

A Tool Kit ...

for assisting Australia's country towns and communities

with understanding and addressing longer-term climate change impacts

CENTRE FOR
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REGIONAL PLANNING



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Purpose of this document

Rural and regional Australia is often defined by its adaptability and innovation. ***Rural and regional communities have demonstrated over many decades that they have the capability to respond to many challenges.*** These include, natural disasters, drought and the broad consequences of changing productivity and commodity markets, as well as globalisation and deregulation.

Climate change presents rural and regional Australia with an additional hurdle. And, along with economic, social and environmental pressures, provides a new and more substantial barrier that carries with it intergenerational impacts that could change the way life exists in rural and regional Australia.

This Tool Kit provides a step-by-step guide for organisations in rural and regional Australia to consider the future in the face of climate change, and to start thinking about climate change impacts and adaptation. Organisations that will find this Tool Kit useful include:

- Regional Development Australia Committees
- Local environment authorities
- Community Councils
- Industry Associations – including business, traders' and main street associations, tourism associations, chambers of commerce
- Non-government organisations, including
 - o local environment groups (e.g. Landcare)
 - o local development associations
 - o local Indigenous community groups/organisations.

The Tool Kit has been designed to assist community organisations to tap into Federal, State and local government to leverage resources in order to address climate change.

The Tool Kit has been developed out of research on the *Future of Australia's Country Towns to 2050* undertaken for the National Climate Change Adaptation Research Facility (NCCARF) (Beer et al 2013). It is specifically aimed at non-coastal communities in Australia.

The approach outlined here aims to assist organisations in rural and regional Australia understand climate change and adapt to its impacts. *The strategies outlined are drawn from national and international examples of best practice.* They recognise that the broad impacts of climate change are dependent on factors such as geography and industry, as well as the capacity of individuals, communities and governments to respond to the challenges they face.

In developing the Tool Kit, we are mindful of the impact of history and current circumstances in shaping the future of country towns. We also recognise that the future of Australia's country towns is not simply a product of climate change, although these changes are forecast to be significant, and include:

- altered rainfall patterns;
- an increase in average temperatures; and,
- increased extreme events – including heat, cold, flood and drought.

Such changes carry with them greater challenges to infrastructure and social institutions, while the capacity of communities to reinvent, restructure and adapt – environmentally, economically, socially and politically – may well be limited. The future of communities will be affected by the stock of community assets they have, including social, economic, human and natural capital (Cocklin & Dibden 2005). Accordingly, *some locations will be more sensitive than others when exposed to climate variability.*

The appropriateness of our infrastructure and buildings is an important part of the story of the adaptation of Australia's urban settlement pattern.

Understanding the processes that will affect Australia's country towns into the future is critical as:

1. rural and regional Australia largely feeds the nation;
2. regional communities are responsible for the majority of Australia's export earnings, with the mining sector alone accounting for 45 per cent of trade income;
3. significant numbers of Australians may be at risk from adverse climate change impacts, simply because of their place of residence;
4. the costs of economic dislocation associated with failed regional communities could impose a significant burden on national fiscal capacity; and,
5. economic opportunities could be lost if we fail to recognise embedded opportunities to better adapt to a changing environment.

The Tool Kit will assist communities to identify a suite of strategies and actions for early impact planning and assist in minimising the costs associated with climate change and adaptation.



Five key action phases set the foundation for the approach outlined in this Tool Kit:

- Review
- Plan
- Decide
- Implement
- Promote

Each is underpinned by one or more of seven guiding principles for understanding and addressing longer-term climate change impacts:

- partnerships and collaboration;
- evidence-based understanding of key impacts, challenges and risks (using best available science and research);
- prioritisation of actions based on resources, capacity and mutual benefit;
- tailoring approaches to place and scale;
- good communication (of what is generally complex information);
- treating adaptation as an iterative and mainstream process; and,
- continuous monitoring, review and evaluation.

Photo: Michelle Graymore



Key terminology

There are two key approaches for reducing the impact of human-induced climate change: mitigation and adaptation. These terms are defined below. This Tool Kit focusses on the later of these two approaches; the one most relevant to local actions for addressing climate variability.

Mitigation

Mitigation refers to what are generally broader and higher level actions to reduce human influences on climate. That is, as the National Climate Change Adaptation Research Facility (*n.d.*) describe:

Mitigation involves actions that are intended to reduce the magnitude of our contribution to climate change. It includes strategies to reduce greenhouse gas sources and emissions and enhance greenhouse gas sinks.

Adaptation

Adaptation, on the other hand, refers to more local level efforts to reduce climate impacts:

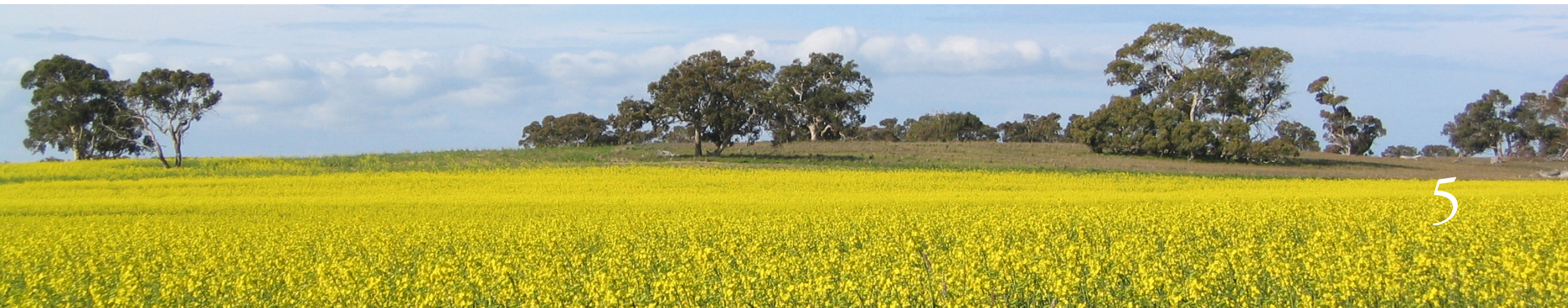
Adaptation consists of actions undertaken to reduce the adverse consequences of climate change, as well as to harness any beneficial opportunities. Adaptation actions aim to reduce the impacts of climate stresses on human and natural systems. (NCCARF *n.d.*)

