Enabling Adaptation in the Australian Capital Territory

Final Report

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PREPARED FOR:
ACT GOVERNMENT

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1 EXECUTIVE SUMMARY

This report presents a synthesis of the findings from two participatory workshops conducted as part of the *Enabling Adaptation in the Australian Capital Territory* (EnAACT) project. The aim of EnAACT is to build a shared understanding of the Australian Capital Territory's (ACT) vulnerability to climate change and to catalyse adaptation through responses that are sensitive to the reality of regional systems. The workshops were conducted in September 2014 with 71 representatives drawn from the six Policy Directorates of the ACT Government. The information gathered from the consultation will inform ACT Government policy to enable adaptation to climate change in the ACT and the broader South East region of NSW.

The EnAACT project considers climate change impacts and adaptation to the year 2060, with the major focus on actions that are required within the timeframes of the ACT's Climate Adaptation Strategy.

This report synthesises the process and outcomes of each of the activities conducted during the workshops and is intended to provide an information base to identify responses and opportunities that assist ACT Directorates to enhance resilience and realise transformations in which the impacts of climate risks for the ACT are minimised.

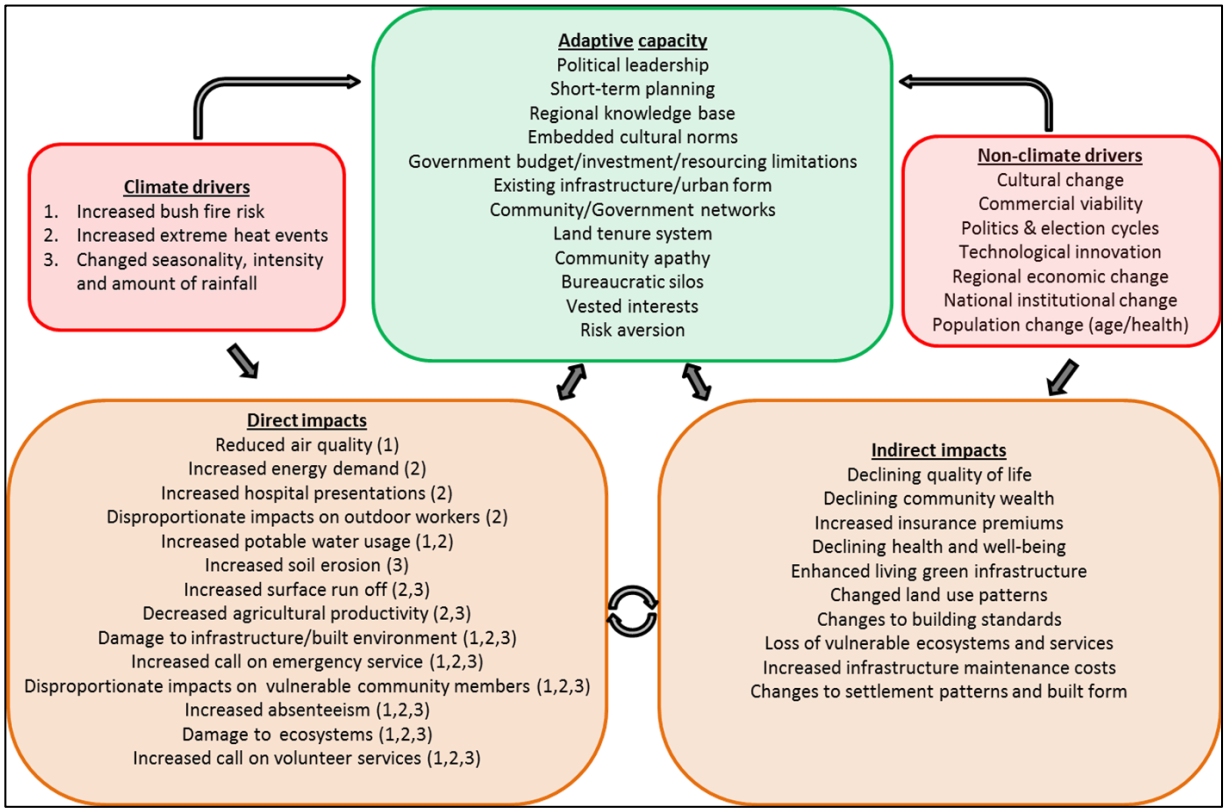
Why is adaptation important?

Adaptation is the process by which vulnerability to climate hazards is minimised. However, adaptation responses can vary greatly depending on the type and severity of the hazard and the capacity of the community to adapt. These responses can range from resilience (changes or coping strategies to maintain business as usual) to transition (incremental system changes) and transformation (fundamental system change). In practice there is considerable overlap and sub components of systems may transform in order to maintain wider system resilience. An incremental approach to adaptation achieved through an understanding of community behaviour and careful long term planning by government in consultation with the community carries reduced risk of disruption to society from abrupt transformation.

Key findings

A snap shot of vulnerability to climate change was constructed for the ACT through a rapid appraisal process that firstly, visualised the impacts on ACT Government service delivery of key climate drivers: more heatwaves and hot days; increasing high bushfire danger and changes in the water cycle (rainfall amount, intensity and seasonality). Secondly, whole-of-government factors that would influence the capacity of the ACT to deliver services under the impacts of future climate were identified. The snap shot indicates that vulnerability is dynamic, is influenced by multiple drivers of change of which climate may not be the most significant at any point in time, and that the impacts are multifaceted and pervade most aspects of lifestyle and livelihoods in the ACT.

Snap shot of vulnerability for the ACT

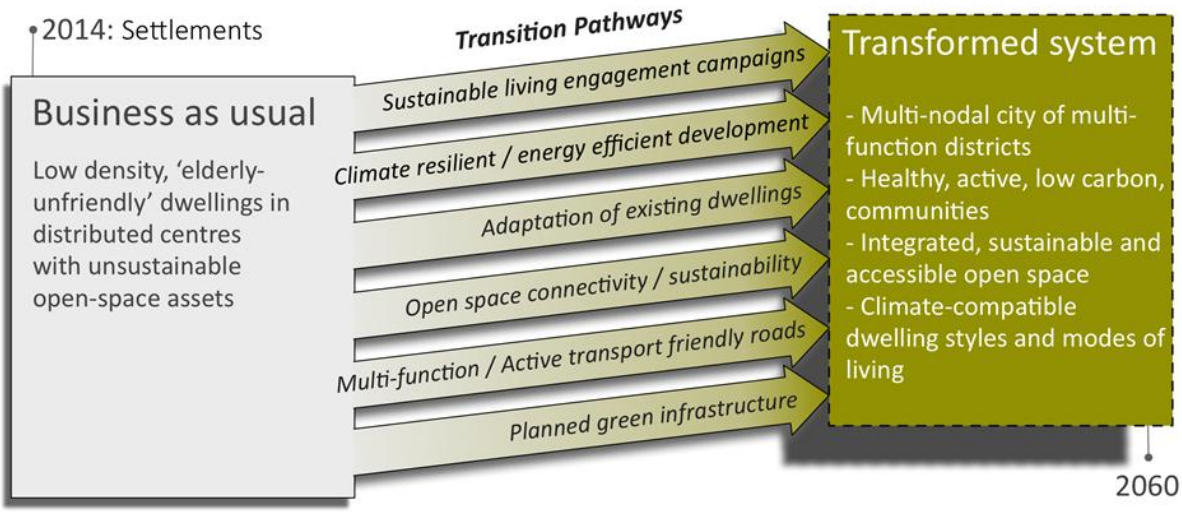


Response pathways by which adaptation can minimise vulnerability to climate hazards were identified. The aim was to promote a lower-risk, incremental approach to adaptation. Each of the major service delivery areas of the ACT Government identified:

- *System resilience*: What constitutes business-as-usual (BaU) in their service delivery area. For business-as-usual, what changes or 'tweaks' are being made to ensure resilience of the current system.
- *Transition pathways*: What alternative systems currently exist in the ACT that might become a transition pathway to navigate the future if BaU becomes non-viable?
- *Transformed system*: A vision of service delivery in a transformed system by 2060.

Six adaptive pathways models were developed covering the major service delivery areas of the ACT including: community health and well-being, disaster and emergency management, settlements and infrastructure, water, natural resources and ecosystems and agriculture.

Example of transformation in the settlements sector of the ACT Government



Common elements found among these models that would require a whole-of-government approach to achieve in ACT included:

- **Multi-nodal, multi-function settlements** matched to the urban form of the ACT that are less vulnerable to climate hazards, provide integrated settlement-transport-employment options, promote community health and well-being and incorporate water sensitive urban design principles and local food production within the urban fabric.
- **Socially engaged communities** that accept a shared responsibility to act on climate hazards and community health and well-being, actively participate in the management of local natural areas, and work collaboratively to reduce car dependence and enhance local food production.
- **Technological innovation** to promote climate compatible modes of living, energy efficiency and assist emergency and ecosystem management.
- **Government services responsive to changing community needs** that are socially inclusive for, in particular, health and emergency management.
- **Regional approach** to emergency services, water resources and land management.

Barriers and enablers of change to the creation of a transformed system for each service delivery area across social, environmental, economic, governance and temporal factors were identified. A series of whole-of-government transition projects were developed as a first step towards achieving the desired transformation.

Example of a whole-of-government 'first steps' to transition project from the water sector

1. Project description	•Holistic natural water system for storm water utilisation
2.Project outcomes	•Make best use of water •More permeable landscape (through modified paving systems etc.)
3.What are the steps?	•Engage designers in need for accelerated change •Introduce more flexibility into ACT water planning •Recognise monetary value of storm water and create positive incentives •FiT mechanism for water capture and use •Identify suitable location for trial – if developed area, look to introduce new system •Develop budget and financial metrics •Calculate cost savings •Evaluate additional benefits: biodiversity and health and well-being
4.Aligned government processes / programs	•Water Strategy •Water Sensitive Urban Design (WSUD)
5.Key stakeholders/ decision makers	•Environment and Planning Directorate (water, natural resource management) •Territory and Municipal Services •Chief Ministers, Treasury and Economic Development Directorate
6.Potential resources?	•Existing evidence-based research – FiTS in ACT •Provide evidence to support ACT budget processes

Finally the relationship and importance of the ACT to climate change adaptation in the South East region of NSW was considered through:

1. Shift-share analysis of employment data over the period 2006 and 2011 for the ACT and the Tablelands and Alpine sub-regions of NSW.
2. Comparison of the potential linkages between the ACT adaptive pathways models and those developed for the SE Region in a parallel project conducted by the NSW Government.

The influence of the ACT on employment in the surrounding regions of NSW was most obvious in Public administration, which was the largest employment sector in the ACT and was the largest category of employment for people living in the Tablelands (almost 1.9-times employment in the second largest category, Agriculture) and the third largest for the Alpine sub-region.

The SE Region adaptive pathways that are of most relevance for the ACT included emergency management, potable water supply, conservation reserves and management of public land (because they explore similar service delivery areas that occur across jurisdictions) and those related to large and small regional centres (because they explored

structural changes to human settlements in the SE Region, which could influence transport services, labour supply/demand or working conditions of importance to the ACT).

Alignment in the transition pathways and transformed systems developed for emergency management service delivery in the ACT and SE region of NSW

SE Region emergency management model	ACT emergency management model
Transition	
Ex-region surge capacity	Regional (cross-border) surge capacity
Community engagement/involvement	Shared responsibility for community safety Decentralised triage and community-based care
Health information systems Pre-emptive emergency management	Adoption of innovative technology
Accessible information across agencies for planning	Inter-operability of services Lower risk built environments
Transformation	
Informed, responsive community	Collaborative co-management of risk
Fully resourced EM service	Equitable and socially inclusive services
Nation-wide surge capacity	Inter-operability and delivery of regional emergency management services
Integrated PPRR across combat-support agencies	Less vulnerable urban form
Integrated health-EM service	

There is a clear need for continuing close co-operation between the NSW and ACT Governments to ensure that climate adaptation actions in the broader South East Region are mutually beneficial and do not lead to maladaptive outcomes for the communities of NSW and the ACT.

2 INTRODUCTION

The *Enabling Adaptation in the Australian Capital Territory* (EnAACT) forms part of the research being conducted in the Adaptive Communities Node of the NSW Adaptation Research Hub. Under the Hub, the NSW Government through the Office of Environment and Heritage (OEH) is developing a regionalised understanding of the potential vulnerabilities to NSW to climate change and adaptation strategies to address vulnerability. A climate change vulnerability assessment of the South East Region of NSW (South East IRVA) has been completed. A subsequent project *Enabling Adaptation in the South East (EASE)* aims to:

- Build on the findings of the SE IRVA to catalyse adaptation action in the South East;
- Develop improved information to climate risks in the South East and deliver integrated sub-regional adaptation options;
- Identify responses and opportunities that assist local communities to improve resilience, minimise impacts and navigate pathways to a transformed future; and
- Facilitate a South East region that is thriving in a changing climate.

Dorte Ekelund, Director General of ACT Government's Environment and Planning Directorate, provided the welcome and open remarks at the first EnAACT workshop.

At present, although the ACT is considered as part of the NSW Government's regional planning for adaptation, and public sector managers from the ACT are included in information gathering for EASE, the vulnerability of service delivery in the ACT to the impacts of climate change is not explicitly considered under EASE. However, services offered in the ACT to the SE Region are accessed by NSW residents. In turn the ACT is reliant on NSW for a portion of its labour force, natural resource supply and food security. To ensure the outcomes of EASE consider the region as a whole and are made more robust, and to assist with whole-of-government consideration of adaptation options EnAACT undertook detailed consultation with the Directorates of the ACT Government.

The NSW Office of Environment & Heritage provides oversight for the EnAACT project in collaboration with the ACT Government and the Institute for Sustainable Futures, UTS as research partner.

Storm Watson, Impacts and Adaptation Team NSW Office of Environment and Heritage, outlined the NSW Government's adaptation projects in the South East Region.

