



## VCCCAR Project: Framing Adaptation in the Victorian Context

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# Synthesis report

Working Paper 8

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## Contents

|  |    |
|--|----|
| Acknowledgements.....  | 1  |
| 1. Executive summary.....  | 1  |
| 2. Framing adaptation at the local and regional scale.....                     | 4  |
| Introduction.....  | 4  |
| The importance of framing.....   | 4  |
| The multiple framings of adaptation.....                                       | 5  |
| Local adaptation pathways.....   | 6  |
| Development of the Adaptation Navigator.....                                   | 7  |
| 3. Economic analysis of current and future climate impacts.....                | 11 |
| Introduction.....  | 11 |
| Critique of existing assessment approaches.....                                | 11 |
| Indicative costings for current day climate-related events.....                | 14 |
| Assessment of future potential losses and consideration of adaptation CBA..... | 16 |
| 4. Social narratives.....  | 18 |
| Introduction.....  | 18 |
| Objectives.....  | 18 |
| Case studies.....  | 18 |
| A summary of findings.....   | 19 |
| Implications for policy and practice.....                                      | 21 |
| The value of social research.....  | 22 |
| 5. Concluding remarks.....   | 23 |
| 6. Project dissemination.....  | 24 |

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## 1. Executive summary

This synthesis report provides a summary of the research activity and conveys the key findings arising from the 18 month 'Framing Adaptation in the Victorian Context' project undertaken between 2010 and 2012. Due to the complex nature of climate change adaptation, the original research program was designed to better understand the conceptual underpinnings of adaptation and then to translate this academic knowledge into 'accessible' content that could be more effectively used by those responsible for local adaptation planning - in essence, to 'develop and test an operational framing of adaptation which will act as a decision-making roadmap to better inform adaptation policy and practice by Victorian authorities at the local and regional levels'.

The analysis on framing was sub-divided into three discrete, though complementary and overlapping, research activities, to better understand different aspects of climate change adaptation in the Victorian context:

- 1) The development of an overarching framework that illuminates and makes sense of the many different components that influence local adaptation processes;
- 2) The framing of current and future climate-related impacts, and adaptation, as viewed through an economic lens; and
- 3) A bottom-up analysis of adaptation, with a particular focus on the adaptive capacity of individuals and communities, as captured by a social narrative approach.

Due to the context specific nature of adaptation (influenced by both the climate-related hazard and local vulnerability) the research activity on framing was intentionally grounded in real world situations through direct engagement with a portfolio of case studies including Greater Bendigo, City of Melbourne, Greater Geelong, and Port Fairy. Therefore whilst the research findings will be of generic interest to a wide range of end-users, the focus for this particular project was on the co-generation of new knowledge with local authorities. The economic analysis was based on climate-related events that have impacted the State in the recent past.

Adapting to climate change is a relatively new concept for academic communities, with scientific knowledge still evolving and subject to debate. The complexity of the issue is enhanced when applying disciplinary lens that approach the issue from different perspectives (climate science, hazards / impacts, risk, vulnerability / resilience). Furthermore, as the agenda moves from one of problem identification to one of policy intervention (in this case through the identification and prioritisation of adaptation options) then political, institutional, social and economic influences also need to be explicitly accounted for. It is therefore of no surprise that many local authorities are grappling with how to make sense of this diffuse and complicated agenda. However, being aware of how problems and responses are being framed is critical to effective adaptation action as the act of framing can influence both agenda setting and subsequent pathways for action. Section 2 of the synthesis highlights some of the key findings in relation to conceptual and operational framing.

Some high level messages can be summarised as:

- Adaptation to climate change is a complex and diffuse issue facing both scientists and policy-makers. The climate 'problem' can be framed in many different ways e.g. current day variability of extreme weather events versus longer term changes to averages; and can also be assessed according to different types of approaches which may ultimately influence the

adaptation pathway followed. This complexity also extends to the 'response' framing. Responses to climate change and variability can take many forms, and be implemented and orchestrated across different spatial and temporal scales, involving a range of different public and private actors.