Further,

Adaptation presents new challenges for business and policy decision-makers: it will take time to build the skills and knowledge on how best to adapt and for implementation of decisions to make a difference. (NCCARF *n.d.*)

And, as Fünfgeld and McEvoy (2011: 6) note:

... climate change adaptation can be considered a process of continuous social and institutional learning, adjustment and transformation. Understanding adaptation as an ongoing process of learning is particularly relevant for local and regional scale decision making.



Climate change and Australia's rural and regional communities: what we know

Significant policy, research and community attention has been directed towards the climate change and its impacts over recent years. Debate about the cause and extent of impacts, the certainty of climate modelling, and the shape and urgency of efforts to measure, mitigate and adapt to the impacts of climate change remains with us. ***But there is a near inescapable consensus amongst scientists – human induced climate change is real and people and places need to prepare for a new future.*** This is true for all communities, regardless of whether they are urban, peri-urban, rural, regional or remote settlements.

This Tool Kit, and the broader research project it draws upon (Beer et al 2013), **emphasises the following key findings from current climate science**, scenario modelling (by the CSIRO in particular):

- projected average annual **warming** of around 1°C nationally by 2030 (above average 1990 figures), ranging from a warming of 0.7–0.9°C for coastal locations and 1–1.2°C for inland areas. And, best estimate projections of average annual warming by 2050 of 0.8–1.8 for a low greenhouse gas emissions scenario and 1.5–2.8°C for a high emissions scenario and for 2070 a warming range of between 2.2°C (low emissions) and 5°C (high emissions);
- anticipated increased occurrence of El Niño Southern Oscillation (ENSO) events, with associated characteristic **intense floods and droughts**;
- changes to the hydrological cycle due to **lower average rainfall** and therefore run-off across much of the continent, with implications for soil moisture and water supply for domestic, commercial and agricultural purposes; and, concomitantly, more frequent and intense rainfall events in the tropical north of Australia, resulting in more frequent floods;
- exposure to **more frequent extreme weather events** including:
 - **more frequent and intense storms and cyclones**, with more intense storm surges predicted for coastal Australia as a result of anticipated rising sea levels and warmer air movements over coastal areas; and
 - **more frequent hot days** across southern Australia in particular, impacting on the frequency and length of heatwave events, the number of days of high bushfire risk and likely the frequency and intensity of bushfires.
- **fewer frosts**; and
- **decreased snow coverage** in alpine regions.

As noted by the report, this translates to projected changes such as those listed in Table 1.

Table 1: Projected changes in weather and climate extremes

Climate Extreme	Projected Change	Confidence in the Change Projected
Number of hot days and nights	↑	Virtually certain
Number of cold nights	↓	Virtually certain
Number of warm spells and heat waves	↑	Very likely
Number of heavy precipitation events	↑	Very likely
Extent of drought affected areas	↑	Likely
Intense tropical cyclone activity	↑	Likely
Frequency of extreme high sea levels	↑	Likely

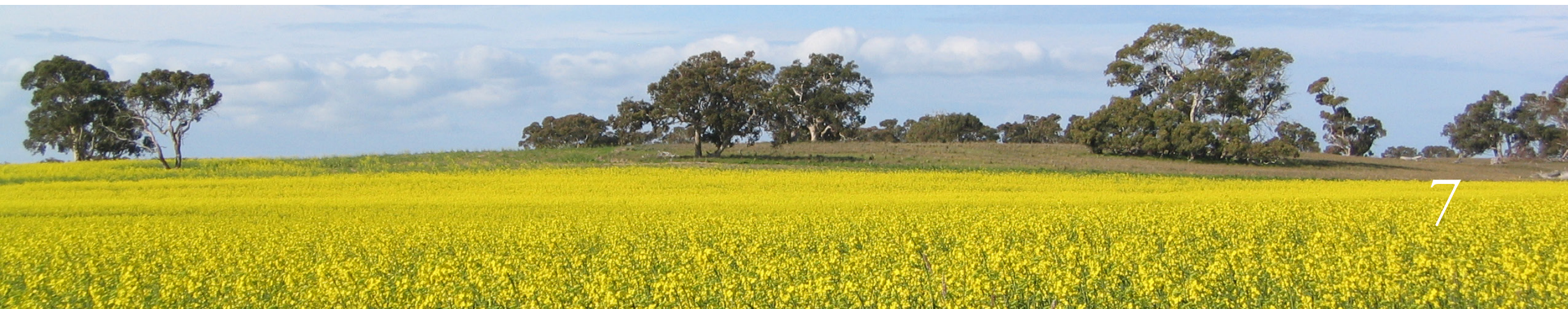
Source: PMSEIC Independent Working Group 2007: 14

Research emphasises that climate variability will have wide ranging impacts on Australia's system of inland settlement, with key changes in inland settlements including:

- shifts in agricultural productivity;
- adverse extreme weather events; and,
- changing local environments and the diminution of resources, including major river systems.

