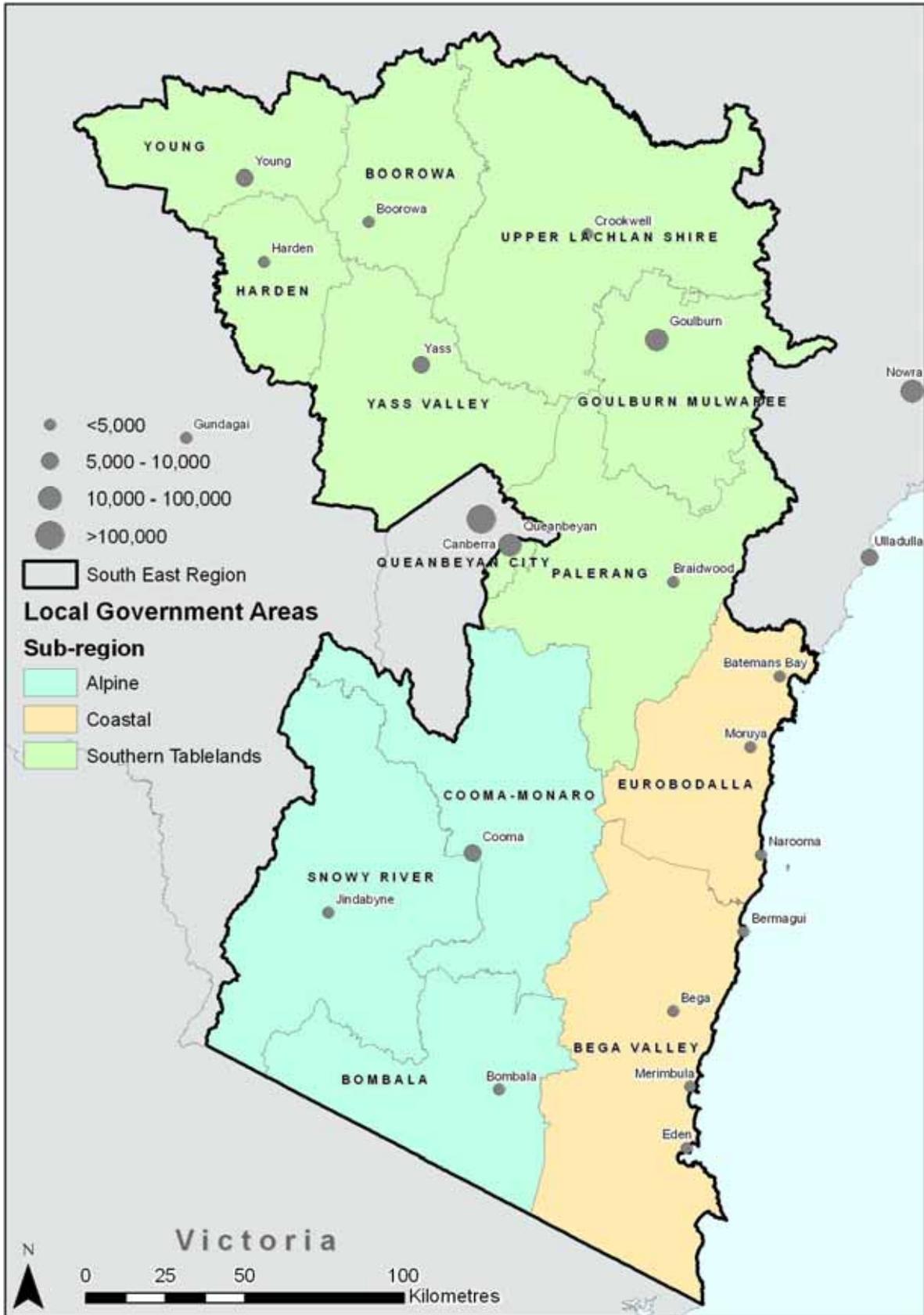
- Southern Tablelands
- alpine
- coastal.