- It is important to be clear what is meant by adaptation in different contexts. For instance, it is multi-faceted and can be shaped by a multitude of goals and outcomes. Individuals, communities, and organisation frame adaptation differently, depending on what they want to achieve with adaptation and how they approach it. Individual factors such as values, professional background, roles and responsibilities and social expectations are also important. Better understanding the scientific and institutional complexity, and being explicit about framing, is crucial for more effective adaptation planning.
- Adaptation by local authorities requires strategic thinking and in many instances is capable of being integrated within existing organisational structures and processes. This requires a commitment to strategic planning and to considering the longer-term implications of today's decisions. However, this can challenge 'evidence-based' decision-making as many of the benefits of adaptation may accrue in the future. As such, dealing with uncertainty is a key feature of adaptation.
- A focus on the local is critically important due to the context-specific nature of the climate hazard(s) and the variations in exposure and sensitivity of different communities to these hazards. Furthermore, planned adaptation processes will also be influenced to a significant degree by the local socio-economic, political and institutional context.
- Adaptation requires breaking down traditional management barriers. From a governmental perspective, adaptation does not easily fall into a single area of responsibility or portfolio. It is cross-cutting and includes a wide range of policy domains, such as urban and regional planning, community development, infrastructure, and governance. Adaptation requires a whole-of-organisation coordinated approach that relies on active collaboration to be effective and efficient.

Due to these myriad of complexities, and the absence of a 'one size fits all' solution to adaptation planning, research attention focused on the development of a web-based interactive framework that could help local authorities in Victoria (and those wider afield) work their way through many of the issues involved when considering adaptation planning.

The *Adaptation Navigator*, launched in 2012 as a 'proof of concept' application, is the outcome of the development and testing of an operational framework for adaptation and represents a key deliverable for the project. Detail on this application forms the content of the second part of section 2. It consists of a series of conceptual maps which represent the adaptation process, structured according to three layers; each presenting increasing levels of detail as the user moves down through the layers of the application. Layer 1 sets out a high-level overview of the adaptation 'landscape' – with 10 knowledge domains also acting as key entry points for users of the application. These are: knowing the climate science; determining the purpose and scope; understanding the policy context; establishing effective governance; setting objectives; engaging and communicating; assessing the effects of climate change; identifying and prioritising options; deciding and implementing measures; monitoring and evaluation.

The project also undertook an *economic analysis* of current and future climate impacts for the State of Victoria. However, whilst the ability to quantify costs is considered extremely desirable by decision-makers, findings illustrated that this is far from straight forward. Indeed, even establishing current day cost figures for the impacts of extreme events proved difficult with totals varying according to the methodology and data used. These current day difficulties make future projections even more problematic.

Different approaches were critiqued for carrying out economic assessments of climate-related impacts. These included general equilibrium (top-down), partial equilibrium (bottom-up), and integrated assessments. Each approach differs in levels of complexity and how it deals with costs, therefore no single methodology suits all purposes and ultimately the choice of assessment will need to be determined by the user's needs. Key issues needing to be explicitly addressed when assessing the costs of climate impacts are also highlighted in the report. These include: the use of a static baseline, dealing with intangibles, appropriate discount rates, dealing with uncertainty, analysing low probability though high consequence events, equity, and the need for transparency.

Given the difficulties involved with assessing the current and future costs of impacts, and the fact that adaptation cost benefit analysis (CBA) remains far from being operationalised, the analysis of costing adaptation options was of a scoping exercise. What was found was that studies covering the Victorian context are extremely sparse; leading to a key recommendation that basic economic analysis needs to be carried out to provide the basis for more in-depth evaluation of the costs and benefits of impacts and adaptation. A first step would be to determine the common climate and socio-economic scenarios that would frame an authoritative State-wide assessment.

The final piece of analysis was to examine the perspectives of different groups from a bottom-up perspective, through a *social narratives* framing. The activity focused on different stakeholder groupings in Port Fairy and the City of Melbourne (Carlton and Docklands), selected to represent different characteristics, vulnerabilities and exposure to different climate-related hazards. In each case, activity was guided to encourage wide-ranging participation and the inclusion of different voices, to elicit knowledge on local stakeholder perceptions of climate risks, to identify and map determinants of adaptive capacity, and to explore the role of social research in adaptation planning.