Climate change also has the potential to affect:

- water resources – including supplies for human and animal consumption, and agricultural and industrial uses;
- agriculture – through changes to rainfall, run off and water storage; via the introduction of new pests and diseases due to changes climactic conditions;



- loss of natural resources, habitat and biodiversity – due to water, pests and diseases and other extreme weather events (bush fires, floods, extreme heat events);
- local transport and other physical infrastructure – roads, rail, ports, buildings, and other concrete structures, including through weather related degradation and inundation of infrastructure; and,
- public health – physical health concerns due to extreme weather, particularly incidence of heat stress and respiratory issues and climate related changes in the areas where vector- and water-borne diseases occur; poor mental health and higher rates of depression in communities because of declining economic fortunes and social pressures; increase demand for emergency services due to weather extremes.

Table A1 included as an Appendix to this Tool Kit identifies a range of climate change concerns at the local level.

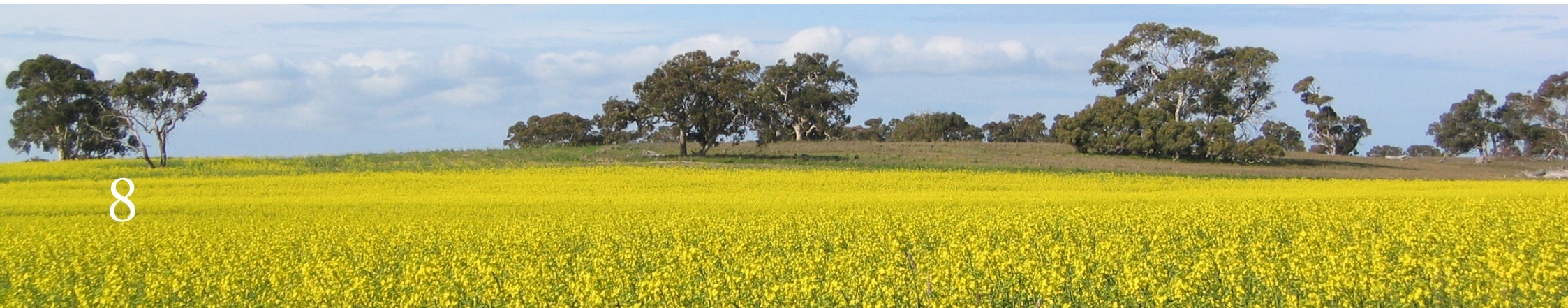
Some industries – including wool production, grains, viticulture and some grazing – are likely to benefit from climate change. ***The fact that some industries will be enhanced in new climate conditions is contrary to commonly held expectations.*** In some communities and sectors of the economy technological change and/or investment in infrastructure will overcome many of the climate change challenges. The key issue, of course, is to be well placed to take advantage of these new technologies and infrastructure through adequate – and early – planning.

Predicted increases in the intensity and frequency of events such as floods, droughts and bushfires comes with a substantial social and economic cost. Australians have seen this all too often with tragic losses of life and damage to crucial infrastructures – towns, individual houses, farms, and community facilities such as schools. The 2009 Black Saturday bushfires in Victoria, the NSW and Tasmanian fires of January 2013 and the floods of January 2011 in Queensland, for example, imposed a substantial impost on the economies and social fabric of affected communities, and indeed, the nation as a whole.

How and to what extent climate variability will impact on inland communities and settlements throughout rural and regional Australia will clearly be affected by factors such as:

- Their industry structure;
- Their geographic location, especially their degree of remoteness;
- Their climatic conditions now and in the year 2030; and,
- The resource ‘endowments’ of communities – and especially their stock of human, social, physical, fiscal and economic capital.

Such resource endowments are crucial for shaping adaptation action.



The Tool Kit ...

Strategy



Review

- ... the problem/challenges;
- ... local manifestations and understanding of the problem/challenges;
- ... local capacities
- ... community commitment to the problem/challenges; and,
- ... other local and regional efforts to address climate change impacts and the sustainability of the community broadly.

Communities committed to understanding and addressing longer-term local climate change impacts should begin their efforts with a **review** aimed at broadening their understanding of local climate change impacts, as well as adaptation and mitigation strategies. This process requires understanding climate change science and likely local and regional impacts. Undertaking a 'stocktake' of resources and capacities to drive local actions is a key step.

The aim of this phase – the Review phase – is to identify and understand likely climate change related impacts for communities; pinpoint past actions for adaptation; and to determine the community's appetite and resources available for instituting adaptation actions.

1. Setting up a structure to drive action

A critical first step in the review phase is securing support for the initiative and assembling a local Committee, Working Group or similar body to drive the review phase and later phases as action grows. *It is preferable that this Working Group includes a respected and vocal local champion or champions to drive the cause*, as well as representatives of other key local organisations such as:

- the Regional Development Australia Committee;
- local environment authority/ies;
- Industry Associations (i.e. business, traders' or main street association, tourism association(s), chambers of commerce);
- local businesses;

- local environment groups (e.g. Landcare);
- local development/town improvement associations,
- local Indigenous community groups/organisations; and,
- health and welfare organisations.

Local government should also be represented on the Working Group. Local governments are important players here as they have the power to develop local policies and programs to drive change or action agendas.

2. Understanding climate change and the local manifestations of climate change

Climate change is a complex area of science. Information on the regional and local level impacts of climate change for Australia's inland communities is scarce. There are, however, a number of useful resources for communities and individuals.

At the national level important resources include:

- Federal government resources, including those available through the
 - o department responsible for climate change;
 - o department responsible for water resources;
 - o department responsible for regional development.
- CSIRO, especially their *Understanding Climate Change* work; and,
- National Climate Change Adaptation Research Facility publications.

The *National Climate Change Adaptation Framework (NCCAF)* (Australian Government 2007) has guided adaptation policy at the national level over recent years and provides useful insights for many communities. State and Territory plans for addressing and adapting to Climate Change may also be useful in the review phase, especially in mapping out local policies and programs of support.