3 METHODS

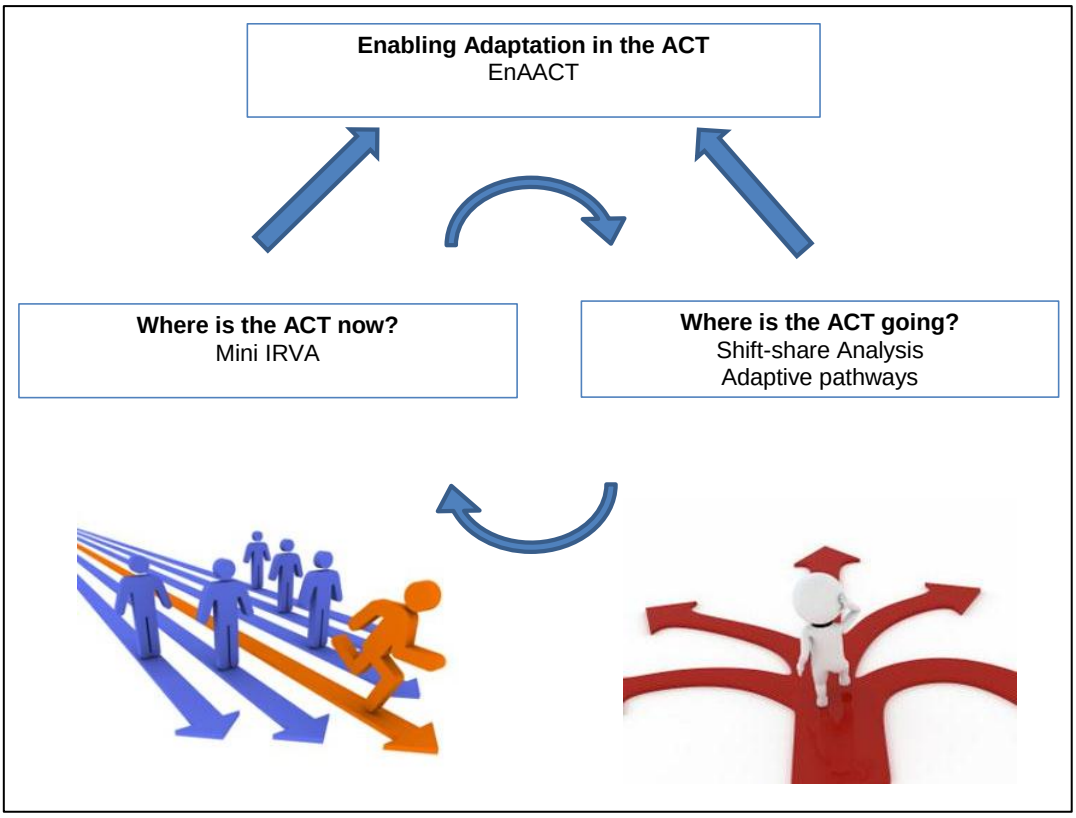
This document reports the findings of qualitative analysis of information collected during two facilitated workshop sessions with decision-makers from the Directorates of the ACT Government (Figure 1). The workshops used a modified Integrated Regional Vulnerability Assessment (IRVA) process (Jacobs et al 2014) as a basis for discussion and to identify adaptation actions. The process acknowledges that understanding of the current vulnerability of government service delivery in the ACT is not codified and relies on collection of the tacit knowledge that resides in the collective store of experience of the ACT's public sector managers.

The workshops involved a rapid IRVA to build a shared understanding of the ACT's vulnerability to climate change. Participants mapped across a range of scales the likely chains of events caused by the impact of the major climate drivers projected to affect the ACT. The climate drivers were identified through analysis conducted by the ACT Climate Council and presented by Professor Will Steffen.

Professor Will Steffen, ACT Climate Council, presented the climate projections for the ACT.

The adaptive capacity of ACT service delivery to respond to these climate impacts was then considered to build a snap shot of contemporary vulnerability to climate change in the ACT specifically to answer the question of 'where is the ACT now?'.

Figure 1: The components of the EnAACT project that were explored through whole-of-government workshops.



The second question posed 'where is the ACT going?' was addressed through a decision pathways approach (e.g. Haasnoot et al. 2013; Bosomworth et al. 2014) that identified transitions to a desirable transformed future.

EnAACT workshops were participatory and drew on staff from the Directorates of the ACT Government.

3.1 CLIMATE DRIVERS IN THE ACT

The major climate drivers for the ACT include:

- More heatwaves and hot days
- Increasing high bushfire danger weather
- Changing water cycle

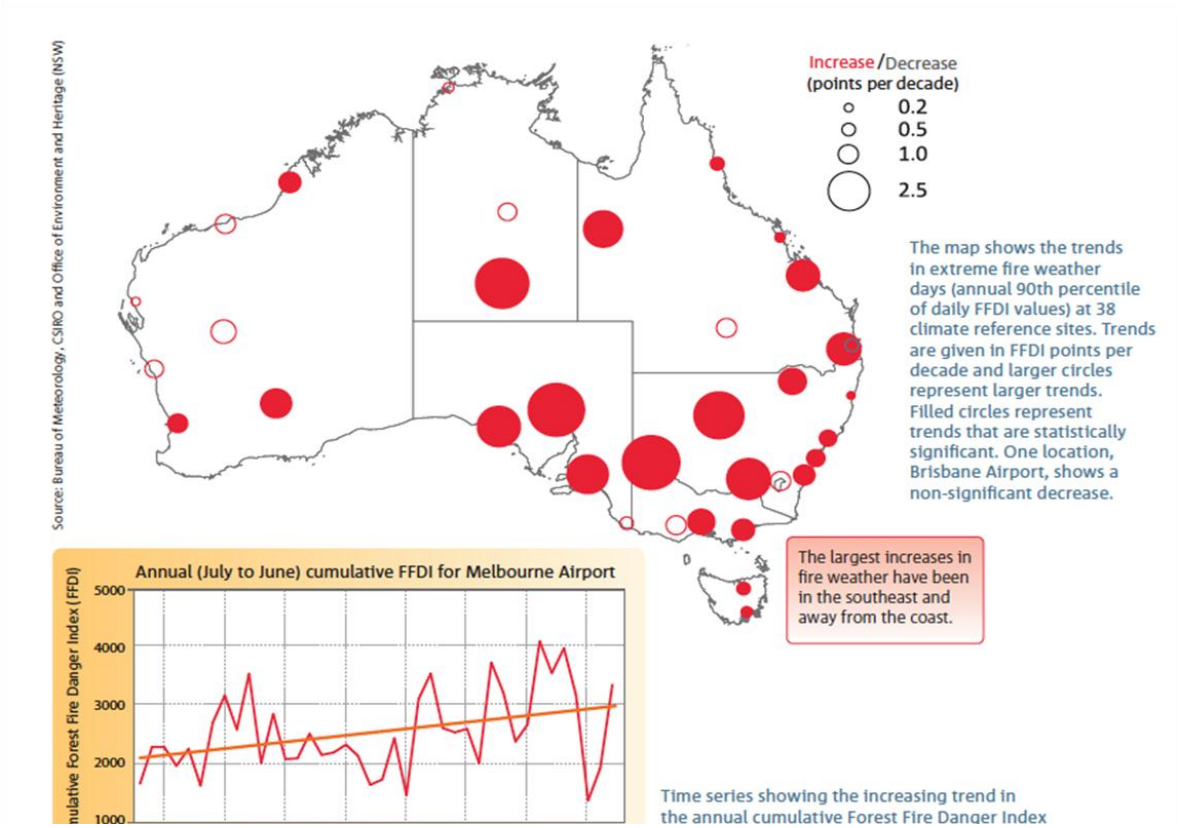
For the ACT an increase in the number of hot days and more frequent heat waves are indicated. The duration of heat waves is projected to increase and the temperature on the hottest days will likely rise. Table 1 compares the long term annual average number of days above 35°C to 2000-09 average and the projected average for 2030 and 2070 (under 2 scenarios) for major capital cities. For Canberra the average number of hot days between 2000-09 was 9.4, higher than the projected number of hot days for 2030, and is projected to increase to an average of 10 hot days under the low emissions scenario and an average of 18 days under the high emissions scenario.

Table 1: Hot days in the ACT (Source: BoM 2013b, CSIRO and Bom 2007)

City	Long term average (1961-1990)	2000-2009 average	2030 projected	2070 projected (low emissions scenario)	2070 projected (high emissions scenario)
Melbourne	9.9	12.6	12 (11–13)	14 (12–17)	20 (15–26)
Sydney	3.4	3.3	4.4 (4.1–5.1)	5.3 (4.5–6.6)	8 (6–12)
Adelaide	17.5	25.1	23 (21–26)	26 (24–31)	36 (29–47)
Canberra	5.2	9.4	8 (7–10)	10 (8–14)	18 (12–26)
Darwin	8.5	15.7	44 (28–69)	89 (49–153)	227 (141–308)
Hobart	1.2	1.4	1.7 (1.6–1.8)	1.8 (1.7–2.0)	2.4 (2.0–3.4)

The increase in heatwaves and hot days is projected to lead to an increase in higher bushfire danger for the Australian Capital Region (ACR). Prolonged hot and dry weather coupled with hot winds create 'tinderbox' conditions increasing the likelihood of a bushfire (Figure 2). Bushfire risk is determined by the Fire Danger Index, which provides an assessment of fire risk based on a set of indices that relate weather conditions to the likelihood of fire outbreak.

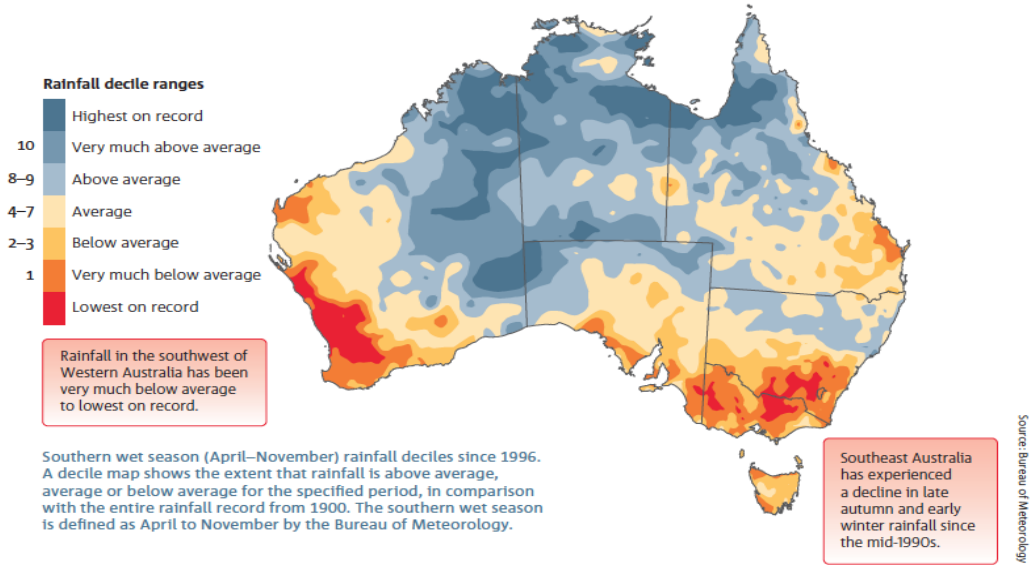
Figure 2: Fire danger projections for Australia provided by the ACT Climate Council (Source: BoM, CSIRO and OEH)



In the ACR the water cycle will change in a number of ways. It is predicted that the annual average rainfall will decrease in southern Australia coupled with an increase in droughts (CSIRO/BoM 2014). In general, heavy rainfall should increase with an intensifying water cycle. However, in SE Australia there has been a slight decrease in heavy rainfall over the past several decades consistent with a drying trend. Seasonality of rainfall is likely to shift in

the ACR, with less rainfall in the cooler months. Since 1996, rainfall has declined to below average indicating a drying trend for this region (Figure 3).

Figure 3: Rainfall change in Australia since 1996 (Source: BOM)



4 RAPID APPRAISAL OF VULNERABILITY

4.1 UNDERSTANDING IMPACTS

The EnAACT workshops used a participatory learning approach to assess the impacts of climate change on the ACT's social, economic and biophysical systems, and the capacity to adapt service delivery by the ACT Government. Participants considered climate impacts and adaptive capacity within six major areas of service delivery. These service delivery areas were: water, disaster and emergency management, natural resources and ecosystems, community health and well-being, settlements and infrastructure, and agriculture. Within these groups participants mapped out various impact pathways (or chains of events caused by the climate impact) of the three impacts most likely to affect the ACT across a range of scales (Table 2).

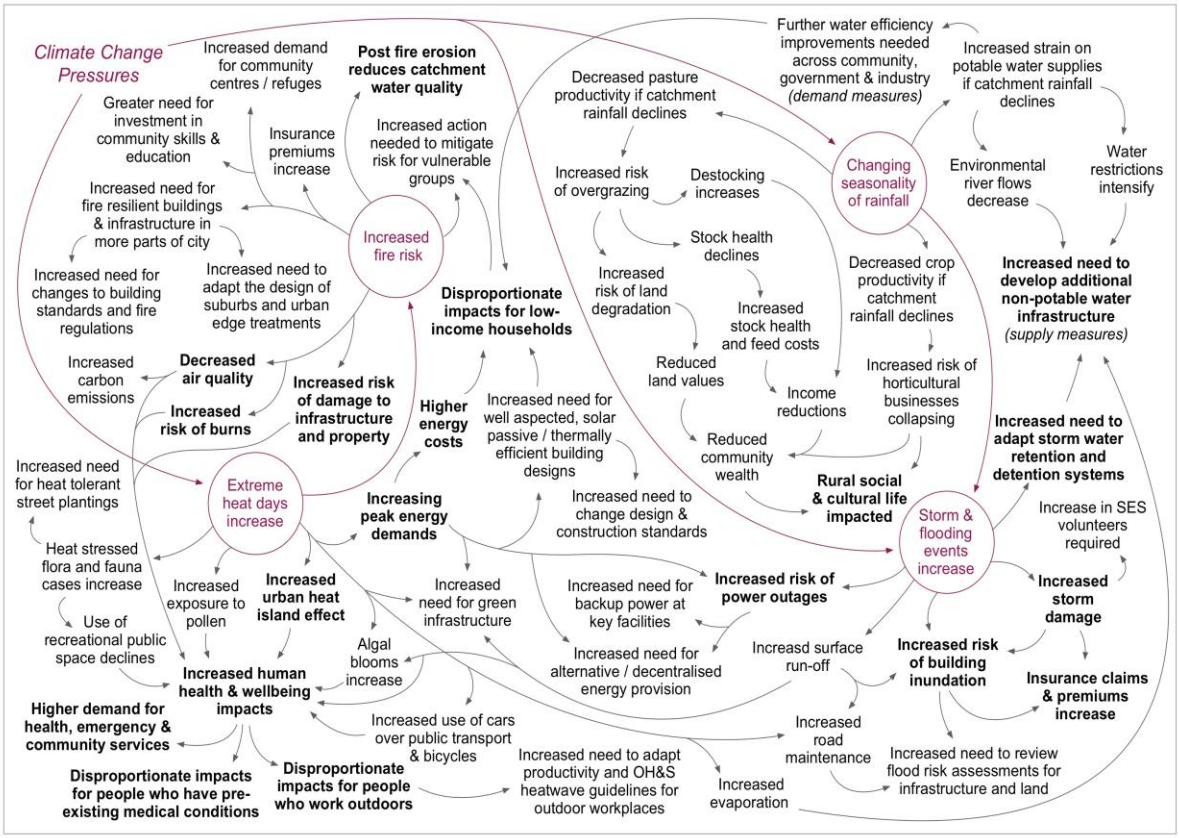
Table 2: The climate drivers selected by each service area of the ACT Government for analysis of impacts

Service area	Climate drivers selected
Community health and well-being	Heatwaves and hot days
Disaster and emergency management	Heatwaves and hot days Bushfires.
Settlements and infrastructure	Heat waves Bushfires Changes in water cycle
Water	Changes in the water cycle.
Natural resources and ecosystems	Heatwaves and hot days
Agriculture	Changes in the water cycle.