### 4.1 Population and demographics

With a population of just over 200,000, the South East NSW region is home to 3.0% of the people of NSW (2011 Census, ABS 2012). The region's population is increasing and is projected to reach 3.2% of the NSW population by 2036 (DoP 2008b). The average age of people in the region is 42 years, which is higher than the NSW average of 35 years. This average age is also steadily increasing; however, growth is not evenly distributed across the region. Figure 7 shows the average age within each sub-region and across NSW, from 1996 to 2006, and also demonstrates the higher rates of increase within these sub-regions when compared with NSW as a whole.



**Figure 7: Average age trends 1996–2006**  
(Based on data from DoP 2008b)



**Figure 8: South East NSW region**

#### **4.1.1 Coastal sub-region**

The population of the coastal sub-region doubled between 1980 and 2006, and grew by about 15% between 1996 and 2006, which represents about three times the population growth of the state as a whole (DoP 2008b). Regional plans indicate that the population is likely to grow by a further 36% by 2031 (DoP 2007).

While the coastal sub-region has seen significant population growth, this has been due to in-migration of retirees, which has offset out-migration by youth. As a result, the coastal sub-region has an ageing population. This trend is expected to continue, with the population aged 65 years and over increasing to 35% by 2031 (DoP 2007).

Strong migration to the coastal sub-region has put productive agricultural land under pressure from urban and rural residential expansion (DoP 2007).

#### **4.1.2 Southern Tablelands sub-region**

The Southern Tablelands sub-region population is ageing; however, it has a relatively young demographic compared to most of the South East NSW region.

From 1996–2006, population growth for the Southern Tablelands was about 18% – three times greater than the rate for NSW overall (DoP 2008b). This growth has been focused on areas near Canberra, leading to:

- a high demand for urban growth and rural lifestyle housing close to Canberra
- a decline in the rural communities and centres located away from the high growth areas
- pressure on rural industries and rural communities to adapt to changing technologies and a changing economic base
- natural resource pressures (DoP 2008a).

#### **4.1.3 Alpine sub-region**

From 1996 to 2006, population growth was negligible in the alpine sub-region and is projected to remain steady out to 2036 (DoP 2008b). Bombala local government area (LGA) is expected to see a slight decrease in its small population, while the other LGAs in the region will see only incremental growth.

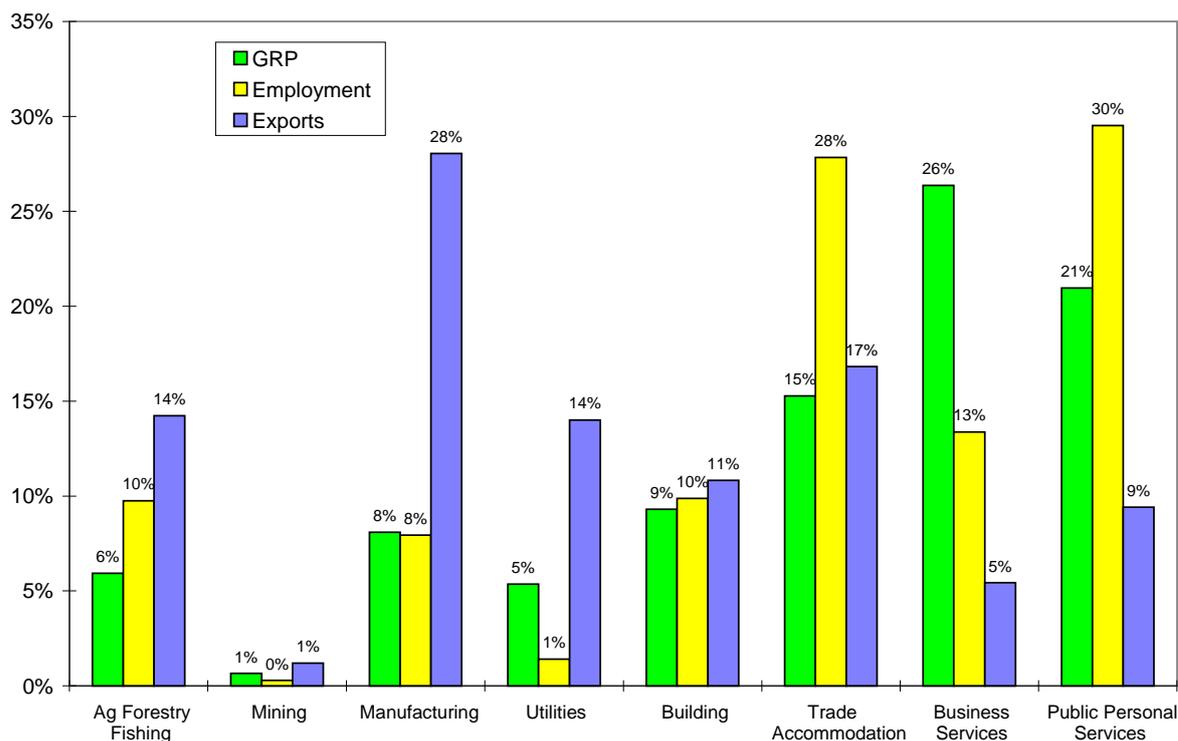
All LGAs in the sub-region are expected to experience an ageing population, with this trend most pronounced in the Cooma–Monaro and Bombala LGAs (DoP 2008b).