The Victorian Centre for Climate Change Adaptation Research (VCCCAR) has produced a number of useful publications for inland rural communities, available on their website, including, for example, *Scenarios for Climate Adaptation Guidebook for Practitioners* (online (Wiseman et al 2011)) and *Towards a Gippsland Regional Climate Adaptation Study* (Moore et al 2011).

A number of useful resources have been developed for local governments specifically – albeit mostly for councils to manage their own risks/shape their own procedures. These documents provide a useful starting point for identifying (and managing) risks for inland communities. Two key publications here are:

- the Federal Department for *Climate Change and Energy Efficiency's Climate Change Adaptation Actions for Local Government* which outlines the reasons for identifying, understanding and managing climate change impacts, particularly in terms of council operations and functions; and,
- the Australian Local Government Association's 2009 report *Towards a National Planning Framework for Climate Change Mitigation and Adaptation* is a second key resource.

State/Territory based local government associations have also developed some planning tools. Arguably the best developed of these are in Western Australia, Victoria and New South Wales. Local Government NSW Planning for Climate change Workshop Package (online), for example, provides a step by step guide to risk assessment and adaptation planning and action; a tool with widespread application for communities.

3. Mapping local resources, capacities and commitment

A key step in the review phase is mapping local resources, capacities and commitment to climate change adaptation. Not everyone will want to be involved in climate change adaptation and not all organisations will see it as a priority. Identifying stakeholders willing to be involved in actions to address climate change, and to champion them locally, is therefore important. Local resources – in terms of people and money – should be investigated and sought.

Stakeholders: The same stakeholders identified for the Working Group should be consulted to determine (a) concerns about climate change impacts and adaptation and (b) what, if anything, has previously been undertaken around understanding climate change adaptation. It is important not to overlook industry associations and health and welfare organisations here, as industry and social impacts are important considerations in terms of the impacts of climate change on rural and regional communities.

Money: Potential sources of financial support for local level efforts to address climate change impacts for communities include:

- local government;
- state government;
- federal government, through the Regional Development Australia Committees and specific climate change adaptation programs;
- Industry Associations; and,
- philanthropists

Community driven actions for climate change adaptation at the local level should dovetail with national, state and local plans for climate change adaptation, where practicable, and where such plans exist.



Photo: Michelle Graymore



Review

Plan

... Research

... Evaluate

The second component of action under this Tool Kit is the planning phase. This phase has two key foci:

- Research to broaden understanding of local climate change impacts and approaches for adapting to impacts; and,
- Evaluation of existing resources (policies, strategies et cetera)

This phase aims to collect, collate and assess relevant resources on climate change impacts and adaptation approaches for communities in order to help set the future course(s) of actions to be undertaken by communities.

1. Research

This step is about examining (and assessing the worth of) broad research on climate change generally, and the research and data on likely local climate change impacts. The goal is to develop a picture of climate change impacts for the community, and to highlight areas where meaningful adaptation actions can be undertaken.

Assessing and understanding robust and timely information about climate change impacts is critical. This information will need to be pieced together from the resources identified in the review phase, as well as in local government plans.

It is important to examine the policy frameworks in place – at the local, state and federal levels – to identify government funding priorities and actions.

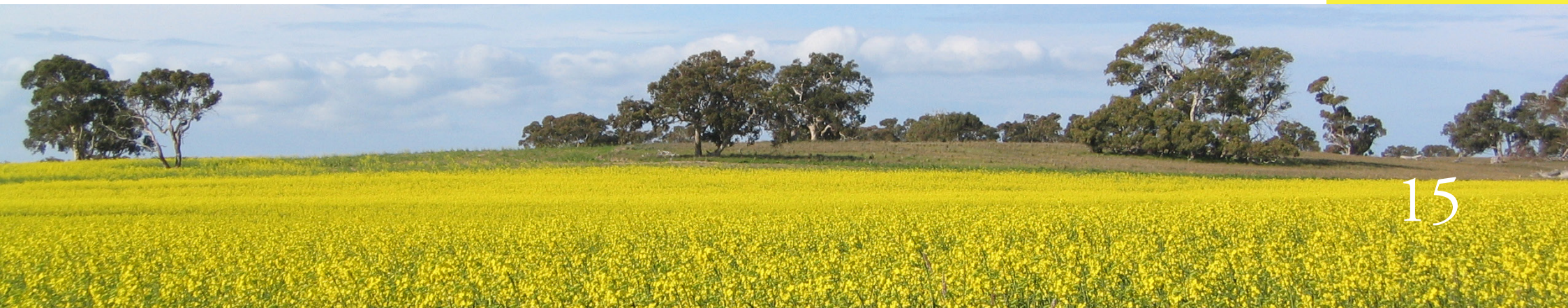
Box 1 outlines a series of useful guiding principles in this context drawn from the South Australian Government's *Climate Change Adaptation Framework for South Australia*.

Box 1: Guiding Principles of *Prospering in a Changing Climate: A Climate Change Adaptation Framework for South Australia*

- Recognise uncertainty and deliver adaptation actions where there is a plausible risk of harm
- Prioritise actions based on careful assessment of risks, costs, efficacy and equity using the best available science to inform adaptation responses
- Give priority to sectors likely to provide the greatest social, economic and environmental benefit for the state
- Develop responses at the most appropriate *scale* to effectively address risks and maximise opportunities
- Involve individuals, industry, business, academia and all tiers of government in developing responses using a coordinated approach
- Build on, enhance and learn from the experience of communities, sectors and regions in developing adaptation responses
- Plan for uncertainty and take action using an adaptive management approach to allow for readjustments as new information arises
- Use the best available, most appropriate and locally relevant science based on good data and robust processes, to inform those best placed to deliver adaptation responses and manage risks
- Take into account the need for flexibility to respond to emerging trends, including population projections and socioeconomic trends
- Consider how best to **optimise and recognise the interconnections between social, environmental and economic systems**, and linkages between sectors in planning to adapt to climate change in a sustainable manner
- Ensure responses avoid unintended consequences and do not undermine our ability to adapt over the long term
- Take early action where there are demonstrated cost–benefits
- Ensure that adaptation responses are appropriately **integrated and mainstreamed** into ongoing business.