The individual impact pathways were then combined into a single 'mind-map' (Figure 4). This process allowed the dynamic interactions that occur between sectors to be explored and exposes often unanticipated impacts on government services that compound across service delivery areas or through multiple climate drivers. Although complex, the mind-map illustrates the way in which climate impacts 'ripple' through the ACT community moving from direct effects 'close' to the impact to indirect, diffuse effects along the pathways. For example, the direct effects of an increase in the number of extreme heat days in the ACT result in more intense urban heat islands, increased peak energy demands and heat stressed flora and fauna. The impact of extreme heat is compounded through its link to an increased risk of bush fire, which in turn generates its own set of impact pathways. The pathways often terminate at indirect impacts that may require a policy response by Government. For example, one of the extreme heat pathways leads from urban heat islands, through impacts on human health and well-being and disproportionate impacts on out-door workers to the need to adapt productivity and OH&S guidelines for exposed workers.

Workshop participants discussing adaptation pathways.

Figure 4: 'Mind-map' of the impacts of major climate drivers for the ACT



4.2 ADAPTIVE CAPACITY

Service delivery groups (Table 2) were asked to consider whole-of-government factors that would influence the capacity of the ACT to deliver services under the impacts of future climate. The discussion was structured around a framework of five capitals or resource types that are created, combined and transformed in pursuit of adaptation (i.e. human, social, natural, physical and financial) (Ellis 2000). Table 3 contains a definition of each of the capitals. While the stocks of capital are vital, the institutional constraints (such as perverse policy outcomes) on the use of resources also should be considered. Participants were also asked to consider potential linkages with or dependencies on other Government service delivery areas by identifying areas of common risks or vulnerabilities so they can be addressed in a coordinated way. Three key questions were considered by each group in light of the projected impacts of climate change:

1. What are three things that <u>must</u> change to continue service to the community? (Indicators)

2. What is needed to make change happen? (Constraining/enabling factors)

3. Who can/should make change happen? (Collective action)

The information on adaptive capacity indicators, constraints and actions from each group was collated and common themes for ACT Government service delivery were synthesised in two ways: visualisation of the themes as a word cloud (Figure 5) and tabulation of key indicators and a brief description of their meaning in the ACT (Table 3).

Figure 5 revealed that the theme most central to the discussion of whole-of-government capacity in the ACT to adapt to climate change was *community*. Sub themes suggested that the characteristics of the community (e.g. population growth, resilience, awareness and knowledge, connectivity and networks, and health), the natural environment (water, lakes, catchments, ecosystems, land), the built environment (infrastructure, design, urban areas, planning) and the economy (investment, costs, resources, business, financial, demand) form the fabric of the ACT that influences Government service delivery.

The word cloud themes are reflected in Table 3, which describes the influences of climate change on service delivery (indicators of adaptive capacity) and their importance. Individual indicators are often inter-related within and among capitals. For example, within financial capital short term planning cycles, failure to account for maintenance costs in asset construction and a lack of appreciation of the economic benefits of early adaptation combine to constrain financial decision making that would encourage adaptation. Among capitals, a regional knowledge and skills base (human), social interaction through policy-spanning networks (social), technology innovation (physical) and economic benefits of early adaptation (financial) form an inter-related set of factors that together influence the ability to develop and adopt new technology that would enable climate adaptation. The number of times a theme occurred in the discussion is indicated by the font size of its label in the cloud.

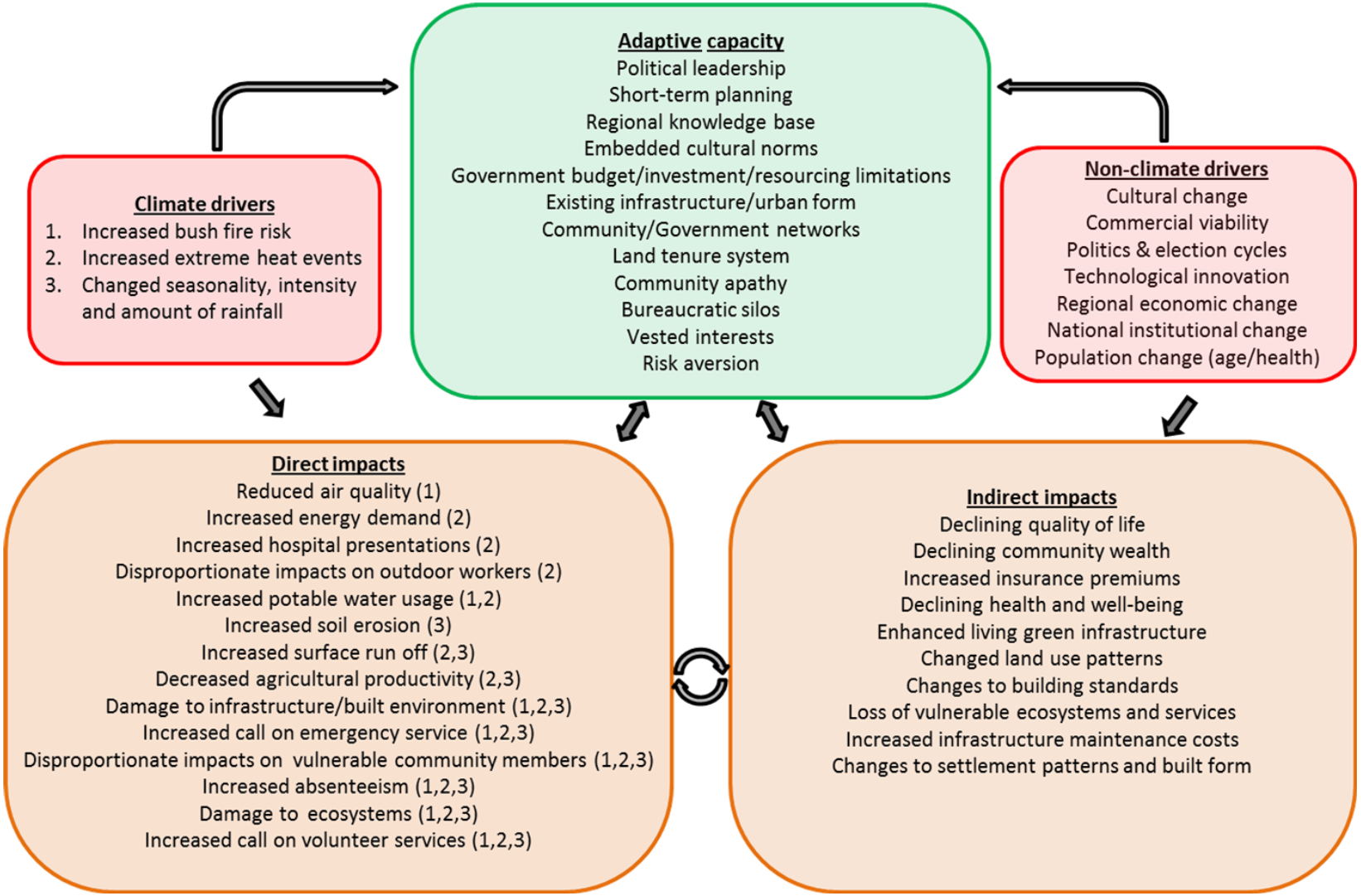
Figure 5: Word cloud of themes emerging from the adaptive capacity discussion

Table 3: Whole-of-government factors that influence the capacity of the ACT Government to deliver services under the impacts of climate change

Influence on services	Importance
Human capital: ***Skills, health and education of individuals that contribute to labour productivity and physical capability.***	
Community understanding of climate change	Poor understanding leads to apathy, complacency and limited community pressure for improvement.
Regional knowledge and skills base	High levels of technical skills are needed to drive regional innovation in service delivery.
Population health	Health influences community resilience to climate impacts and ability to access and demand for government services.
Social capital: ***Social relationships and bonds, family links, groups and leadership that allow formation of support networks.***	
Complacency/willingness to change	Affects community support for and acceptance of ACT Government adaptation efforts in the face of vested-interest.
Social interaction	Social networks that span government policy silos and discrete ACT settlements improve access to resources and build capacity for adaptation.
Community lifestyles	Open space provision, transport services and urban settlement patterns help shape healthy lifestyles that benefit the ACT economy.
Natural capital: ***The productivity of land, natural resource stocks and ecosystem services provided by environmental assets***	
'The Bush Capital'	ACT's landscape and amenity features support a range of ecosystem services but raise risks to some climate impacts such as bush fire.
Water availability and quality	Climate uncertainty requires whole of government approaches to water cycle management for population growth and amenity value of water assets.
Land management	Urban development patterns place pressure on green infrastructure, provision and maintenance of open space and local food production.
Physical capital: ***Capital items produced by economic activity from other types of capital: built environment, infrastructure, equipment and consumer goods.***	
Engineering/ building standards	Current design practices do not adequately incorporate sustainability or adaptation to a changing climate in the built environment.
Urban form	Current settlement patterns place pressure on ability of government to provide and maintain transport, infrastructure and open space for ACT residents.
Innovation	Innovation in technology can drive efficiency in government service delivery and behaviour change in the community.
Financial capital: ***The level, variability and diversity of income sources, other financial resources that contribute to wealth.***	
Short-term planning cycles	Limited planning horizons fail to account for the impacts of climate change.
Maintenance costs of government assets	Changes in climate increase the costs of maintaining existing ACT Government assets and need to be factored into asset construction planning.
Benefits of 'early' adaptation	Significant savings and avoided costs accrue to government from undertaking adaptation measures before climate impacts occur.

Vulnerability is generally considered to result from the interaction of exposure (Figures 2 and 3; Table 1) and sensitivity (illustrated qualitatively in Figure 4) to a climate hazard and the capacity to adapt (described qualitatively in Table 3). These three components have been combined in Figure 6 to provide a snap shot of vulnerability for the ACT. The snap shot also shows the influence on vulnerability of important non-climate drivers of adaptation such as demographic change, cultural change, political cycles and regional economic change. The numerals (in parentheses) associated with each of the direct impacts link that impact to its dominant climate driver. However, individual climate drivers can result in multiple common impacts. For example, damage to ecosystems can result from the impacts of bushfire, extreme heat and changes to hydrological cycles. The snap shot indicates that vulnerability is dynamic, is influenced by multiple drivers of change of which climate may not be the most significant at any point in time, and that the impacts are multifaceted and pervade most aspects of lifestyle and livelihoods in the ACT. While knowledge is often cited as a key constraint on the capacity to adapt, particularly in the public sector, the range of factors identified as influencing adaptive capacity demonstrate the importance of a whole-of-government approach to adaptation planning and policy.

Figure 6: Snap shot of vulnerability for the ACT.

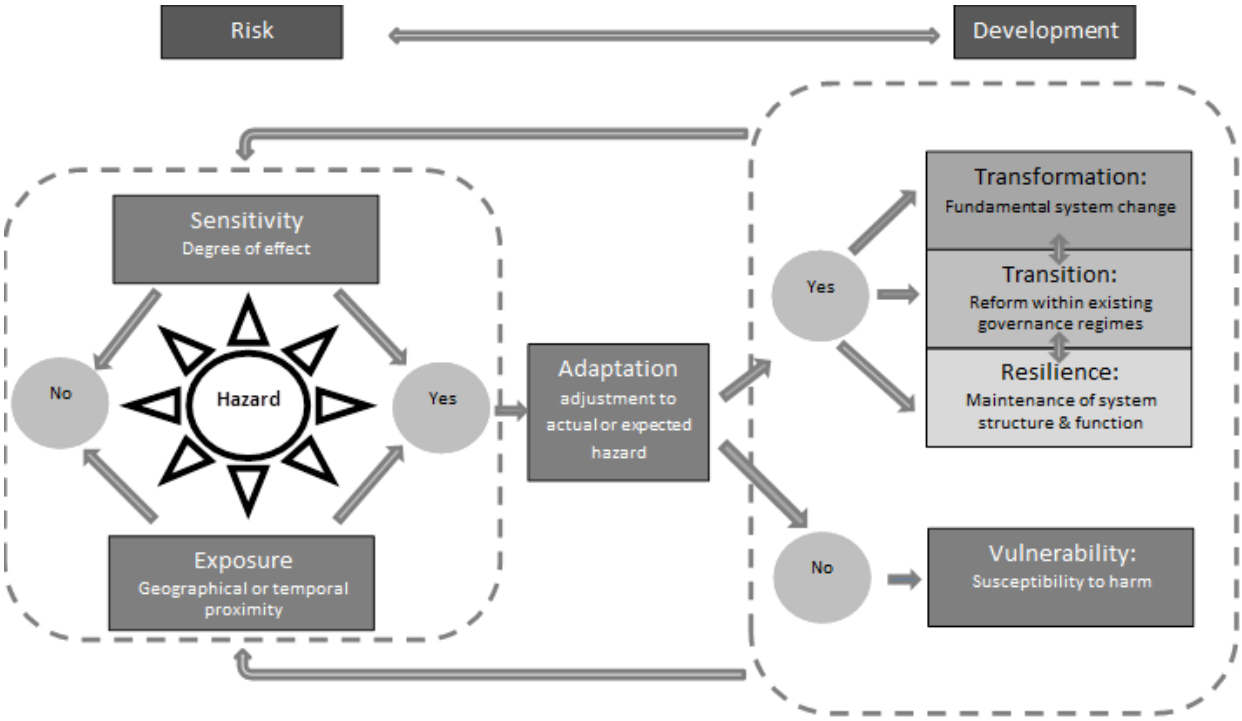


5 PATHWAYS TO TRANSFORMATION

5.1 ADAPTIVE PATHWAYS: FROM BUSINESS-AS-USUAL TO SYSTEM TRANSFORMATION

Adaptation is the process by which vulnerability to climate hazards is minimised (Figure 7). However, adaptation responses can vary greatly depending on the type and severity of the hazard and the capacity of the community to adapt. These responses can range from resilience (changes or coping strategies to maintain business as usual) to transition (incremental system changes) and transformation (fundamental system change). In practice there is considerable overlap and sub components of systems may transform in order to maintain wider system resilience. For example, in agricultural systems, fundamental changes to production techniques may be required to maintain the livelihoods of farmers and the resilience of Australia's food production system.