#### **4.1.4 Regional economy**

- Employment share for the region at 44.3% is lower than for NSW (50.1%).
- The region contributes 1.6% of the NSW Gross State Product.
- Agriculture, forestry and fishing account for 6% of the Gross Regional Product (GRP).

Figure 9 highlights the dominance of the service industries in the region; however, primary industries are vital to the local economy in parts of the region, such as dairy farming in the Bega Valley and Eden, and horticulture in Young (DoP 2007).

Alpine tourism accounts for only 3.5% of the GRP, but accounts for around 30% of the gross product of each of the three LGAs of Bombala, Cooma–Monaro and Snowy Mountains.



**Figure 9: Industry structure of the South East NSW region (2005–06)**

## 4.2 Emergency services and infrastructure

### 4.2.1 Emergency services

- The region is serviced by the Murrumbidgee and Southern NSW Local Health Districts.
- The region lies within the Illawarra/South Coast and South Eastern Emergency Management Districts.
- The region is part of the South Region of the NSW Rural Fire Services, specifically the Southern Tablelands Zone, Lake George Zone, Far South Coast Team and Monaro Team, and is serviced by the Regional South Area Command of Fire and Rescue NSW.
- The region sits within the Southern Region of the NSW Police Force Operations and is covered by the Local Area Commands of Goulburn, Monaro and Far South Coast.

### 4.2.2 Transport infrastructure

- The Princess Highway is a critical north–south transport link between Sydney, Wollongong and communities along the South Coast. The Hume and Federal highways form an important transport corridor between Sydney and Canberra.
- The Kings Highway is a critical east–west corridor linking Canberra to the South Coast.
- The Main Southern Railway from Sydney to Melbourne traverses part of the region. A spur line runs through Bungendore and Queanbeyan prior to termination in Canberra.
- The region is well serviced by airports catering to light aircraft, and Canberra airport provides connecting flights to major Australian cities, with international flights scheduled to commence by late 2012.

### 4.2.3 Water infrastructure

- There are 15 water storages in the region, with three dams used for regulating the river flows for extractors: Brogo, Burrinjuck and Wyangala.
- Many towns in the coastal sub-region rely on coastal sands and alluvial aquifers for town water.
- Cross-border water resource agreements exist with the ACT for Queanbeyan and surrounds.

### 4.2.4 Energy infrastructure

- The Snowy Mountains Hydro-electric Scheme and associated infrastructure is located in the alpine sub-region.
- The region has extensive electricity distribution and transmission networks.
- The Eastern Gas Pipeline traverses the region.
- 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.