Source: Government of SA 2012a: 17, emphasis added.

Plan



The key messages to bear in mind here from the research and best practice examples of adaptation actions, are the importance of:

- partnerships;
- good communication (of what is generally complex information);
- prioritisation;
- tailoring approaches to geography and place; and,
- treating adaptation as an iterative and mainstream process.

A central part of assessing the value of existing research for communities is identifying the factors that are known to limit the effectiveness of localised efforts to address climate change. Research highlights some of these limitations are worthy of consideration.

The report *Design of Guidelines for the Elaboration of Regional Climate Change Adaptations Strategies* for the European Commission (Ribeiro et al 2009: 15), for example, identifies a series of gaps in adaptation guidelines that have direct applicability in Australia. These include:

- lack of understanding of adaptation as a process and what it means in terms of outcomes;
- need for better direction in adaptation guidelines and toolkits regarding setting objectives;
- lack of data on climate risks and their impact(s) at the regional/local level;
- little or poor examination of sector impacts of climate change and adaptation;
- poor cooperation and communication between key actors and agencies in developing adaptation plans, communicating results and key information and reviewing activities, and poor communication/alignment of/about adaptation actions across regional and other jurisdictional boundaries.

At the more local level, other research (e.g. Pillora 2011) points to some of the key gaps in information and process for adaptation by local governments. These include:

- the need for accessible and consistent information on ‘effects, impacts and responses’ to climate change and climate science, including within and between government departments;
- understanding of the long-term costs of/budgeting for adaptation;

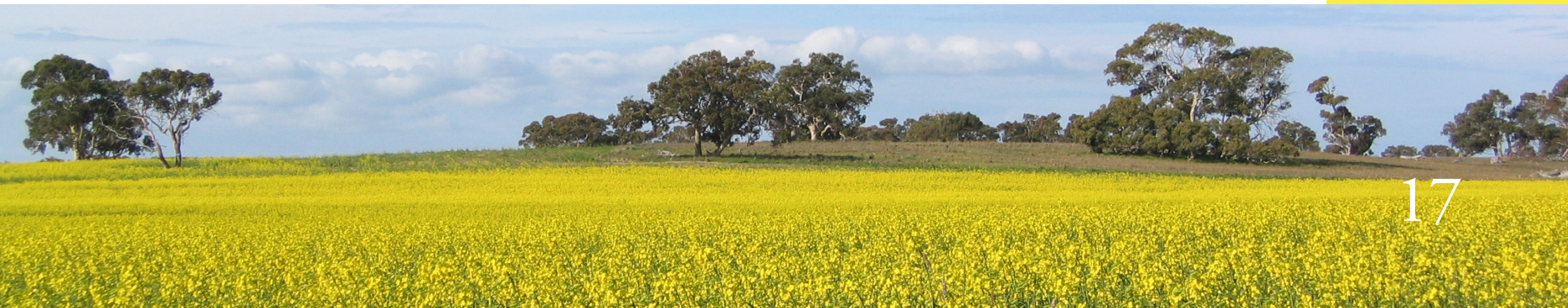
- assistance to access the specialist advice needed to engage in adaptation and risk management planning;
- support from state/territory governments with enforcement of certain planning guidelines and regulations at the local level;
- assistance to set and prioritise actions for communities and local government operations;
- funding commensurate to responsibilities devolved to local governments, particularly for councils and communities with poor resources and most vulnerable to climate change and associated economic and social impacts;
- better sharing of institutional and organisational learning from adaptation planning trials;
- how to make climate adaptation the core business of relevant organisations;
- development of common metrics, performance indicators/targets and frameworks for institutions with common characteristics and facing similar challenges; and,
- the presence of different priorities and programs for adaptation between jurisdictions nationally, with implications in some cross-border regions, adding to confusion and potentially duplication of effort where climate impacts, effects and responses find expression across borders.

This last point is particularly pertinent in Australia where state borders (and in some instances local government boundaries) determine access to information, programs and other support, and where climate change impacts and therefore adaptation actions may need to cross boundaries. This is yet another argument for regionalisation of adaptation plans, in a similar vein to regional development organisations, natural resource management boards/catchment management authorities and the like. It also shows out the importance of high level direction and coordination of vulnerability assessment and adaptation planning activities.

2. Evaluate existing policies and strategy documents

The next step of the Planning Phase is to evaluate other resources of direct relevance to understanding local climate change and enact adaptation responses to these impacts. Paramount among such documents are government and agency policies and strategy documents.

Assessing how the Working Group and its actions fit with broader climate change policies – locally, regionally and at state and national levels – and develop strategies to make the best possible use of government policies – and funding sources – for the wellbeing of the community and its long term future.



Decide

... Commit to actions/approaches.

1. Debate actions and approaches

The Working Group should begin by identifying an extensive list of possible actions or approaches to adapt to anticipated and real local climate change impacts. Because of the broad potential reach of areas of action, it is best to shortlist these under the areas of concern identified for impacts:

- water resources;
 - o security of water supply
 - o timing of rainfall events
 - o adequacy of infrastructure
- extreme weather events;
 - o fire
 - o flood
 - o frost
 - o drought
- industry sector (agriculture *et cetera*);
 - o developing new industries
 - o strengthening existing industries
 - o building a more adaptable economy and workforce

- natural resources, habitat and biodiversity;
 - o threats
 - o opportunities
- infrastructure;
 - o transport
 - o telecommunications
 - o retailing
 - o emergency responses
 - o electricity and other power sources
 - o social infrastructure
- public health
 - o adequacy of facilities
 - o education
 - o preparation for change.