Figure 7: Adaptation pathways to reduced vulnerability in response to climate hazards. Adapted from Pelling (2011)



If the more extreme predictions of climate change are realised, it is likely that adaptation responses will need to go well beyond the available coping strategies. However, abrupt transformation is a highly unpredictable process with often unknown outcomes. An incremental approach to adaptation achieved through an understanding of community behaviour and careful long term planning by government in consultation with the community carries less risk of disruption to society. However, such an approach requires an aspect of fore-sighting to be incorporated in strategic planning processes to ensure that the alternative transition pathways lead to an agreed, desirable future.

Given the uncertainty around the timing of climate impacts and the inherent difficulty of attempting to predict the future a pathways approach to adaptation allows the best available knowledge to be used for progressive, staged decision-making. It facilitates planning that is responsive and flexible under changing circumstances over time and it allows consideration of interactions between major adaptation actions with overlapping timeframes (Bosomworth et al 2014).

To develop adaptation pathways for the ACT participants considered:

- **System resilience**: What constitutes business-as-usual in their service delivery area. That is, traditionally, what is the way that their business is conducted including aspects of the economy, society, natural resource use or institutional arrangements? For business-as-usual (BaU), what changes or 'tweaks' are being made to ensure resilience of the current system.
- **Transition pathways**: What alternative systems currently exist in the ACT that might become a transition pathway to navigate the future if BaU becomes non-viable? Is there obvious innovation that might become a trend?
- **Transformed system:** If a service delivery area were to follow the transition pathways what would be the features of the transformed system by 2060?

Facilitators guided discussions in small groups.

In answering these questions, six adaptive pathways models were developed covering the major service delivery areas of the ACT including: water, disaster and emergency management, natural resources and ecosystems, agriculture, community health and well-being, and settlements and transport infrastructure. The models are described in detail below; however, many contained common elements that require a whole-of-government approach to achieve in the ACT that include:

- **Multi-nodal, multi-function settlements** matched to the urban form of the ACT that are less vulnerable to climate hazards, provide integrated settlement-transport-employment options, promote community health and well-being and incorporate water sensitive urban design principles and local food production within the urban fabric.
- **Socially engaged communities** that accept a shared responsibility to act on climate hazards and community health and well-being, actively participate in the management of local natural areas, and work collaboratively to reduce car dependence and enhance local food production.
- **Technological innovation** to promote climate compatible modes of living, energy efficiency and assist emergency and ecosystem management.
- **Government services responsive to changing community needs** that are socially inclusive for, in particular, health and emergency management.
- **Regional approach** to emergency services, water resources and land management.

Water

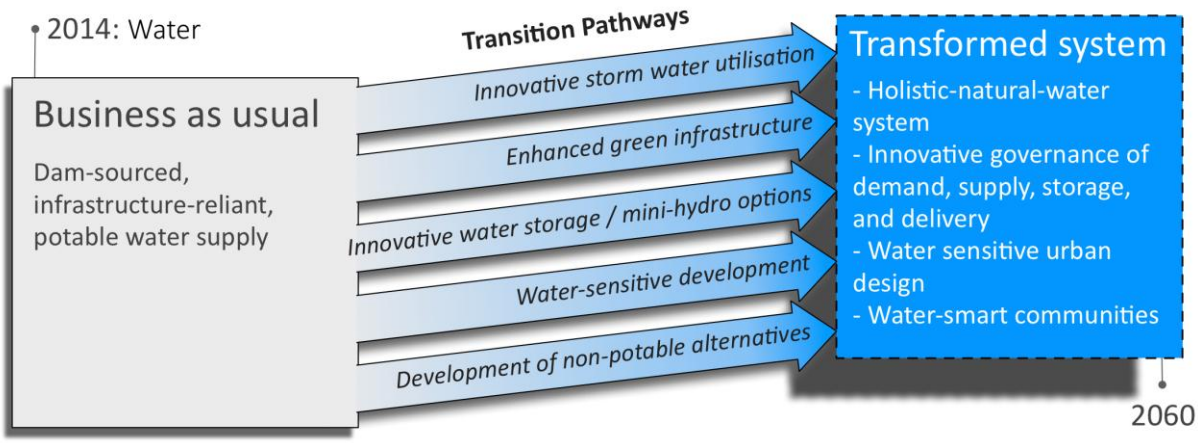
Business as usual

The ACT water sector is presently characterised by a 95% reliance on dam-sourced, infrastructure reliant potable water system (Figure 8). In terms of demand management, permanent conservation measures, water pricing adjustments and increased reporting of faults has seen water consumption levels (measured in GL) plateau in recent years. The ACT is also part of a three party regional water agreement initiated in 2008, involving the Australian and NSW Governments, to supply water to Queanbeyan from Googong Dam for a period of 150 years.

Resilience

Regional catchment governance is currently contributing to resilience within the ACT water sector through a range of measures that includes: taking a wider geographic approach to water security issues; adapting existing potable water storage and supply infrastructure; engaging in evidence based auditing, testing and review of policies; engaging in water trading agreements with NSW; pricing water to influence consumer behaviour; advocating for changes within the urban form; and ongoing engagement with the ACT community about water efficiency to maintain momentum.

Figure 8: Transformation of the ACT Water sector



Completed infrastructure adaptation projects to increase potable water security include: the enlargement of the Cotter Dam to 76 GL, which has increased water storage capacity in the ACT by 35%; and the Cotter to Googong bulk transfer pipeline, which has the capacity to provide up to 150 ML of surplus water from the Cotter Catchment to the Googong Reservoir each day. In addition, an interstate water trading agreement established between the ACT and NSW Government will also allow for the transfer of water from Tantangara Reservoir (NSW) to the ACT, via the Murrumbidgee to Googong Water Transfer pipeline. The transfer pipeline will have the capacity provide up to 100 ML of additional water per day to the Googong Reservoir. ACTEW has developed a project implementation plan and is currently purchasing water security entitlements from Murrumbidgee Regulated River licence holders downstream of the ACT.

In terms of stormwater management, the number of water quality control ponds in the ACT has increased tenfold since 2000. These ecological engineering innovations adapt the urban form to address the increasing frequency of storms and the threat that nutrient rich surface run-off poses for water quality within Lake Burley-Griffin. The ACT has also instituted a Water Sensitive Urban Design General Code, directed at Government agencies, land and commercial developers, planners, builders and homeowners, which is aimed at reducing stormwater run-off and optimising opportunities for water reuse.

Transformed system

Transformation in the water sector would see the development of a holistic-natural-water-system, where innovative governance decisions cover all aspects of water use and demand management, supply sources, storage, and water delivery (Figure 8). From a systemic perspective, water sensitive urban design measures would further adapt the urban form to handle the increasing frequency of storms and increase water recovery and re-use to reduce the demand on potable water. A water-driven urban form would also increase water security for land use and community amenity. In addition the community will be proficiently water-smart to value and conserve water on an on-going basis.

The transition

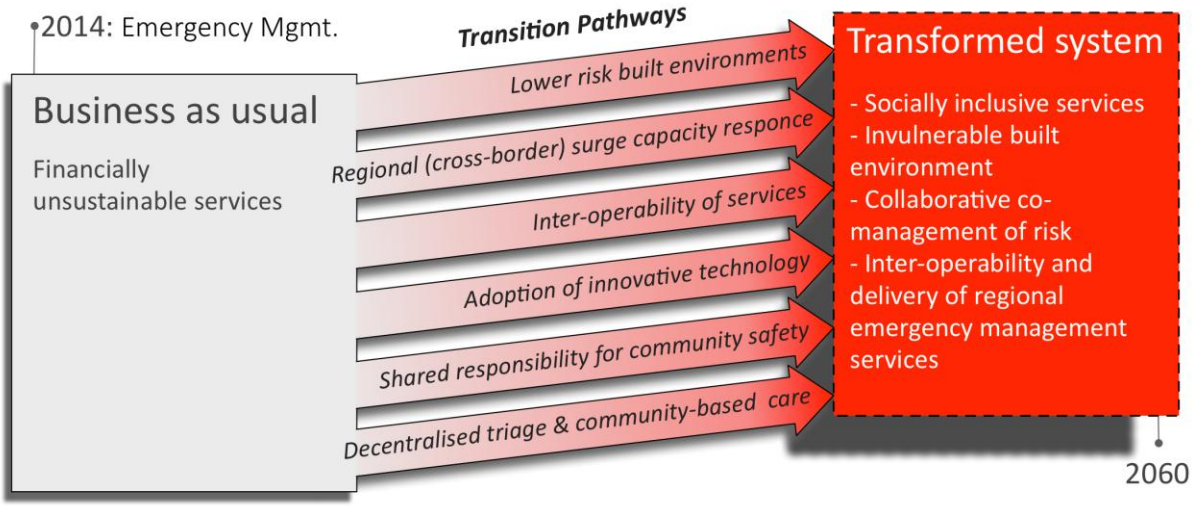
Priority adaptive pathways to transform the ACT water sector include: innovative stormwater utilisation projects; continued development of green infrastructure to reduce the impact of urban surface run-off on water quality; innovative water storage and mini-hydro projects; water-sensitive development as the new standard; and developing alternative non-potable water sources (Figure 8).

Disaster and Emergency Management

Business as usual

With increasing funding requirements to meet the demand for services, the current ACT emergency management sector can be characterised as currently financially unsustainable (Figure 9). The inherent unpredictability of emergency events is a contributing factor to the financial strain on emergency services.

Figure 9: Transformation of the ACT Disaster and Emergency Management sector



Resilience

Sector resilience is currently supported through adaptive measures that include: volunteer assisted collaborative partnerships, such as Community Fire Units; technology improvements, such as predictive modelling and direct community messaging that deliver early intervention warnings about extreme event risk; strengthening regulations to improve fire safety standards; encouraging the retrofit of fire detection units and automated response systems; promoting shared responsibilities for improving resilience within the built environment; and increasing preparedness skills within the community to minimise risk and reduce demand on emergency services.

Transformed system

A transformed ACT emergency management sector would require development of an equitable and socially inclusive system (Figure 9). Greater financial sustainability would flow from improvements to the built environment, the operationalization of best practice risk management models, such as collaborative co-management, which enhance service interoperability and delivery at the regional scale.

The transition

Priority adaptive pathways to transition the ACT emergency management sector include: on-going adaptation of the built environment and urban form to reduce vulnerability to climate hazards, in particular bush fires; further improvements to cross border responses in surge capacity; use of technological innovations such as, predictive models and communication technologies to more rapidly predict and target emergency responses; and promotion and adoption of shared responsibility for the management of extreme events that leads to a decentralised triage and community care approach to particularly towards vulnerable community members (Figure 9).

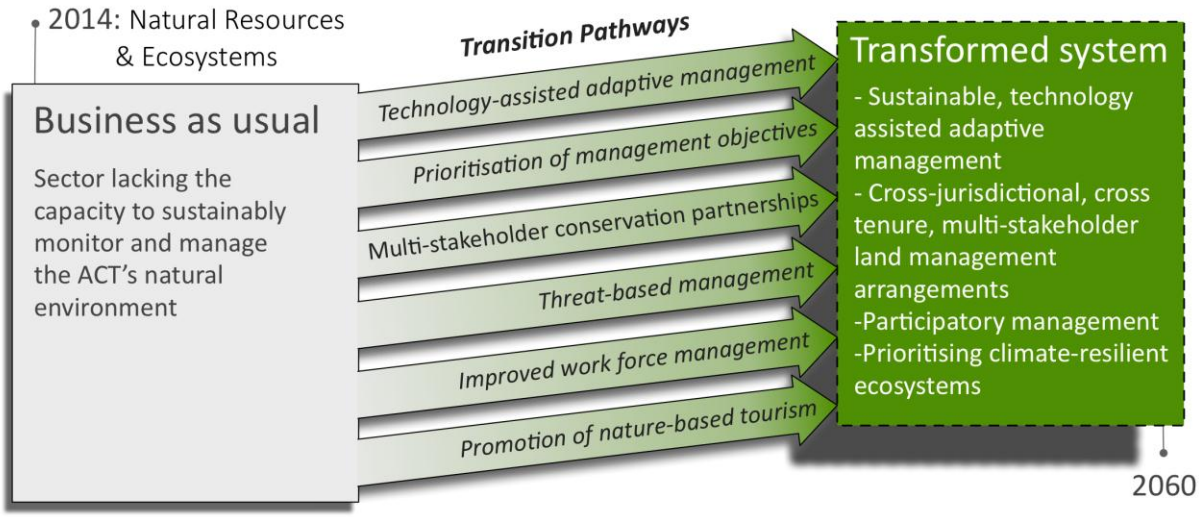
Natural Resources and Ecosystems

Business as usual

The natural resources and ecosystems sector currently lacks the capacity to sustainably monitor and manage the ACT's natural environment (Figure 10). This is attributed to relatively static resourcing of the sector coupled to growing conservation estate and requirements for public land. There is an acknowledgement within the sector that future

climate of the ACT is likely to result in changes to ecosystems and declining biodiversity over time.

Figure 10: Transformation of the ACT Natural Resources and Ecosystems sector



Resilience

Sector resilience is currently being supported through a range of adaptive strategies, encompassing alternative management models, implementing prioritised actions, making strategic use of technology, and placing a greater emphasis on community awareness and partnerships.

Specific examples of these adaptive actions include: integrating management strategies across land tenure types to share management responsibilities between park rangers and rural leaseholders; exploring opportunities to privatise aspects of public land management; operationalising priority actions, such as monitoring, management of threats, enhancing connectivity and using the best available science to manage native fauna; making greater use of GIS mapping; and a shift towards volunteerism and community network partnerships that empower the community to value natural resources and support landscape management in the ACT.

Transformed system

A transformed ACT natural resources and ecosystems sector would employ sustainable adaptive management models to support climate-resilient ecosystems. Cross-jurisdictional, cross-tenure, multi-stakeholder management arrangements would characterise the transformed system (Figure 10). Prioritisation and technology-assisted monitoring would be normalised as part of service delivery.