## 4.3 Topography and land use

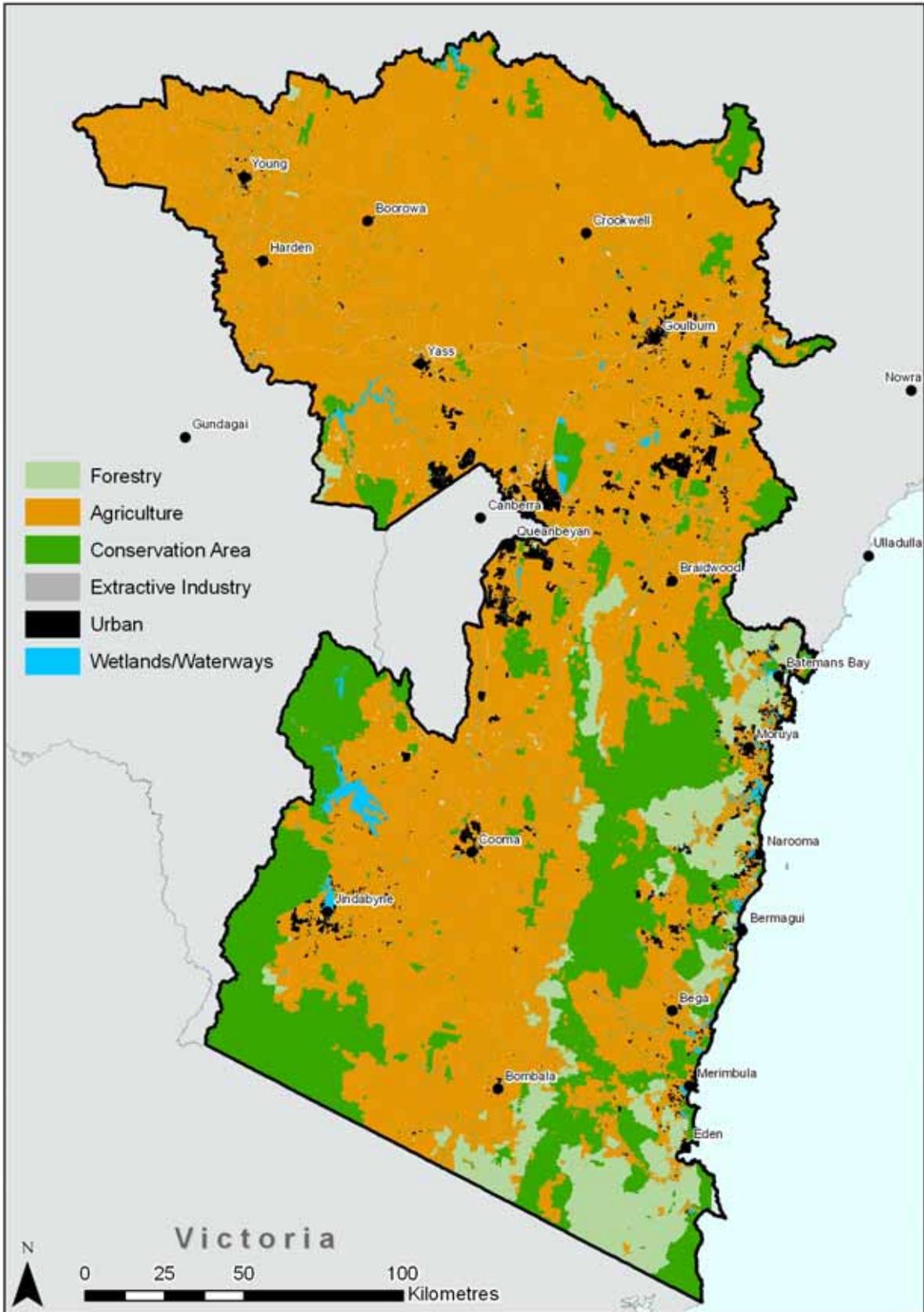
The South East NSW region makes up approximately 7.6% of the land area of NSW. The region is topographically diverse. It includes Australia's highest mountains and the sources of the Snowy, Murray, Murrumbidgee and Lachlan rivers. The region has more than 200 km of coastline stretching from Durras Lake north of Bateman's Bay to Cape Howe on the Victorian border, including the large embayments of Batemans Bay and Twofold Bay.