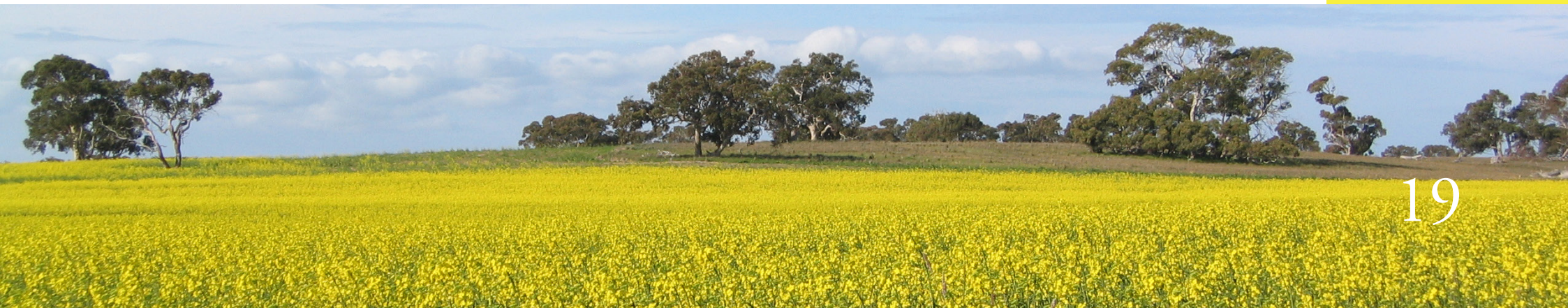


Photo: Charmaine Thredgold

For each area of action, the Working Group should work to identify:

- 1) what they want to achieve (outcomes);
- 2) how it will be achieved (method);
- 3) how it fits with existing or planned government policies or the mandate/actions of other community groups;
- 4) who will be affected adversely and positively by the action; and,
- 5) indicative financial cost of undertaking the action (and not undertaking the action).

Decide



All proposed actions should be considered in terms of cost of action versus the risks of doing nothing. *In many instances, the community will be surprised by how relatively small steps can make a difference to the adaptation status of a town or settlement.* Importantly, the implementation of adaptation strategies can be built into normal business processes of governments, community groups and the private sector. Timely action can result in significant savings for communities, while developing new opportunities for the future.

2. Consult

In addition to consulting among stakeholders in the Working Group, consultation should be undertaken with the broader community around understanding of climate change impacts and appetite and readiness to undertake actions to adapt to such impacts.

Some of the important steps potentially available for consultation include:

- awareness raising – meaningful engagement with stakeholders about actions and why they are being taken. This engagement could take multiple forms, including the use of a website, newsletters, Facebook or one-on-one meetings;
- media can be an important ally in sharing information with the broader community;
- meetings with other community groups can establish new partnerships in key areas of adaptation;
- community forums with residents and the business community can raise awareness and help build support;
- web-based distribution of information is a key strategy for reaching a wide audience and letting other communities know about your efforts; and,
- schools can be an important resource for adaptation, both in educating future community members and in mobilising community resources.

3. Commit

Gaining commitment from as broad a group of stakeholders as possible is crucial in the Decision Phase. It is especially important to secure the support of local government, the local Regional Development Australia Committee and other state agencies if they are not already engaged with the Working Group.

This Phase also requires that the Working Group decide whether it is best to develop a formal plan of actions or work.

Implement

1. Develop an action plan

This Phase requires knowing the sequence of goals to be worked towards and ways of achieving them. As part of this process, it is necessary to *develop a listing of relevant funding agencies* – state, federal, local – as well as considering the capacity and roles of other community groups and philanthropic organisations in achieving adaptation goals. Here it is important to be detailed in planning actions and to establish priorities that can be flexible within the bounds of opportunity and need.

2. Be accessible to a wide audience and include your stakeholders in your implementation

Ensure actions and the rationale for undertaking them is clear and accessible to all stakeholders and the community at large. One set of adaptation measures could include developing more effective capacity to fight fires, or the establishment of alternative water resources. Such steps immediately call to mind key partners and the capacity to achieve multiple benefits for the community. Let other groups know that you share goals and seek to help them in their aspirations.

The local media can be an important resource for implementation, both in building enthusiasm for change, recruiting stakeholders and drafting volunteers for particular actions.

3. Undergo constant review and evaluation

No plan is without fault and every plan is subject to the conditions of the day. It is therefore necessary to acknowledge redundancy and plan for the review of the Working Group and its strategy. External and internal stakeholders can provide feedback on progress and the perception of progress, and establish a mechanism for monitoring, review and evaluation. Even simply counting the number of meetings held and the people talked to can provide an indication of the strength of the plan and the strength of the Working Group. Where immediate success is not evident, work towards change and where necessary bring in others.

Implement





Photo: Selina Tually

Promote

... internally

... locally

... regionally

The steps taken by the Working Group to adapt to climate change need to be promoted widely amongst key stakeholders, the broader community and governments. People need to be aware of planned actions for adaptation and understand local climate change impacts and the rationale behind them. It is also important that both activities and success stories are celebrated. Actions to secure the future of a town or community deserve to be trumpeted, and such celebrations help build a sense of common purpose and achievement.

At the same time, the promotion of activities with local, state and federal governments helps build the confidence of the policy makers that the community is a 'success' story and deserving of further investment. Over time, people within the community and external parties will have a stronger sense of the community as a place with a future. This in turn will encourage investment, be attractive to existing and new residents and help secure additional government expenditure.

Promote





Photo: Michelle Graymore

Conclusions and Lessons Learned

This report provides a practical series of steps for communities to direct their attention to understanding local climate change impacts and adaptation actions. It draws on research from a project for the National Climate Change Adaptation Research Facility titled *Australia's Country Towns 2050: What Will A Climate Adapted Settlement Pattern Look Like?* (Beer et al 2013). The research, and this Tool Kit, are important additions to the limited resources aimed specifically at understanding the impacts of climate change on Australia's inland settlements.