The transition

Priority adaptive pathways to transform the ACT natural resources and ecosystems sector include (Figure 10): technology-assisted adaptive management, in particular for environmental monitoring (such as GIS tools), and more effective dissemination of monitoring information to private lease holders and conservation volunteers; continued prioritisation of conservation objectives (such as connectivity), within areas of high conservation value (such as Namadgi National Park), with a focus towards sustaining

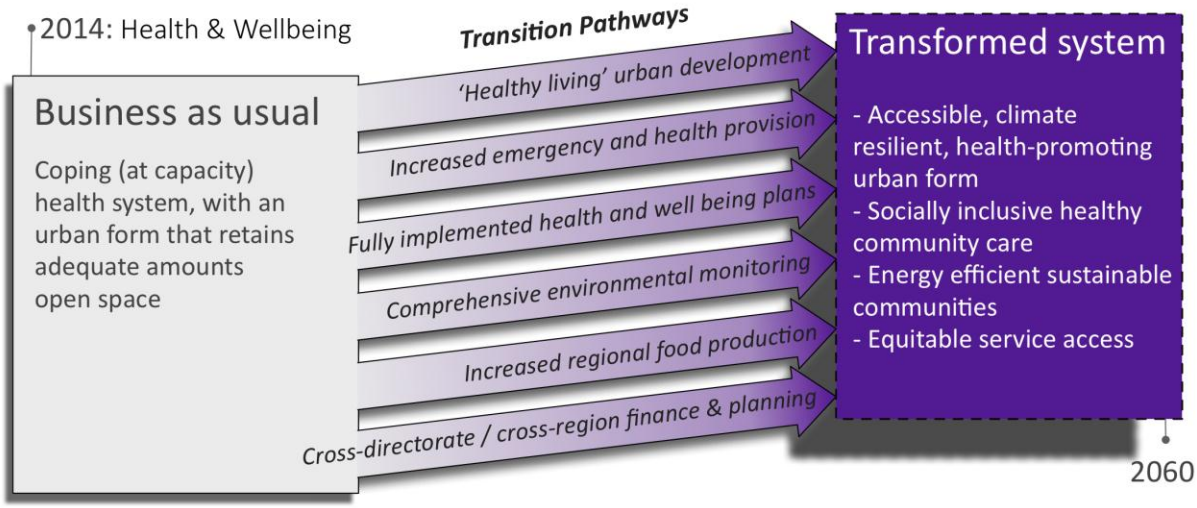
threatened species (taking a triage approach), to maximise the use of limited resources; cross-jurisdictional, cross-tenure, multi-stakeholder (public/private) partnerships that distribute management responsibility to a wider set of actors; threat-based management strategies prioritising climate-resilient ecosystems; improved workforce management; and exploration of further opportunities for nature-based tourism.

Community Health and Wellbeing

Business as usual

Presently the ACT community health and wellbeing sector can be characterised as a coping health system, with public and private health services operating at or near capacity (Figure 11). From a wider systemic perspective: the ACT's urban form retains adequate amounts of open space to support sufficient access to sport and recreation opportunities, while home energy efficiency programs are underway to extend the health and wellbeing benefits of energy efficient housing to a wider spectrum of the community. Lower than average rates of smoking, alongside an increase in the uptake of fitness services and dietary recommendations, suggest a general trend towards the population being more willing or able to take responsibilities for managing personal health. However health and wellbeing outcomes vary among communities within the ACT and general trends may not apply to community members who experience social exclusion or relative socio-economic disadvantage.

Figure 11: Transformation of the ACT Community Health and Wellbeing sector



Resilience

Sector resilience is currently being supported through a range of adaptive strategies encompassing environmental monitoring, health promotion partnerships, strategic asset management, cross-border health funding arrangements and strategic planning processes. Specific examples of these interventions and processes include: air and water quality monitoring programs; the ACTSmart Outreach Energy and Water Efficiency Program partnering with community organisations to support vulnerable households; a cross border service funding agreement between the ACT and NSW Governments that recognises patient flow to the ACT from the south east region; and an array of plans to address issues of future concern, such as delivering human services, healthy buildings and infrastructure, active

living and weight, emergency response capacity, climate change, heat management and heat response, carbon neutrality and environmental sustainability.

Transformed system

A transformed ACT community health and wellbeing sector would be socially inclusive, climate resilient and economically viable (Figure 11). Under this system access to health services is equitable and community volunteers do not feel isolated; adaptation of the built environment will result in a more health-promoting urban form, with the appropriate building standards, infrastructure and open space provision that reduces the risks of extreme heat, bushfires and storms; and where financial sustainability is improved by having a more active and healthy community, serviced in-part through the increased uptake of tele-health and online monitoring tools.

The transition

Priority adaptive pathways to transform the ACT community health and wellbeing sector include (Figure 11): Healthy living urban development; increased emergency and health service provision; fully implemented whole of governmental health and wellbeing plans; and comprehensive environmental monitoring and management.

Settlements and infrastructure

Business as usual

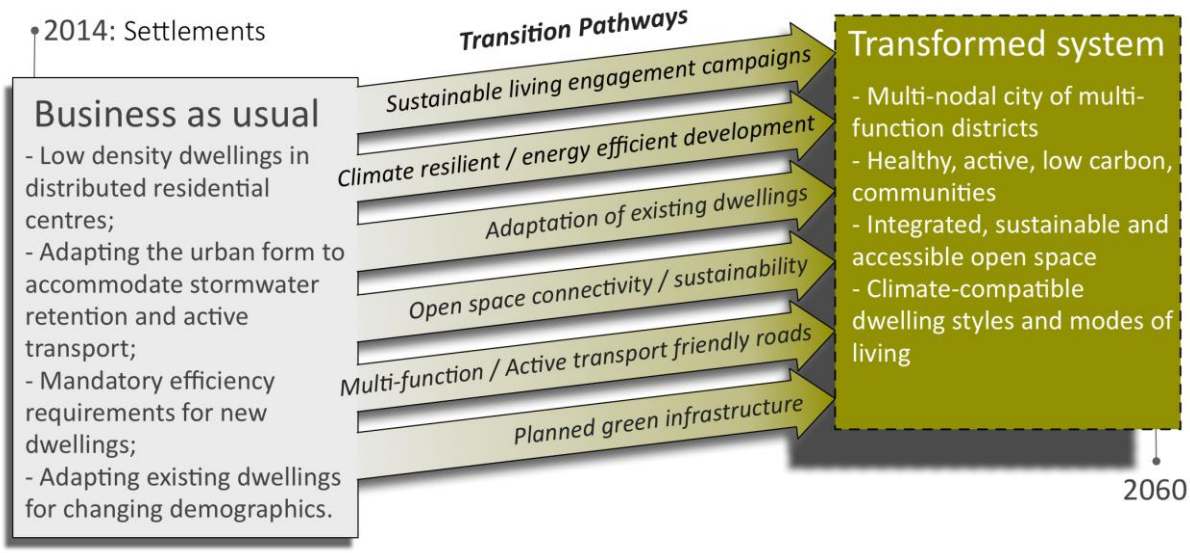
The ACT is characterised by the predominance of detached, low-density dwellings (72.8% of the housing stock in 2011), within sprawling suburban areas (Figure 12). A smaller number of medium-density (semi-detached) and high-density (multi-unit) dwellings are typically located in and around town centres. During the last decade low-density suburban development has continued to expand into green-field sites, with urban infill contributing to a moderate rise in medium-high density dwelling stocks, primarily within the inner north of Canberra.

From a transport perspective, Canberra's sprawling suburban footprint and expansive road network has resulted in car travel being the dominant transport mode. The current ACT transport sector can be characterised as a 'predict and provide' service provision model. In an attempt to forecast and meet changing demands, consideration is given to population projections, demographic statistics, future land releases, employment locations, social trends and the availability and use of existing transport modes. Although this approach aims to adapt the sector to the ACT's changing needs, the demand response can often lag behind community expectations.

In terms of equity and social inclusion, the ACT has a deficit of suitable housing options for an aging population, with older residents continuing to move into segregated communities (Aged Persons Units), rather than aging in place or downsizing to other forms of housing. The ACT does retain a higher proportion of public housing than other jurisdictions (as the dwellings were previously used to accommodate public sector employees), however this stock, which is distributed throughout the metropolitan area, also represents on average the oldest public housing portfolio in Australia, with substantial maintenance and repair issues.

Lastly, the continued expansion, development and upgrading of open spaces throughout the ACT (such as parks, reserves and sporting facilities), has resulted in an increasingly large asset base to manage and maintain.

Figure 12: Transformation of the ACT Settlements and Infrastructure sector



Resilience

The sector is currently being transformed through a range of adaptive strategies including:

Public education campaigns – to promote shared responsibility for climate change adaptation, by increasing community awareness and preparedness for extreme heat, fire, storm and flood events; and 'how to' sustainable living education campaigns.

Mandatory requirements for new developments – to encourage more climate resilient, energy efficient buildings (residential and commercial), by adapting regulations, standards, codes, and material guidelines, which also differ across the city in terms of risk. This approach as encourages choice and diversity in dwellings types, which also requires new market interventions, including new housing business models.

Adapting existing dwellings – to improve energy efficiency and to respond to changing age demographics.

Active transport – existing roadways are being changed to prioritise for multi-use, with increasing shifts towards cycling (electronic and push bikes), walking, public transport and low emission vehicles. Other transport resilience initiatives include supporting active transport by improving dedicated cycling infrastructure and end of trip facilities (storage and change rooms); and through improvements to the ACTION bus network to encourage wider public transportation use (analysing the MyWay trip database to provide timetabling and route improvements, and providing real-time journey information to travellers, park n ride options and transit lanes).

Business case for change – to substantiate investment and operational spending, the ACT Government evaluates the potential for future costs to be incurred if adaptation did not take place.

Green infrastructure – green infrastructure initiatives, such as stormwater retention ponds, are now mandatory at the time of urban renewal (to maximise least cost retrofitting) and built into land planning approvals.

Adapting the urban form – a tree strategy has been prepared for streets and public spaces, which includes adapting plant species to be more climate resilient. Public domain standards

(for design and maintenance) are also promoting improvements; and key public open spaces are now watered with non-potable sources.

Transformed system

A transformed settlements sector would consist of a multi-nodal city, containing multi-function districts with a higher degree of self-containment (workplaces, retail, and essential services) provided in each district (Figure 12). The transformation would also support low carbon living, allowing more people to live, work and move without high-energy usage, while maintaining a good standard of living and wellbeing. Incentives to support seasonal living (flexible access to services and working hours) would also help to shape the climate resilient city. Likewise, a strategic re-think of open space policies would improve sustainability for parks, reserves and sporting facilities where opportunities for grounds to be watered by non-potable water sources are realised; and safe, inclusive infrastructure is well maintained year round.

The transition

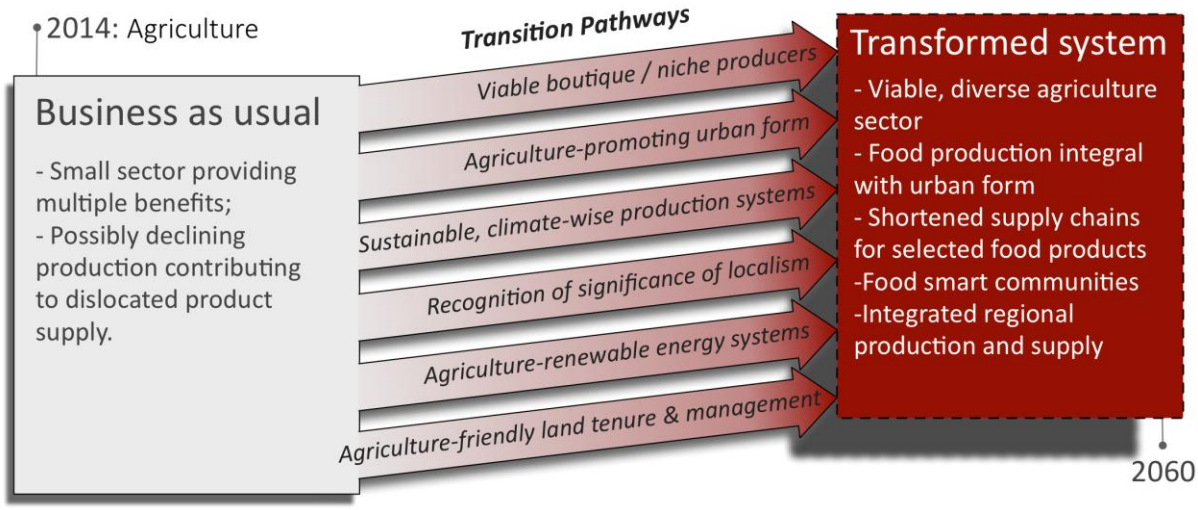
Priority adaptive pathways to transform ACT settlements will continue to include (Figure 12): sustainable living engagement campaigns; more climate resilient and energy efficient developments; further adaptation of existing dwellings; improved connectivity and sustainability of open space; multi-function roads and an active, transport-friendly urban form; and planned green infrastructure.

Agriculture

Business as usual

Agriculture in the ACT is a small production sector that is currently threatened by land use change, particularly larger scale grazing and forestry enterprises (Figure 13). The sector provides multiple benefits to the ACT (e.g. in land management and diversification of livelihoods) in the context of an urban system dependent on externally sourced agricultural products.

Figure 13: Transformation of the ACT Agriculture sector



Resilience

Sector resilience is currently provided through a nascent community interest in localism, food miles and the health benefits of community involvement in food production, and the growth of food-tourism in the ACT and the region more broadly.

Transformed system

A transformed food and fibre production sector would operate at multiple-scales to shorten selected supply chains within the ACT (Figure 13). The sector would include viable, diverse, niche-based enterprises for food and fibre production integrated with regional tourism. Future urban form would incorporate food production and encourage localism through the involvement of food-smart communities in gardening, farmers-markets and collaborative consumption.

The transition

Basic information on the size and status of the ACT's agriculture sector and associated industries would identify which production systems have a viable future and (Figure 13):

- Identify the need to maintain and promote an agriculture sector in the ACT;
- Assist in planning the form and function of new human settlements;
- Devise boutique/niche production systems that integrate improved NRM practices and the ability to adapt to future climate.

Opportunities exist within the ACT's land tenure system to encourage investment by landholders in continuous improvement in natural resource management in return for greater security of tenure.

5.2 CROSS DIRECTORATE PRIORITIES AND SECTOR TRANSFORMATIONS

A dot democracy process was applied to determine the most important cross-sectoral issues for government. Participants were provided with two sticky dots that were used to vote for the top two priorities for Government among the transition pathways needed to realise the sector transformations.

Participants then considered the changes that are needed to create a transformed system for each service delivery area. This was facilitated through an identification of the barriers and enablers of change across social, environmental, economic, governance and temporal factors. In addition, the interactions between existing policies and programs and directorates/jurisdictions were considered. This process led to the development of a series of whole-of-government transition projects. Project descriptions include a project title, a brief description of the outcomes, the steps in establishing the project, identification of any aligned government policies and processes, identification of the key stakeholders and decision-makers, and any resources that could be drawn upon to achieve the outcomes.

A completed dot democracy of the natural resources pathways model.

Water

For water in the ACT the whole-of-government priority was identified as innovative storm water utilisation (Figure 14). A number of related issues also rated highly including innovative water storage, enhanced green infrastructure, water-sensitive urban development and development of non-potable alternative water sources.