Some key implications for those responsible for adaptation decision-making can be distilled from this piece of research. The report structures these according to: recognising the importance of language and communication, valuing the importance of creating spaces for knowledge exchange and consensus building, ensuring access to authoritative, timely and salient climate information, using more accessible concepts such as community well-being as a hook for climate change action, the need to be clearer about the roles and responsibilities of different actors, recognition of the value of existing networks and arrangements at the local level, and also identifying the role that incentives can play in mobilising local action.

On a final note, social research was found to play an important bridging role between the experts (climate science and planning communities) and effective community-based adaptation activity. This recognises that adaptation is a diffuse and complicated agenda and that we all have a role to play in planning for future sustainable communities under a changing climate.

## 2. Framing adaptation at the local and regional scale

### ***Introduction***

Climate change has been identified by authoritative sources as one of the key challenges facing societies across the world. Recent weather-related extreme events affecting Australia (e.g. the heatwave and bushfires affecting SE Australia in 2009; flooding in Queensland and Victoria in 2011) are projected to increase in both frequency and intensity in coming decades. Longer term changes to precipitation and temperature regimes, as well as a rising sea level, will be further consequences of future changes to the global climate system and herald significant challenges to Australian communities. It is therefore increasingly important that local and regional decision-makers in Victoria explicitly consider the threats (and in some cases potential opportunities) that a changing climate will bring.

Responses to climate change are commonly considered according to two types of action: mitigation (measures taken to reduce the generation of greenhouse gas emissions, or increase their absorption) or adaptation (measures taken to adapt to climatic change that is unavoidable due to continuing emissions and the inertia of the climate system). Whilst the mitigation agenda is clearly defined, and relatively amenable to quantifiable targets and actions, the adaptation agenda is much more complicated and diffuse. Indeed, due to the sheer complexity of the issue it is often unclear what is actually meant by adaptation, and in operational terms how good practice can best be supported. This component of the research project therefore sought to bring greater clarity to the adaptation agenda in the Victorian scientific and policy 'landscapes' by developing an operational framework in support of local and regional adaptation planning.

Adaptation measures can address either discrete or multiple hazards, take many forms ranging from physical outcomes such as large scale engineering schemes e.g. flood defences or financial interventions e.g. insurance schemes; or else they can be process-based, evidenced by changes to management operations or planning practice, for example. Strengthening local adaptive capacity is also part of the adaptation armoury. Furthermore, responses to climate change and variability can be implemented and orchestrated across different spatial and temporal scales by a range of different public and private actors. Better understanding this web of scientific and institutional complexity - and the implications for local and regional decision-making - therefore formed the basis for the research that was carried out.

### ***The importance of framing***

The act of framing, whether implicit or explicit, not only has important agenda setting qualities but where fundamental differences in framing exist they also have the potential to act as a significant barrier to effective, and inclusive, climate adaptation policies. Indeed, evidence elicited from a scoping exercise conducted by a project workshop indicated that terminology is not always applied consistently in adaptation policy making and that key definitions vary across different stakeholder groups. Whilst it was not the purpose of the research to favour one particular approach over another, it is argued that local adaptation processes in Victoria would be improved by greater recognition - and transparency - of different framings of adaptation; as well as a greater emphasis on the co-development of a shared understanding of the purpose, goals, and approaches of adaptation activity [Note - Dovers (2005) usefully distinguishes between 'problem' and 'response' framings].

Recognising that adaptation pathways are strongly shaped by social and political influences (driven by a range of factors - including personal perceptions of risk, beliefs, culture, and risk tolerance), initial attention focused on the framing of adaptation by different actors in the Victorian context (framing is understood as a way of making sense of a complex topic like climate change, which then enables the development of a shared meaning, and sense of purpose, when addressing the challenges to be faced). Analysis was applied to both the conceptual and operational levels. Consideration of how issues are framed by different actors was critical to the analysis as it influences how individuals and organisations interpret, and ultimately respond to, a multitude of climate change related issues.