The key message of this Tool Kit is that planning is needed to prepare for the climate of the future. Regardless of your views on the certainty of climate change, ***it is clear that actions taken to adapt to the weather conditions of the future can only work to the benefit of local communities.***

Importantly, communities need to take responsibility for their own future. ***Government policies and strategies will not ensure the future of any country town if the residents and businesses do not mobilise to action.*** Change is an inescapable feature of life in Australia's country towns, and climate change adds another dimension of complexity to an already fast moving environment. The critical question is: will the community act to take advantage of the opportunities that may appear on the horizon – the farming of carbon credits, the development of new industries, introduction of new, more water efficient, crops – or will they wait to act in the hope of a return to the past? Rural and regional Australia is full of towns that have died because they could not, or would not, adapt. Australia's regions are known for their resilience and innovation – these are the resources that can ensure the wellbeing of country towns across Australia for the coming generations.

Conclusions



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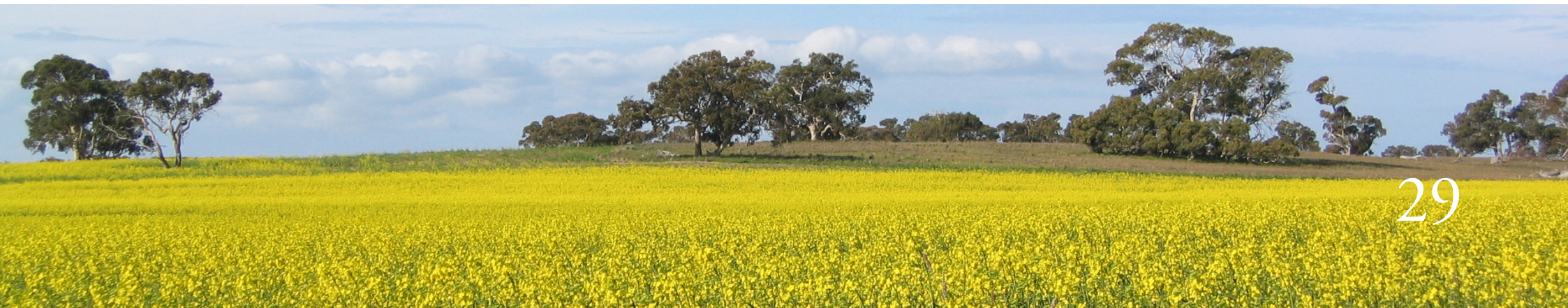
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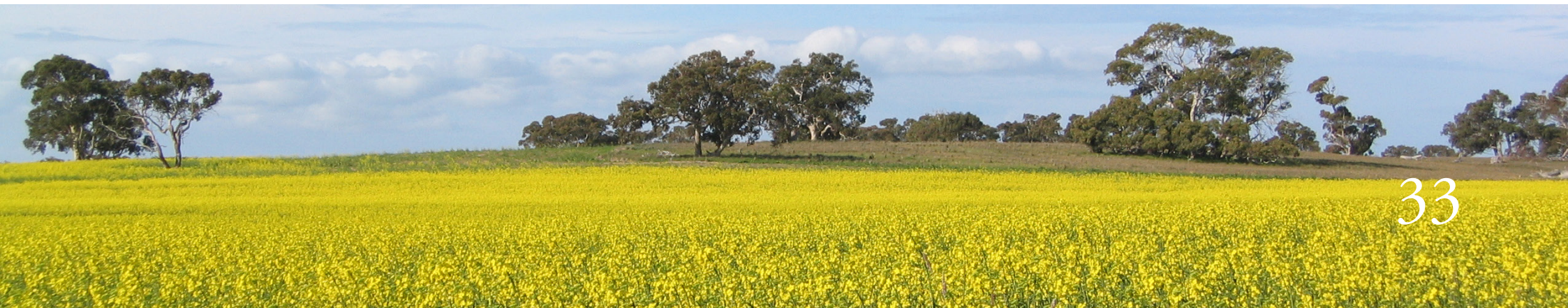


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Appendix A

Potential impacts of climate change on local government services, infrastructure and processes

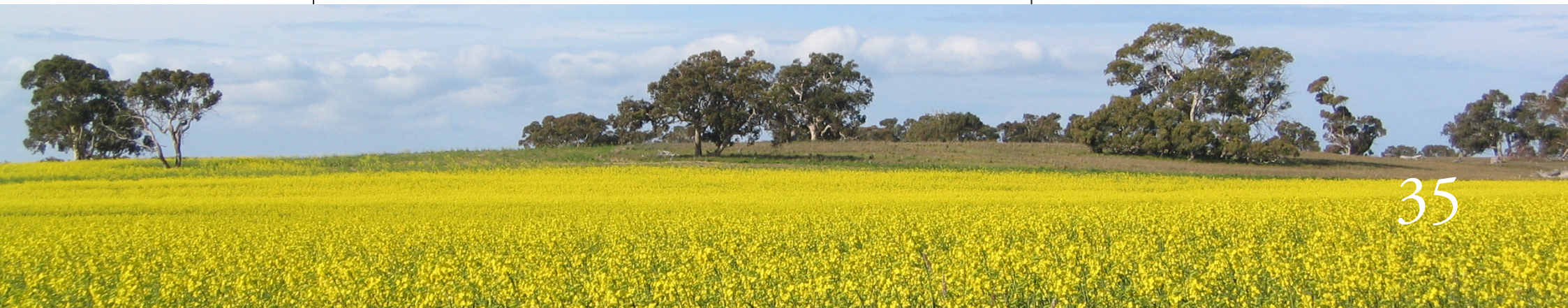
<p>Planning policy and development assessment</p>	<p>Inappropriate location of urban expansion areas Increased uncertainty in long-term land-use planning and infrastructure design, i.e. location of future developments, suitability of infrastructure designs to cope with changing climate, etc Loss of private property and community assets Increase in insurance costs and public liability claims Increased pressure on disaster management and response resources Early retirement of capital infrastructure Cost of retrofitting of systems</p>
<p>Litigation</p>	<p>Potential legal challenges if it is argued that councils have unreasonably failed to take into account the likely effects of climate change in exercising a wide range of their service, planning and development activities Potential OHS and public liability claims</p>
<p>Coastal infrastructure</p>	<p>Increased coastal erosion and inundation Increased frequency, or permanent inundation of, coastal infrastructure and utilities e.g. water, sewerage, gas, telecommunications, electricity, transportation</p>