Figure 14: Cross-directorate prioritisation of transition pathways for Water in the ACT

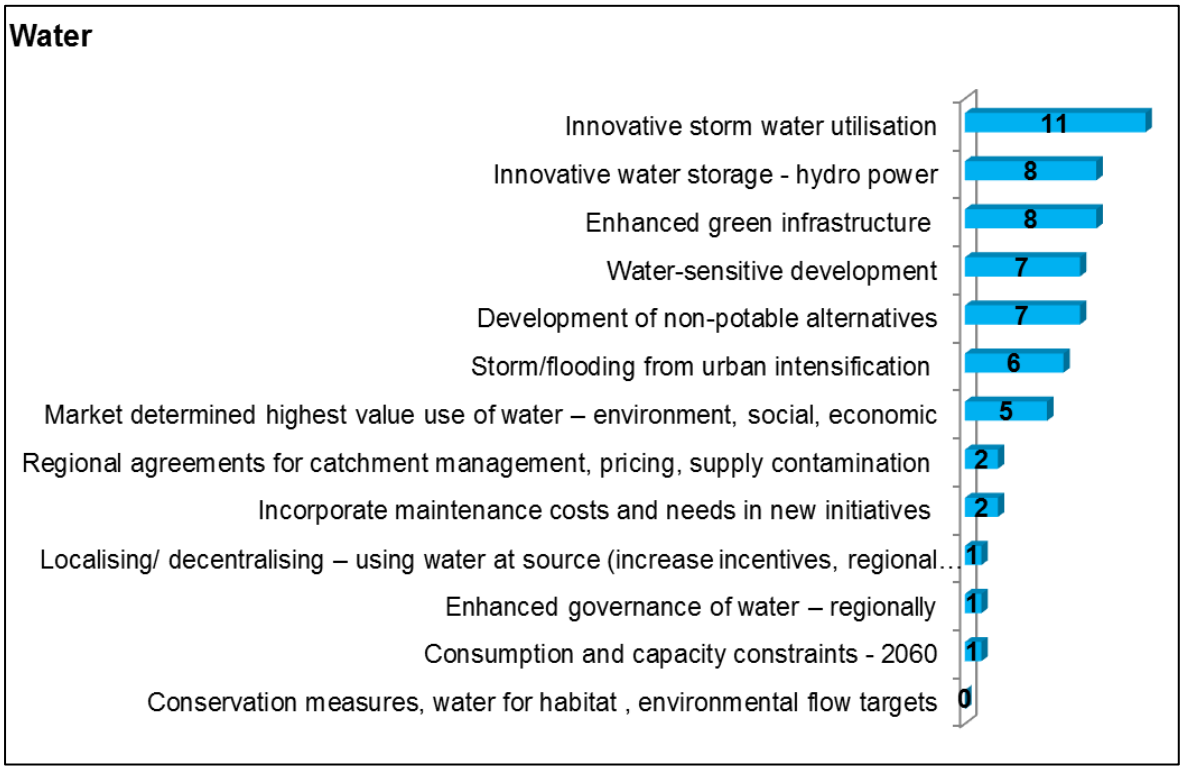


Table 4 collates the key constraining and enabling factors associated with achieving the change to a transformed system in the ACT. Table 5 sets out a project that begins the process of establishing a holistic natural water system for storm water utilisation.

Table 4: Constraining and enabling factors associated with transformational change for water.

	Constraints	Enablers
Social	• Community behaviour, comfort zone • Public acceptance of amenity	• High acceptance of water saving (already happening)
Environmental	• Less potential on smaller blocks	• Potential on older/longer blocks • Space is available to include WSUD in new developments

Economic	• Cost-benefit for developers of:
	  ○ Price of water
	  ○ Cost of infrastructure
	  ○ Cost of maintenance
	• Current gardens (~70%) designed to use potable supply not stored rain water
		• Potential revenue for government from storm water harvesting
		• Potential to reduce insurance risk
		• Reduced reliance on potable supply

Temporal	• Significant recent government investment in enhanced dam storage	• System in place that is working • Dam storage in place

Table 5: 'First steps' project towards transformation for water

1. Project description	•Holistic natural water system for storm water utilisation
2.Project outcomes	•Make best use of water •More permeable landscape (through modified paving systems etc.)
3.What are the steps?	•Engage designers in need for accelerated change •Introduce more flexibility into ACT water planning •Recognise monetary value of storm water and create positive incentives •FiT mechanism for water capture and use •Identify suitable location for trial – if developed area, look to introduce new system •Develop budget and financial metrics •Calculate cost savings •Evaluate additional benefits: biodiversity and health and well-being
4.Aligned government processes / programs	•Water Strategy •Water Sensitive Urban Design (WSUD)
5.Key stakeholders/ decision makers	•Environment and Planning Directorate (water, natural resource management) •Territory and Municipal Services •Chief Ministers, Treasury and Economic Development Directorate
6.Potential resources?	•Existing evidence-based research – FiTS in ACT •Provide evidence to support ACT budget processes

Disaster and Emergency Management

For emergency management in the ACT the whole-of-government priority was identified as lower risk built environments (Figure 15). A number of related issues also rated highly including the inter-operability of emergency services and regional cross-border surge (peak case load) capacity.

Table 6 collates the key constraining and enabling factors associated with achieving the change to a transformed system in the ACT. Table 7 sets out a project that begins the process of e*nhancement of the built environment legislation, policies and implementation.*

Figure 15: Cross-directorate prioritisation of transition pathways for Disaster & Emergency in the ACT.

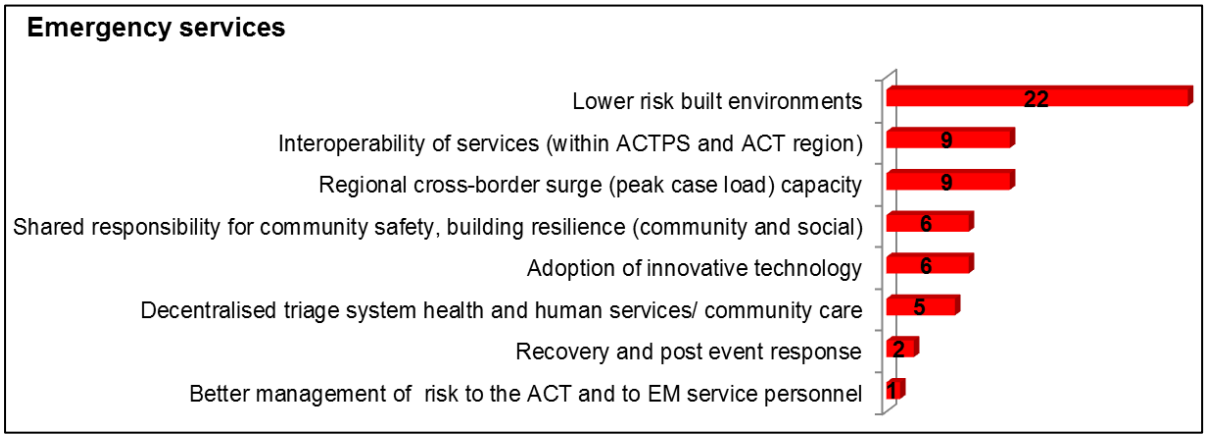


Table 6: Constraining and enabling factors associated with transformational change in disaster and emergency management.

	Constraints	Enablers
Social	• Lack of understanding of climate change risks • Apathy • Personal preferences and norms on housing stock and • Poor affordability	• Strong sense of social inclusiveness and community spirit • Existing engagement between Government & Community • Community fire units
Environmental	• Balancing the "bush capital" image with changing expectations of amenity & urban design driven by climate • Maintaining the heritage value of legacy properties • Geographical constraints	• Redefining the bush fire prone areas. • Improvements to building regulations • Urban densification
Economic	• Costs of increasing regulations • Lack of resources for innovation in building standards and technology • Pockets of disadvantage • Multi-jurisdictional approach requiring negotiation for coordinating resources	• Canberra is an affluent community • Focus on prevention – i.e. better building standards
Temporal	• Ground work that needs to happen now to develop processes to be ready by 2060 • Pace of change during an emergency	• Cross directorate networks

Table 7: 'First steps' project towards transformation in disaster and emergency management

1. Project description	•Enhancement of the built environment legislation, policies and implementation.
2.Project outcomes	•A more resilient built environment with a more resilient community
3.What are the steps?	• Review current uptake and enforcement – stakeholder consultation •Gap analysis and options •Develop case for legislative and regulatory change, enforcement, education and awareness and partnership with industry stakeholders and developers •Inter jurisdictional consultation on national standards •Interface with planning system to determine where we can build •CBA of energy building efficiency standards/ thermal performance •Compliance and certification options •Staging and sequencing of reform
4.Aligned government processes / programs	•Zero emissions building policy •ACT Building Act review •National construction code process •National disaster resilience (COAG) •Other strategies effecting building standards e.g. Housing affordability/bush fire standards review
5.Key stakeholders/ decision makers	•Environment and Planning Directorate •Territory and Municipal Services •Construction Industry
6.Potential resources?	•Not specified

Natural Resources and Ecosystems

For natural resources and ecosystems in the ACT the whole-of-government priority was identified as technology assisted use-based management (Figure 16). A number of related issues also rated highly including the prioritised landscape management and NRM-conservation partnerships to facilitate public-private partnerships and encourage shared responsibility for natural areas.

Table 8 collates the key constraining and enabling factors associated with achieving the change to a transformed system in the ACT. Table 9 sets out a project that begins the process of establishing nature-based tourism.

Figure 16: Cross-directorate prioritisation of transition pathways for natural resources and ecosystems in the ACT

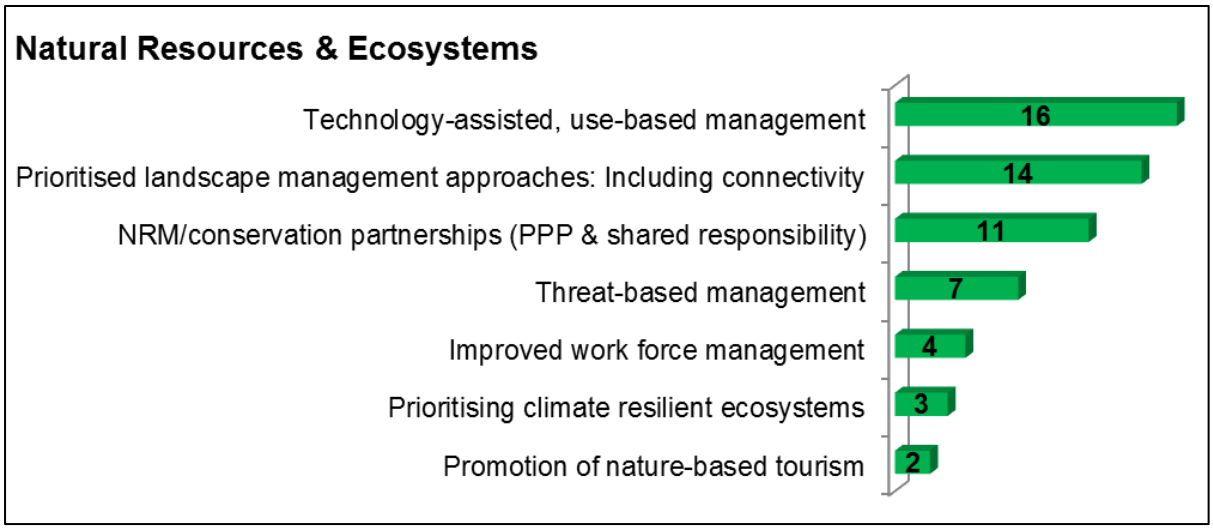


Table 8: Constraining and enabling factors associated with transformational change in natural resources and ecosystems

	Constraints	Enablers
Social	• Stigma attached to land, parks and reserve managers. • Community mistrust of PPPs, and both public and private managers. • Misinformation • Current lease-hold system	• Engaged and informed community • Social ownership and connections to the land/ natural environment
Environmental	• Unknown impacts of management actions due to complex and dynamic systems • Emergency management actions on bushland • Car dependency/ roads	• Research (+ funding) • Lightening of the regulatory burden • Adaptive and efficient regulatory system
Economic	• Development needs (revenue base and growing population) • Lack of promotion and perception of 'iconic' landscapes in the ACT • Lack of collaboration/ coordination between private and public actors	• Ecosystem services – built into and recognised in other sectors • Iconic wildlife within close proximity to towns
Temporal	• Lag times between actions and results	• Monitoring and reporting, gathering information to build skill base and knowledge • Community expectations – driving governance changes
Governance	• Legal and cross-jurisdictional	• Incentives and penalties for

	challenges • In-ability to form cross-jurisdictional agreements	tourism operators

Table 9: 'First steps' project towards transformation in natural resources and ecosystems

1. Project description	•Nature-based tourism
2.Project outcomes	•A co-management system for ACT's Natural Resources and Ecosystems that effectively maintains the integrity of the reserves and builds a broad investor base for management support
3.What are the steps?	•Government or skilled experts identify 'iconic' landscape features (marketable sites), how many, where, and the potential for a tourism program •Stakeholder consultation •Consideration of the entire public land and reserve base by field workers, cultural groups, academics etc •Scoping and economic evaluation of feasible options/ approaches to nature-based tourism •Establish offset/green legacy for private investors •Improve transport infrastructure and connectivity and investigate alternatives e.g cycle paths •Market testing •Build on Government information services for parks and reserves
4.Aligned government processes / programs	•Tourism ACT programs •COAG Councils on nature-based tourism •Active transport/ health initiatives •ACT Community engagement programs Nature reserves and national parks •Cost savings initiatives
5.Key stakeholders/ decision makers	•Environment and Planning Directorate- Conservation, Parks and Reserves and NRM/ Natural Environment Policy and Programs •TAMS •Chief Ministers, Treasury and Economic Development Directorate, Tourism ACT •Community Groups- e.g friends of', park users, sports groups and cultural Institutions •Private investors (potential for development)
6.Potential resources?	•Existing infrastructure and Government resources •Tenders/proposals to identify potential for PPP in implementation of nature-based tourism projects

Community Health and Wellbeing

For community health and well-being in the ACT the clear whole-of-government priority was identified as promoting healthy-living urban development (Figure 17). Several other issues received lower levels of support including increased emergency and health service provision, fully implemented government health and well-being plans and comprehensive environmental monitoring and management.

Figure 17: Cross-directorate prioritisation of transition pathways for Community Health and Wellbeing in the ACT

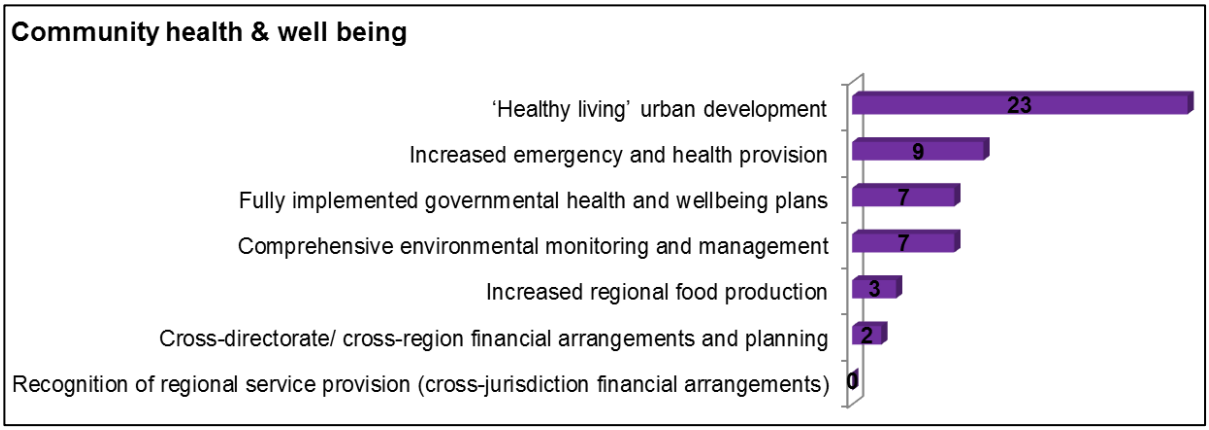


Table 10 collates the key constraining and enabling factors associated with achieving the change to a transformed system in the ACT. Table 11 sets out a project that seeks to establish climate resilient community spaces.