Figure 10 details the major land uses of the region. The region contains substantial areas of Crown reserves (62% of the NSW total), ensuring that the natural environment is a key feature of the region. Agriculture is the predominant land use of the region, with grazing land covering the greatest area (see Table 1).

**Table 1: Land use in the South East NSW region**

Land use	Area (ha)
Grazing	2,267,689
Fallow	24,863
Cropping	201,888
Remnant vegetation (private land only)	172,092
Commercial forestry plantations	68,000
State forest	364,182
National park estate	970,104

**Sources:** ABS (2008), National Plantation Inventory (2008)



**Figure 10: Map of land use in the South East NSW region**

## 4.4 Climate and hydrology

The climate of South East NSW region is predominantly cool temperate, with the higher elevation Southern Tablelands and alpine sub-regions having greater daily temperature extremes, colder winters and hotter summers than the coastal sub-region. The region experiences an average annual rainfall of 730 mm. The alpine sub-region experiences the highest averages with over 2000 mm falling on the highest peaks, and snow usually lasting for three to four months of the year. Annual rainfall totals are also high in the coastal sub-region (nearly 900 mm), but lower on the Southern Tablelands (more than 600 mm). The Monaro is in a rain shadow, where average rainfall is relatively low at 530 mm per year. The seasonality of rainfall varies across the region. Rain is fairly uniformly distributed among seasons in the Southern Tablelands, slightly dominant in summer and autumn in the coastal sub-region, and dominant in spring and winter in the alpine sub-region.

### 4.4.1 Climate change in the South East NSW region

Consistent with global trends, by 2050 the climate in the South East NSW region is virtually certain to be hotter, with a likely rainfall increase in the summer and a decrease in the winter. Snowfall is likely to decrease. Runoff and stream flows are likely to decrease in spring and winter, particularly in the west, and increase in summer. Summer rainfalls are likely to increase the rate of sheet, rill and gully erosion (DECCW 2010). Changes in weather patterns in the coastal parts of the region are currently difficult to predict (DECCW 2010).

Sea level is virtually certain to rise, leading to coastal recession and inundating agricultural soils on coastal plains. When coupled with potential increased flooding, sea level rise is virtually certain to pose an increased risk to property and infrastructure in coastal areas. Residential, commercial and public property and infrastructure near coastal lakes and estuary entrances and on coastal floodplains are vulnerable, including roads, water supplies and sewerage systems (DECCW 2010).

Coastal agricultural soils are likely to be inundated and acidification is likely to increase. Dryland salinity, currently a problem in parts of the region (especially in the lower rainfall areas of the Southern Tablelands), is likely to be exacerbated by changes to groundwater hydrology. Higher temperatures are likely to increase the activity of soil micro-organisms in the sub-alpine areas, leading to significant loss of organic matter (DECCW 2010).

Sea level rise, increased temperatures, loss of snow cover, and changes in water availability, rainfall seasonality, drought and fire regimes are very likely to cause widespread changes to some natural and semi-natural ecosystems. Snow-dependent ecosystems and many unique alpine species are very likely to disappear. Low-lying coastal ecosystems are very likely to be vulnerable to inundation and saline intrusion into the watertable. Productivity is likely to decline on the Southern Tablelands and slopes due to drier conditions (DECCW 2010).

Further details of the projected changes are provided in **Appendix A: Climate change projections and biophysical impacts for South East NSW**.

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## Appendix A: Climate change projections and biophysical impacts for south east NSW

Table A1: Climate change projections for South East NSW region

Climate variable	Trend	Projection
Average daily maximum temperature	Increase	Autumn, winter and spring – increase 2.0–3.0°C Summer – increase 1.5–2.0°C
Average daily minimum temperature	Increase	Increase 1.0–3.0°C, greater increase in the east than the west
Average rainfall	Decrease in alps and Monaro, increase in South Coast	Details of projected changes in average rainfall are uncertain, and vary across the region – more details below
Rainfall seasonality	More rainfall in summer, less in winter, sub-regional variation	Spring – 5–20% increase in central and southern tablelands, no change in ACT and south coast, 5–20% decrease in alps and Monaro Summer – increase by 20–50% all regions Autumn – no change in central and southern tablelands, 5–10% increase in south coast, 5–20% decrease in alps and Monaro Winter – 20–50% decrease in central and southern tablelands, alps and Monaro, no change in south coast
Atmospheric CO <sub>2</sub>	Increase	A2 IPCC emissions scenario