	<p>Destruction, damage and disturbance to council-managed marinas and boat ramps Increased erosion and/or exceeding of seawalls, jetties and other coastal defences</p>
<p>Economic Development and Tourism</p>	<p>Impacts on viability of industries Pressure on tourism activities (especially those relying on natural resources) Impacts on tourism/recreation activities along the coast Increased costs associated with operation and maintenance costs of public amenities/recreational sites due to climate variation</p>
<p>Social and community planning</p>	<p>Rural decline and climate impacts on the rural and regional sectors Increased population pressure on temperate zones Internal migration and accommodation of new migrants and climate change refugees</p>
<p>Provision and use of recreational facilities</p>	<p>Impacts on coastal recreational infrastructure Loss of existing public space in coastal areas Impacts on tourism/recreation activities along the coast Increased costs associated with operation and maintenance costs of public amenities/recreational sites due to storm damage Variation in landscaping design and plant species Needing to provide additional climate protective infrastructure for the young and elderly</p>



Maintenance of recreational facilities	<p>Reduced water quality and quantity resulting in less watering/irrigation of open space and sports grounds and closure of ovals</p> <p>Limited water for swimming pools, etc</p> <p>Beach and inland lake closures, e.g. due to e.coli levels after storms</p> <p>Limited water for swimming pools</p> <p>Need for more open space shelters</p>
Health services; Community/workplace health	<p>Milder winters improving communities' comfort levels</p> <p>Increase in geographical range and seasonality of vector-borne diseases and the possibility for an expansion of infect zones (eg, Ross River fever)</p> <p>Potential increased role in community immunisation</p> <p>High temperatures increasing incidence of food and water-borne diseases</p> <p>Risk of increased cryptosporidium infections during open water swimming in summer</p> <p>Health impacts due to exposure to extreme weather, eg, heat waves</p> <p>Extreme rainfall events transporting contaminants into waterways and drinking water supplies</p> <p>Increased pressure on drinking water supplies</p> <p>An increase in injuries due to increased intensity of extreme events, eg, storm surge and coastal flooding in coastal regions of Australia due to changes in sea level rise and human settlement expansion into coastal catchments</p>

Emergency/bushfire management	<p>Increased emergency response and recovery operations</p> <p>Risks to public safety and tourism and longer term impacts on regional economies</p> <p>Responding to flooding, drought, bushfire, cyclones/ major storms, coastal inundation, heat wave, landslides, erosion</p> <p>Reduction in water availability for irrigation</p> <p>Changes in pest management</p>
Agriculture/biosecurity	<p>Changes in the type and viability of primary industries</p> <p>Loss of farming properties</p> <p>Reduction in water availability for irrigation</p> <p>Changes in pest management</p>
Natural resource management/coastal management	<p>Increased coastal erosion and inundation</p> <p>Loss of private property/community assets</p> <p>Loss of beach width</p> <p>Changes to wetlands due to sea level rise, shoreline erosion and saltwater intrusion</p>
Weed/pest management	<p>Changes in distribution of invasive species due to changes in climate and associated loss of biodiversity and changes to bushfire intensity</p>
Biodiversity Protection	<p>Shifts in distributions of plant and animal species</p> <p>Increased risk of population and species extinctions</p> <p>Reduced ecosystem resilience to stress</p> <p>Increased ecosystem and species heat stress</p>



Appendix A cont.

	<p>Increased pressure on dunal systems</p> <p>Changes to mangrove habitats due to salt water intrusion</p> <p>Increases in ecological disturbances</p>
Water and sewerage services	<p>Inundation of storm water and sewerage systems</p> <p>Reduced security of water supply (depending on source)</p> <p>Environmental and supply contamination</p> <p>Increased peak flows</p> <p>Increased potential for erosion</p> <p>Changes in groundwater levels</p> <p>Changes in flood plains</p> <p>Reduced dry weather sewerage flows</p> <p>Reduced/unreliability of power supply for sewage pumping and treatment if existing electricity suppliers cannot maintain pace with long term changes in climate</p>
Stormwater and drainage	<p>More intense rainfall resulting in inflow and infiltration into wastewater networks</p> <p>Exceeding existing flood defences</p> <p>Exceeding drainage capacity</p> <p>Reduction in drainage capacity due to sea level rise and storm surge</p> <p>Changes in mean and peak stream and river flows</p> <p>Lower levels of rainfall, reducing pressure on storm water systems</p>

Wastewater	<p>Changes in intensity of rainfall events impacting inflow and infiltration to wastewater network</p> <p>Potential for blockages and dry weather overflows during dry spells</p>
Water supply	<p>Changes in mean and peak stream and river flows</p> <p>Uncertain water availability</p> <p>Insufficient water supply in some areas</p> <p>Increased potential for water contamination</p> <p>Salination of surface and groundwater supplies</p> <p>Changes in availability of groundwater available for irrigation</p>

Source: ALGA 2009 in Pillora 2011.