Table 10: Constraining and enabling factors associated with transformational change in community health and wellbeing

	Constraints	Enablers
Social	• Lack of desire to change perceptions and attitudes • Lack of education surrounding the link between the environment and personal health • Cultural norms around car travel • High community expectations of service delivery	• Education – real life examples (stories) • Most liveable city benchmark • Community organisations • Cycle ways and active transport
Environmental	• Lack of connectivity between spaces • Water quality • Regulations	• Existing open spaces • Current plans and policies
Economic	• Cost of infrastructure/ materials • Lack of resources • Impacts on other Directorates and costs to government regarding feasibility of open space projects and ongoing maintenance	• Affluence of ACT society
Temporal	• Conflicting priorities	

Table 11: 'First steps' project towards transformation in community cealth and cell-being

1. Project description	•Climate resilient community spaces
2.Project outcomes	•Healthy, socially inclusive, resilient and caring community. •A mix of hard and soft landscaping to encourage people to utilise open spaces.
3.What are the steps?	•Review design standards of open spaces to take climate change into account and reduce risks from heat •Develop connectivity between hard and soft landscaping- pathways, BBQs, drinking stations and furniture with drought resistant plants/vegetation •Encourage active travel: recreation around waterways, shaded walk-ways to environments and resting places, link to water sensitive urban design
4.Aligned government processes / programs	•TAMS & EPD – Build on existing policies and programs (healthy weight initiative, recreational facilities, drinking water, Water sensitive urban design (wetlands)) •LDA – New developments •TAMS – Parks and city services •CMTED, HEALTH
5.Key stakeholders/ decision makers	•Engage community organisations – 'Friends of..' to develop shared responsibility, participation, community ownership, pride etc.
6.Potential resources?	•Not specified

Settlements and Infrastructure

For settlements in the ACT the clear whole-of-government priority was identified as climate responsive standards, regulations and incentives for all buildings (Figure 18). Several other issues received lower levels of support including increasing shade trees and changing plants in the public realm to minimise heat islands and changing social norms around community expectations and preferences of how people live in the ACT.

Figure 18: Cross-directorate prioritisation of transition pathways for settlements and infrastructure in the ACT

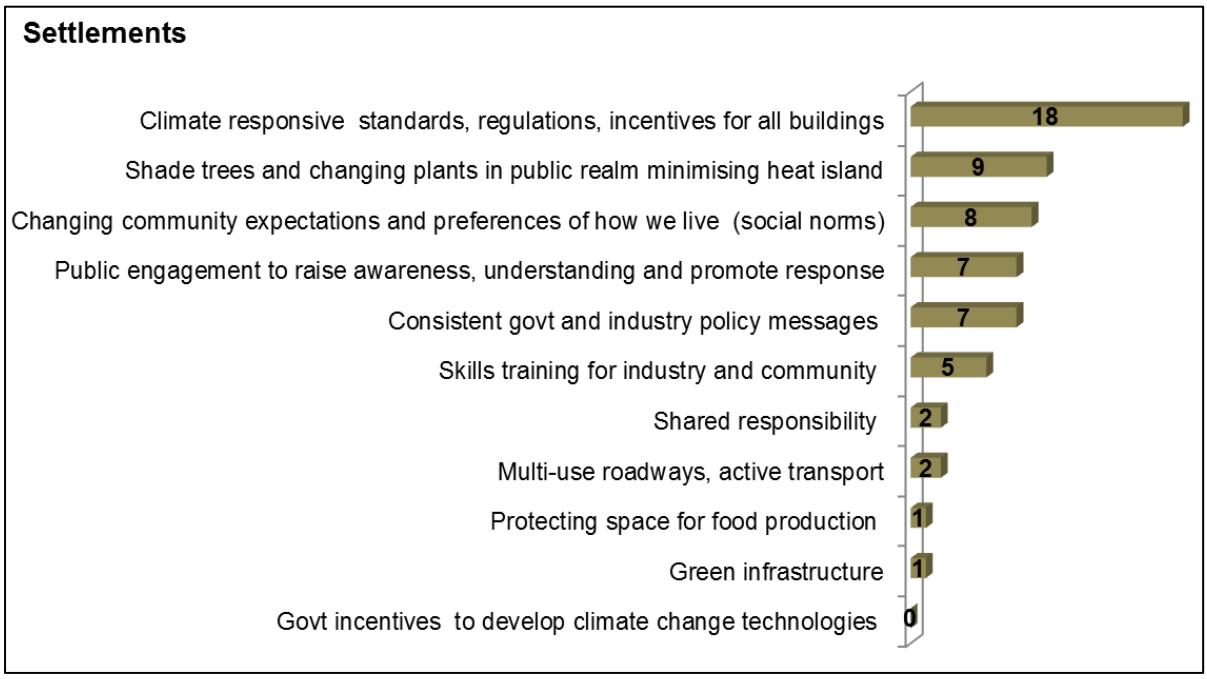


Table 12 collates the key constraining and enabling factors associated with achieving the change to a transformed system in the ACT. Table 13 sets out a project that seeks to develop a green infrastructure strategy for the ACT.

Table 12: Constraining and enabling factors associated with transformational change in settlements and infrastructure

	Constraints	Enablers
Social	• Regulations are only part of the solution • Inertia from all stakeholders: community, government, business, industry and politicians	• Education and awareness of the community, industry and peak bodies • Engagement processes to hear people's views and values
Environmental	• Lack of consistency in building codes (BCA) across Australia • NSW standards and regulations inconsistent with ACT • Lack of local knowledge and research base	• Building performance standards are currently under development • Education and awareness of the community and industry and peak bodies
Economic	• Cost of achieving a climate	• Incentives to change

	adapted house or commercial building • Evaluation of costs vs. benefit takes short term view and does not include operational costs	• Demonstration of the benefits • More effective allocation of resources to fund adaptation actions
Governance	• Lack of Whole-of-Government integration in policy development • Lack of skills and knowledge to better inform policy • Lack of motivation and leadership to foster innovation • Lack of action on existing policies, plans and strategies	• Consultation within and between Directorates to allow for better integration at policy development stage • Utilise existing Cabinet process

Table 13: 'First steps' project towards transformation in settlements and infrastructure

1. Project description	•Green Infrastructure (GI) Strategy
2.Project outcomes	•An urban environment that is resilient to a changing climate with public spaces that are shaded and have high amenity, biodiversity and water infiltration.
3.What are the steps?	•Identify extent of green infrastructure in the ACT •Identify and fill knowledge gaps through research, engagement and trials •Identify the barriers to adoption •Put processes in place to remove barriers •Deliberative engagement with government and industry to draft a GI strategy •Prepare draft GI strategy (policy and actions) •Consultation with stakeholders about the draft GI strategy •Government adoption of strategy with adequate budget for works
4.Aligned government processes / programs	•Territory Plan codes •Water Sensitive Urban Design •Ministerial Statement of Planning Intent •TAMS design standards review and plant species lists review
5.Key stakeholders/ decision makers	•Government (Cabinet) •Strategic Board •Peak Industry and professional bodies •Key Directorates are TAMS, EPD, LDA, CMTEDD/ Treasury
6.Potential resources?	•Draw on expertise from within ACT Directorates and State Governments •Requires funding for trials

Agriculture

The whole-of-government priority for agriculture in the ACT was identified the establishment of viable boutique/niche producers in the ACT (Figure 19). Other issues that received support included the adoption of sustainable climate- and soil-wise production systems and establishing an agriculture-promoting urban form.

Table 14 collates the key constraining and enabling factors associated with achieving the change to a transformed system in the ACT. Table 15 sets out a project that seeks to establish long-term land tenure arrangements to promote best use of agricultural land in the ACT and surrounding regions.

Figure 19: Cross-directorate prioritisation of transition pathways for agriculture in the ACT.

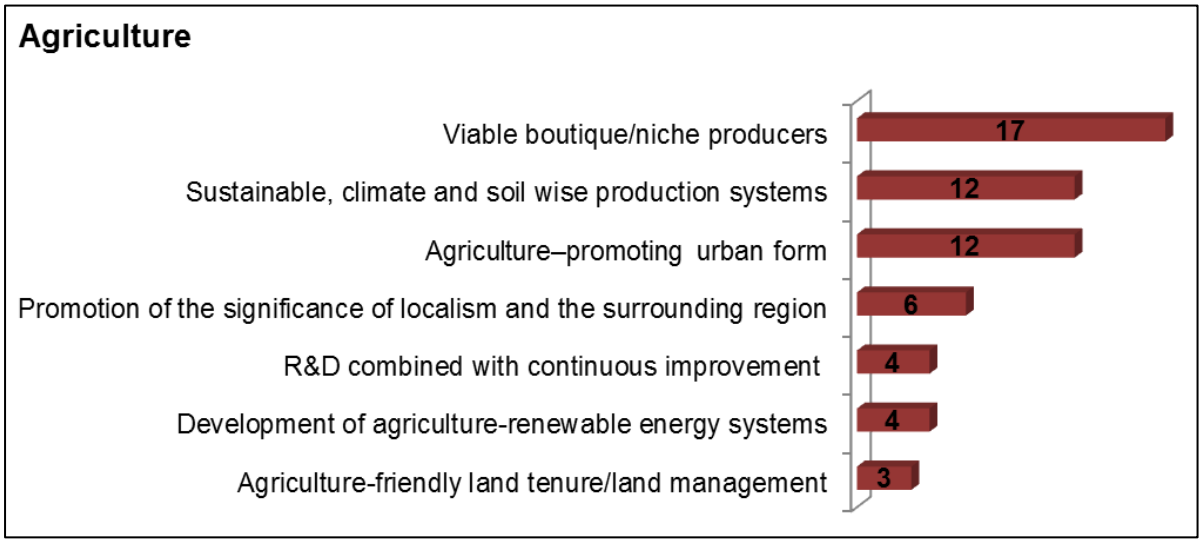


Table 14: Constraining and enabling factors associated with transformational change in agriculture.

	Constraints	Enablers
Social	• Perception of insignificance of agriculture sector in the ACT • Large sectors of the community wedded to convenience shopping • Few or no outlets for local produce in supermarkets and shopping malls/centres • Tenure conditions on rural leases e.g. relatively short (20yr) tenure period • Pressure from urban expansion	• General community support and demand for local produce. • Rural setting of “bush capital” • Educated and aware population sectors demanding local produce • Targeted leasing and longer lease periods • Community gardens
Environmental	• Water and land availability • Environmental hazard from climate change and variability i.e. increases in frequency and magnitudes of extreme events • Biosecurity issues	• Development of incentives for climate-wise production systems • Implementation of land capability/viability assessments • Cross jurisdictional support/collaboration • Potential for innovative, intensive and holistic agricultural production techniques e.g. organic compost, green waste collection
Economic	• Perception that local produce is more expensive than supermarkets • Viability around economies of scale in agricultural production • Loss of revenue from land sales for future urban development	• Economic potential of outlets for local produce in supermarkets and shopping malls • Development of incentives for local producer collectives • Development of incentives for local producers to market in high profile locations e.g.

		shopping malls • Potential for innovative forms of marketing e.g. vending machines • Agri-tourism
Temporal	• Land bank pressure for future development • Time to establish viable industry and enterprises • Lack of public education on the value and benefit of local agriculture	

Table 15: 'First steps' project towards transformation in agriculture

1. Project description	•Long-term land tenure arrangements to promote best use of agricultural land in the ACT and surrounding regions
2.Project outcomes	•Development of a viable, diverse and niche-based agricultural sector that provides multiple land management benefits
3.What are the steps?	• Review existing broad-acre and urban open space zoned land to determine and protect suitable areas for agriculture. •Undertake land capability assessments – for current and projected future environmental conditions in rural and urban areas •Exploration of land tenure and use options •Inventory of existing and projected demand, opportunities and synergies for agriculture in the ACT and surrounding region •Determine agricultural products and systems suitable for ACT land and climate in the long-term •Determine complementary industries and events (e.g. food and wine festivals) to bolster and enhance agricultural production •Develop agriculture and food security policies for the ACT
4.Aligned government processes / programs	•Land management agreements
5.Key stakeholders/ decision makers	•Rural lessees •ACT and regional business sectors - tourism, food retail, ACT & Australian Government cultural facilities and institutions •ACT Government Ministers and agencies
6.Potential resources?	•Land zoned non-urban (NUZ1-4) •Urban parks and recreation (PRZ1)

6 LINKS TO NSW GOVERNMENT ADAPTATION INITIATIVES

The Enabling Adaptation in the ACT project is a parallel project to Enabling Adaptation in the

South East (EASE) and contributes to the next phase in regional adaptation planning that follows on from the Integrated Regional Vulnerability Assessment in the South East. The EASE pilot project focuses on climate change adaptation pathways to address the:

- *NSW2021* target to 'minimise impacts of climate change in local communities' (Goal 23); and
- *NSW South East Regional Action Plan Priority 6* – Manage our Natural Resources and to protect the environment. The project builds on the information developed for the South East to identify responses and opportunities to improve the resilience of local communities to extreme events and climate risk'.

The Enabling Adaptation in the South East (EASE) project involves both the NSW and ACT State Governments, relevant Federal agencies and 14 Local Government areas that have been identified Regional Action Plan. To assess how these organisations' activities can be adapted to increase agency resilience to the vulnerabilities identified in the SE IRVA.

The EnAACT project contributes to the NSW EASE project to ensure the region is considered as a whole, and will also feed into the NSW Adaptation Hub Adaptive Communities Node. Engagement with the NSW DPC-led Regional Leadership Network will seek to establish path dependencies and enhance collaboration in the NSW-ACT border region.

We considered at the connections between EASE and EnAACT in 2 ways:

1. Shift-share analysis of employment data over the period 2006 and 2011, that is, consecutive census collection periods for the ACT and the Tablelands and Alpine sub-regions of NSW.
2. Comparison of the potential linkages between the ACT and NSW sub-regional adaptive pathways models.