### ***The multiple framings of adaptation***

Although humans have always adapted to their surrounding environment – termed autonomous adaptation – planned adaptation to changes in climate variability is a new field of investigation for both scientists and policymakers. With an explicit consideration of longer term change it is one that is rapidly rising up agendas worldwide. A key research objective was therefore to critically analyse the conceptual underpinnings of the different knowledge domains influencing adaptation thinking and to reflect on how these are being interpreted and applied by different policy communities in Victoria. Translating these findings into information that could then be taken on board by decision-makers to better inform their adaptation policies and planning represents one of the key outcomes from the research (see working paper 1).

Australia is a continent well versed with having to deal with climate-related stressors. Drought, bushfires, and flooding, have all figured prominently in Victoria's history, including the recent past. In response to these impacts, a prominent community of practice has coalesced around the theme of emergency management. However, with increasing acknowledgement that longer term climate change needs to be considered (as well as current day variability) there is an increasing convergence between previously discrete communities of practice concerned with hazards, climate risks, and vulnerability. A full critique of different theoretical concepts and how they are articulated at the operational level is provided in Working Paper 1. In brief summary:

1. A *hazard-based* approach has a natural disasters framing and by its very nature is one based on the experience of extreme events. Historically, this community of practice has tended to concentrate on reactive / responsive modes of intervention concerning current day events (though emergent thinking in the disaster risk reduction field is increasing the emphasis placed on prevention and planning for extreme events over longer term time frames). However, the implications of longer term changes to the climate beyond variability of extreme events are not well addressed, and important socio-economic drivers are often relegated to secondary importance.
2. A *risk-based* approach has been the dominant framing for adaptation planning by Australian local authorities to date. This fits well with their existing organisational risk management structures and processes; dealing with potential climate impacts according to an assessment structured according to likelihood and consequence. Whilst an organisational focus is useful for considering the sustainability of operations it may however be restricted to a relatively narrow set of risks and adaptation options; resulting in a compartmentalised view that is often at the expense of a more holistic understanding of the broader consequences for the wider community. Due to the subjective prioritisation of risks, an effective participatory



process and transparency become critical components of the risk assessment process. There is also a tendency for low probability, though high consequence, impacts to be omitted.

3. A *vulnerability-based* approach is the dominant paradigm in developing countries where existing socio-economic conditions often exaggerate sensitivity to the impacts of climate-related events. A vulnerability lens tends to focus on current day livelihoods and inequalities (as well as the efficient operation of critical service infrastructure). This approach typically draws from 'bottom-up' knowledge and is less dependent on expert driven knowledge, such as detailed climate scenarios, and as such is often more inclusive of a wider selection of 'voices'. However, bottom up assessments of this type tend to limit the ability to compare across different situations.
4. *Resilience* as a concept has gained significant traction in the Australian context in recent times, with the terminology gaining in popularity due to its positive connotations (and related pragmatic political advantages). This lens is also acting to blur the lines between the different approaches described above, with different communities of practice now incorporating resilience into everyday discourse. It is important to note that the concept remains contested, particularly when human agency is involved (ability to learn etc.), and there are critics that argue that it remains a buzzword that has yet to be operationalised in any meaningful way. However, whilst conceptual ambiguities remain, others have suggested that this positive framing may be useful in promoting adaptation action by avoiding some of the politicised 'barbs' that are often present in climate change debates in the Australian context.

### ***Local adaptation pathways***

It is widely recognised that a focus on local level issues is critically important due to the context-specific nature of the climate hazard(s) and the specific factors contributing to the exposure and vulnerability of different communities (or constituent parts of a community e.g. elderly groups impacted by heat stress). Furthermore, planned adaptation processes will also be influenced to a significant degree by the local socio-economic, political and institutional context. At an operational level, adaptation therefore needs to be tackled in locally appropriate ways - though it is important to recognise that given the intertwined complexities there is no 'one size fits all' template for guiding local adaptation planning. That said, local government authorities have a pivotal role to play in the practical planning and implementation of climate change adaptation. They are the tier of government closest to the people and therefore have a more direct ability to access and influence local residents and communities and they also provide a range of services to the community; many of which are likely to be increasingly impacted by climate variability and change in the future. Municipal governments therefore have a direct responsibility to act on the grounds of a duty of care and ensuring that services can continue to be provided in the face of climate change (this community wellbeing focus is in contrast to private organisations whose adaptation activity will be stimulated by other, often economic, drivers).