Source: DECCW 2010

**Table A2: Biophysical impacts due to climate change in South East NSW region**

Biophysical impact	Trend	Projection
Sea level	Rising	40cm by 2050, 90cm by 2100
Soil moisture	Drier conditions in southern tablelands and alps	Drying due to changes in precipitation plus evaporation increases: Spring – 10–20% increase in north of region Summer – 10–20% increase Autumn and winter – no clear pattern
Runoff	Annual minor decrease	Spring – decrease substantially Summer – increase substantially
Snowfall	Decrease	More precipitation falling as rain due to higher temps, and reduction in rainfall in spring and winter likely to reduce snow cover
Soil erosion	Increase	Sheet and rill erosion increase Gully erosion increase in summer, decrease in winter
Ecosystem function	Decrease	Widespread changes in natural and semi-natural ecosystems, snow-dependent ecosystems likely to disappear, low-lying coastal ecosystems vulnerable to inundation and salt water intrusion. Productivity likely to decline on the southern tablelands and slopes
Salt water intrusion	Increase	Settlements and ecosystems in low-lying areas are vulnerable to salt water intrusion and erosion

Source: DECCW 2010

**Table A3: Changes to natural hazards due to climate change in South East NSW region**

Natural hazard	Trend	Projection
Heatwaves	Increase in frequency and intensity	Heatwaves are projected to become more severe because of higher temperatures as a result of climate change. They are also likely to become more frequent, but projections are dependent on mid-latitude circulation patterns
Bushfire	Change	More bushfire weather and longer fire season leading to likely increase in frequency, but uncertain changes to fuel availability
Drought	Become more severe	Short, medium and long-term drought more severe, around 5% decreased runoff on average
Riverine flooding	Increase	Increased intensity of flood producing rainfall events, however preceding catchment conditions will affect degree of flooding
Flash flooding	Increase	Combination of rising sea levels and catchment driven flooding is likely to increase flood height, frequency and extent
Coastal erosion and inundation	Increase, increase shoreline recession	Sea level rise may cause the erodable coastline to recede by 20–40 m by 2050 and 45–90 m by 2100

Source: DECCW 2010

## Appendix B: Agencies and organisations represented at sector workshops

Sector group workshop	Attending agencies/organisations
<b>Human health</b> <b>(12 Feb 2010, 21 participants)</b>	<ul style="list-style-type: none"> <li>• NSW Health – Greater Southern Area Health Service</li> <li>• NSW Department of Human Services – Ageing, Disability and Home Care</li> <li>• NSW Department of Environment, Climate Change and Water</li> <li>• ACT Health</li> <li>• Australian National University</li> </ul>
<b>Tourism</b> <b>(3 March 2010, 12 participants)</b>	<ul style="list-style-type: none"> <li>• NSW Industry &amp; Investment (Tourism)</li> <li>• Regional Development Australia</li> <li>• Snowy River Shire Council</li> <li>• Bombala Council</li> <li>• Eurobodalla Shire Council</li> <li>• NSW Department of Environment, Climate Change and Water</li> <li>• ACT Department of Environment, Climate Change, Energy and Water</li> <li>• Australian National University</li> </ul>
<b>Human settlements</b> <b>(10 March 2010, 16 participants)</b>	<ul style="list-style-type: none"> <li>• NSW Department of Planning</li> <li>• Queanbeyan City Council</li> <li>• NSW Department of Housing</li> <li>• Yass Valley Council</li> <li>• Cooma–Monaro Shire Council</li> <li>• Young Regional Council</li> <li>• Eurobodalla Shire Council</li> <li>• NSW Department of Environment, Climate Change and Water</li> <li>• Goulburn Mulwaree Council</li> <li>• ACT Planning and Land Authority</li> <li>• Harden Shire Council</li> <li>• Australian National University</li> </ul>