Identifying sub-regional engines of growth through shift-share analysis of employment data

What is shift-share analysis?

Shift-share analysis is a technique employed within regional economics to understand relationships between industry, the macro-economic environment and competitive advantage in regions. It seeks to decompose employment growth into three components – a national share, an industry mix share and a residual. The residual share is then used to identify competitive industries from within a local economy. For example, an industry that has a comparative advantage locally would be expected to show employment growth that is greater than the growth trend for the national economy or for that industry mix. Alternatively, an industry that is at competitive disadvantage would be expected to show a growth in employment that is less than the growth trend for the national economy or for that industry mix. Shift-share offers a relatively simple approach to separating national and industry contributions to regional employment growth. However, some caveats should be applied to its use.

Shift-share:

- Minimises the impact of issues such as business cycles
- Does not identify the factors that actually provide comparative advantage; and
- Provides a snap-shot of two particular points in time only (in this case the 2006 and

2011 census data) and so is sensitive to the time period chosen.

Top employing regional industries

Employment in the ACT in 2011 is dominated by public sector employment in Public Administration, Defence, Education, Public Order and Safety and Health (Table 16). There is a significant concentration of employment within professional, scientific and technical services and a major component of this employment is also likely to be public sector employees. Employment is lower order service activities such as food and beverage services and store based retailing are consistent with employment patterns expected in a major urban centre.

The ACT influences employment in the surrounding regions of NSW. Public administration is the largest category of employment for people living in the Tablelands (almost 1.9-times employment in the second largest category, Agriculture) and the third largest for the Alpine sub-region. Employment available in the ACT in professional scientific and technical services in particular, through CSIRO and the ACT's universities is also likely to influence the levels of employment in this category in the Tablelands and Alpine sub-regions of NSW (Table 16).

Table 16: Employment in industries of significance in the ACT and in the Tablelands and Alpine sub-regions of NSW for 2011. Shading indicates strong connections between place of residence (Alpine and Tablelands sub regions) and place of employment (ACT) for selected industries

ACT n = 5000	Tablelands n = 1500	Alpine n = 250
Public Administration (51,288)	Public Administration (6,823)	Agriculture (803)
Professional, Scientific and Technical Services (14,175)	Agriculture (3,673)	Accommodation (682)
Defence (12,495)	Construction Services (3,187)	Public Administration (564)
Food and Beverage Services (9,022)	Other Store-Based Retailing (3,045)	Food and Beverage Services (552)
Other Store-Based Retailing (8,871)	Food and Beverage Services (2,771)	Preschool and School Education (447)
Preschool and School Education (8,068)	Professional, Scientific and Technical Services (2,705)	Construction Services (431)
Tertiary Education (7,746)	Preschool and School Education (2,555)	Other Store-Based Retailing (424)
Computer System Design and Related Services (6,104)	Defence (2,334)	Professional, Scientific and Technical Services (381)
Public Order, Safety and Regulatory Services (5,913)	Public Order, Safety and Regulatory Services (1,981)	Food Retailing (335)
Hospitals (5,351)	Food Retailing (1,852)	Sports and Recreation Activities (335)
Social Assistance Services (5,132)	Social Assistance Services (1,643)	Electricity Supply (277)

***except Computer System Design and Related Services**

Employment growth 2006-2011

In aggregate total employment in the ACT grew by 23,144 people between 2006 and 2011. Twelve industry sectors (Table 17) accounted for 17,488 new jobs or three quarters of new

jobs created. Growth occurred in:

- Public sector employment – growth in Public Administration was by far the largest category accounting for over 40% of total ACT growth alone.
- Other public sector employment including Defence, Public Order and Safety, Education and Health.
- Service economy activities including both highly skilled activities such as Computer system design and related services and professional, scientific and technical services and lower skilled activities such as food and beverage services, and personal and other services.

At least some of the growth in health and residential care services was probably attributable to demographic trends in the ACT. The growth in public sector employment is unsurprising given the role of Canberra as the administrative centre for the Australian Government. However, given recent moves at the Federal level to smaller government these trends are unlikely to continue and this will undoubtedly have a flow on effect to the South East Region. The high concentration of employment growth in specialist professional and scientific services (computers, medical, tertiary education) is also related to the institutional make up of Canberra as Australia's capital city and provides a significant foundation for further knowledge-based economic development. Surprisingly, given the amount of urban development in and around Canberra, building and construction related activities did not feature among the ACT's growth industries.

Table 17: Employment growth in the ACT

Industries that grew by 300 or more jobs between 2006 and 2011	Job growth
Public Administration	9,545
Defence	1,523
Computer System Design and Related Services	1,121
Public Order, Safety and Regulatory Services	863
Food and Beverage Services	781
Professional, Scientific and Technical Services (except Computer System Design and Related Services)	757
Tertiary Education	736
Preschool and School Education	525
Medical and Other Health Care Services	482
Residential Care Services	389
Hospitals	385
Personal and Other Services	381

The ACT's locally competitive industries

Shift-share analysis identified several industries displaying employment growth through regional competitive advantage against a strong declining trend in national employment (Table 18). Not surprisingly *Public Administration and Defence* showed both a large growth in employment and a relatively large regional share of growth of 45% and 29% respectively. For most other industries, employment growth was attributable to growth in the industry mix rather than national or regional trends. Other industries, such as *Fabricated metal product manufacturing* and *Library and other services* showed large regional shares of employment growth (of 219% and 114% respectively) but these were calculated from a relatively low level of total employment. The analysis again demonstrates the importance of public sector on

ACT employment.

Table 18: Shift-share analysis of ACT's top growth (A) and locally competitive (B) industry sectors form 2006 and 2011 census data.

Industry sectors	Total employment	Growth	National share	Industry Mix	Regional Share	Regional share (%)
A: Top growth sectors – actual job growth						
Public Administration	51288	9545	-23445	28701	4289	45%
Defence	12495	1523	-6162	7243	442	29%
Computer System Design and Related Services	6104	1121	-2799	4367	-447	-40%
Public Order, Safety and Regulatory Services	5913	863	-2836	3807	-108	-12%
Food and Beverage Services	9022	781	-4629	5930	-520	-67%
Professional, Scientific and Technical Services*	14175	757	-7536	10099	-1806	-239%
Tertiary Education	7746	736	-3937	5214	-541	-73%
Preschool and School Education	8068	525	-4237	5329	-567	-108%
Medical and Other Health Care Services	4987	482	-2530	3244	-232	-48%
Residential Care Services	1913	389	-856	1305	-60	-15%
B: Locally competitive sectors – by regional component of shift-share						
Public Administration	51288	9545	3474	1782	4289	45%
Defence	12495	1523	913	167	442	29%
Commission-Based Wholesaling	87	44	4	0	41	93%
Fabricated Metal Product Manufacturing	275	17	21	-42	37	219%
Insurance and Superannuation Funds	1002	203	66	102	34	17%
Library and Other Information Services	998	28	81	-85	32	114%
Furniture and Other Manufacturing	372	-42	34	-103	26	-63%
Motor Vehicle and Motor Vehicle Parts Retailing	1128	23	92	-89	20	88%
Textile, Leather, Clothing and Footwear Manufacturing	155	-16	14	-50	19	-121%
Rental and Hiring Services^	523	-3	44	-56	9	-293%

*Except Computer System Design and Related Services. ^Except Real Estate.

The ACT's locally declining industries

The shift-share analysis of declining industry sectors in the ACT presents a different picture (Table 19). Several sectors showed significant declines in employment between 2006 and 2011 including *Construction services*, *Building construction*, *Building cleaning and pest control services* and *Finance*. For these sectors the loss of employment was attributable largely to the regional share of employment rather than change in the national economy,

although some also showed a declining industry share (e.g. *Food retailing* and *Accommodation*). The most significant locally declining sectors (i.e. where the regional share of employment loss was greatest) included *Construction services*, *Professional scientific and technical services*, *Social assistance services* and *Building construction*. Of these *Professional scientific and technical services* and *Social assistance services* had a declining regional share despite positive employment growth in the sector. These declines point to areas that warrant further analysis over time to detect ongoing trends. Such changes in industries may be signals of trends in the restructuring of the local economy. Greater understanding of the context of their decline can in turn provide direction for economic development activities and investments.

Table 19: Shift-share analysis of ACT's most declining (A) and locally uncompetitive (B) industry sectors identified from 2006 and 2011 census data.

Industry sectors	Total employment	Growth	National share	Industry Mix	Regional Share	Regional share (%)
A: Most declining sectors - actual job decline						
Construction Services	4431	-947	448	421	-1815	192%
Building Construction	2982	-424	283	65	-773	182%
Building Cleaning, Pest Control and Other Support Services	1556	-418	164	159	-742	177%
Finance	1107	-399	125	-45	-480	120%
Food Retailing	4369	-369	394	-319	-444	120%
Administrative Services	2255	-364	218	47	-629	173%
Repair and Maintenance	1894	-360	188	27	-574	160%
Accommodation	1805	-280	174	-118	-335	120%
Printing (including Reproduction of Recorded Media)	502	-231	61	-200	-92	40%
B: Locally declining sectors – by regional component of shift-share						
Construction Services	4431	-947	677	191	-1815	192%
Professional, Scientific and Technical Services*	14175	757	1690	873	-1806	-239%
Social Assistance Services	5132	313	607	725	-1019	-326%
Building Construction	2982	-424	429	-80	-773	182%
Building Cleaning, Pest Control and Other Support Services	1556	-418	249	75	-742	177%
Administrative Services	2255	-364	330	-65	-629	173%
Repair and Maintenance	1894	-360	284	-69	-574	160%
Preschool and School Education	8068	525	950	142	-567	-108%
Hospitals	5351	385	625	307	-548	-142%

*Except Computer System Design and Related Services.

Interconnected Pathways: ACT-SE NSW

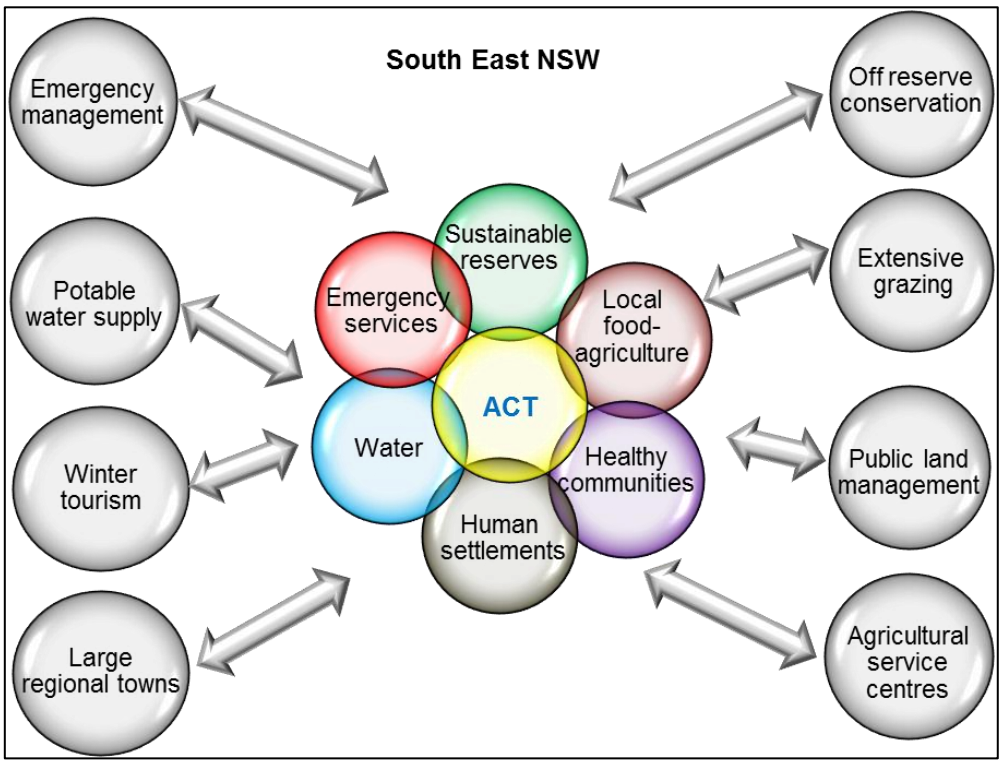
The NSW Office of Environment and Heritage's *Enabling Adaptation in the South East* (EASE) is a related project running in parallel with EnAACT. Through EASE a series of adaptive pathways was developed to describe the transformations required to maintain NSW

Government service delivery under future climate for the three sub regions of South East Region: Coast, Tablelands and Alpine. These models include:

- Extensive grazing
- Regional agricultural service centres
- Off-reserve conservation
- Potable water supply
- Public land management
- Large regional towns
- Emergency management
- Winter alpine tourism
- Beach tourism
- Dairy farming
- Coastal development
- Ecosystem management

Figure 20 shows the EASE pathways that are of most relevance for the ACT because they explore similar service delivery areas (such as emergency management, potable water supply, conservation reserves and management of public land) that occur across jurisdictions, or because they represent structural changes to human settlements in the SE region, which could influence transport services, labour supply/demand or working conditions of importance to the ACT (such as changes projected for large regional towns and smaller agricultural service centres).

Figure 20: Interconnections between the pathways developed for sectors of the ACT Government and those developed for the South East Region of NSW through the Enabling Adaptation in the South East (EASE) project.



Although at time of writing analysis of EASE is incomplete, the emergency management models from both projects are presented to illustrate the interconnections across jurisdictions (Table 20). While there are some differences in scale between the two emergency management models and a greater focus on the urban environment in EnAACT there are also similarities. For example, in transition, both regions seek to improve surge capacity, and increase involvement, engagement and responsibility for emergency management from the community. Common features of a transformed system include the establishment of responsive and responsible communities, a fully resourced emergency management service and the normalisation of surge capacity that extends beyond current administrative boundaries.

Table 20: Alignment across EASE and EnAACT in the transition pathways and transformed systems developed for emergency management service delivery

EASE emergency management model	EnAACT emergency management model
Transition	
Ex-region surge capacity	Regional (cross-border) surge capacity
Community engagement/involvement	Shared responsibility for community safety Decentralised triage and community-based care
Health information systems Pre-emptive emergency management	Adoption of innovative technology
Accessible information across agencies for planning	Inter-operability of services Lower risk built environments
Transformation	
Informed, responsive community	Collaborative co-management of risk
Fully resourced EM service	Equitable and socially inclusive services
Nation-wide surge capacity	Inter-operability and delivery of regional emergency management services
Integrated PPRR across combat-support agencies	Less vulnerable urban form
Integrated health-EM service	

A more detailed analysis of the interactions between pathways will be reported under EASE. However, there is a clear need for continuing close co-operation between the NSW and ACT Governments to ensure that climate adaptation actions in the broader SE Region are mutually beneficial and do not lead to maladaptive outcomes for the communities of NSW and the ACT.

7 SUPPORTING LITERATURE

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