Sector group workshop	Attending agencies/organisations
<p><b>Primary industries</b>  <b>(17–18 March 2010, 22 participants)</b></p>	<ul style="list-style-type: none"> <li>• Industry &amp; Investment NSW</li> <li>• Hawkesbury–Nepean Catchment Management Authority</li> <li>• Lachlan Catchment Management Authority</li> <li>• Murrumbidgee Catchment Management Authority</li> <li>• Southern Rivers Catchment Management Authority</li> <li>• NSW Office of Water</li> <li>• NSW Department of Environment, Climate Change and Water</li> <li>• Australian National University</li> <li>• ACT Department of Environment, Climate Change, Energy and Water</li> </ul>
<p><b>Infrastructure</b>  <b>(24 March 2010, 14 participants)</b></p>	<ul style="list-style-type: none"> <li>• NSW Roads and Traffic Authority</li> <li>• Yass Valley Council</li> <li>• Country Energy</li> <li>• Young Regional Council</li> <li>• Commonwealth Attorney-General's Department</li> <li>• Snowy River Shire Council</li> <li>• ACT Chief Minister's Department</li> <li>• Australian National University</li> <li>• Cooma–Monaro Shire Council</li> <li>• ACT Department of Territory and Municipal Services</li> <li>• NSW Department of Environment, Climate Change and Water</li> </ul>

Sector group workshop	Attending agencies/organisations
<p><b>Emergency management (28 April 2010, 26 participants)</b></p>	<ul style="list-style-type: none"> <li>• NSW Police</li> <li>• NSW Rural Fire Service</li> <li>• NSW Fire Brigades</li> <li>• NSW Ambulance Service</li> <li>• NSW State Emergency Service</li> <li>• NSW Department of Premier and Cabinet</li> <li>• NSW Department of Environment, Climate Change and Water</li> <li>• Industry &amp; Investment NSW</li> <li>• NSW Department of Services, Technology and Administration (NSW Public Works)</li> <li>• Transport NSW</li> <li>• Bega Valley Shire Council</li> <li>• Goulburn Mulwaree Council</li> <li>• Snowy River Shire Council</li> <li>• Yass Valley Council</li> <li>• ACT Department of Environment, Climate Change, Energy and Water</li> <li>• Australian National University</li> </ul>
<p><b>Landscapes &amp; ecosystems (4 May 2010, 28 participants)</b></p>	<ul style="list-style-type: none"> <li>• NSW Department of Environment, Climate Change Water</li> <li>• NSW Office of Water</li> <li>• Hawkesbury-Nepean Catchment Management Authority</li> <li>• Lachlan Catchment Management Authority</li> <li>• Southern Rivers Catchment Management Authority</li> <li>• Murrumbidgee Catchment Management Authority</li> <li>• Bega Valley Shire Council</li> <li>• Eurobodalla Shire Council</li> <li>• Goulburn Mulwaree Council</li> <li>• Palerang Council</li> <li>• Yass Valley Council</li> <li>• ACT Department of Environment, Climate Change, Energy and Water</li> <li>• Australian National University</li> </ul>

Sector group workshop	Attending agencies/organisations
<p><b>Water</b>  <b>(12 May 2010, 25 participants)</b></p>	<ul style="list-style-type: none"> <li>• NSW Office of Water</li> <li>• Industry &amp; Investment NSW</li> <li>• Southern Rivers Catchment Management Authority</li> <li>• Cooma–Monaro Shire Council</li> <li>• Queanbeyan City Council</li> <li>• Snowy River Shire Council</li> <li>• Yass Valley Council</li> <li>• Young Regional Council</li> <li>• NSW Department of Environment, Climate Change and Water</li> <li>• ActewAGL (ACT)</li> <li>• ACT Department of Environment, Climate Change, Energy and Water</li> <li>• Australian National University</li> </ul>