As argued previously in this synthesis report, and in greater depth in the working papers, local adaptation pathways will ultimately be influenced by how climate change issues are framed by the different actors involved. This involves not only how the climate-related problems are framed (what needs to be adapted to) but also the responses that are identified and implemented (how will adaptation occur and who is responsible). A core set of framing questions that illustrate this process

are shown schematically in Figure 1, however adaptation pathways should not be seen as a static entity rather to be effective they will need to involve a constant re-framing of issues as new information and knowledge becomes available. This highlights the importance of understanding adaptation as a continuous process of social learning among the diversity of actors involved. Of particular importance to this journey are processes that facilitate trust building and the integration of different sources of knowledge (academic, policy and practical), including opportunities for self-reflection by those involved with decision-making processes. In this regard, State Government has an important ‘enabling’ role to play.

|                            |   |
|----------------------------|---|
| Adaptation to what?        | What climatic stressors exist?<br>What non-climatic stressors exist?  |
| Who or what adapts?        | What system(s) will need to adapt to climate change impacts?<br>What system elements are at risk of climate change? |
| How does adaptation occur? | What is the intended outcome of adaptation?<br>What actors and organisations need to be involved in adaptation?     |
| What is good adaptation?   | What can be deemed successful and efficient adaptation?<br>How can the success of adaptation be measured?           |

Source: Adapted from Smit, Burton et al. (2000).

**Figure 1: Core framing questions**

### ***Development of the Adaptation Navigator***

It was originally intended that operational adaptation planning guidance, informed by international best practice examples, would be developed and specifically tailored to the Victorian context for use by local authorities. However, it was found that the step-by-step format of many existing adaptation toolkits - strongly influenced by traditional project cycle management approaches – did not fit well with the adaptation practice of local authorities, which in reality is often ‘messy’ and non-linear. This is reinforced by the latest international literature into effective adaptation practice which suggests that much of what can be considered effective adaptation planning (i.e. where adaptation has been progressed from planning through to implementation) is most often based on learning by doing, on continuously re-scoping adaptation goals, and on leveraging windows of opportunities as they arise (see for example: Measham *et al*, 2011).

A review carried out for the project also found that the majority of local governments - considered leaders on climate change adaptation in Australia (and abroad) - have opted for developing their own tailor-made framework for guiding adaptation activity. Each of the three local government case studies (Greater Bendigo, Greater Geelong, and Melbourne) has adopted such a tailor-made approach. This however, is not always an option for resource poor local governments with limited capacity. Therefore, to address the identified needs of Victorian local authorities, the research team worked closely with the case study authorities to co-develop a flexible guidance framework that

would enable users with different capacities to ‘find their way’ through adaptation planning from a local government perspective, by:

- Identifying different options for approaching adaptation;
- Collating a wide range of background information; and
- Providing links to existing toolkits and methods for specific aspects of adaptation, to avoid duplicating tools that are already available on the internet, such as the UKCIP Adaptation Wizard and Monitoring and Evaluation toolkit (AdaptME).

### ***Design of the Navigator application***

Rather than produce yet another paper version of guidance it was decided that an interactive web-based application would be of greatest value to potential users (see working paper 7 for more detail). The development of the application was guided by the iterative feedback from case study partners, other potential users, academic experts, and designers; and sought to address the following criteria:

1. Content was to be informative for a range of different users;
2. Information needed to be easily and quickly accessible;
3. Structure to be intuitive and logical;
4. An eye catching and appealing layout;
5. Easy to use for those with limited computer skills.

The Adaptation Navigator, in support of operational adaptation planning, consists of a series of conceptual maps structured according to three layers; each presenting increasing levels of detail as the user moves down through the layers of the application (see Figure 3). Layer 1 sets out a high-level overview of the adaptation ‘landscape’ – with 10 knowledge domains, or ‘regions’ when adhering to a map metaphor, also acting as key entry points for users of the application (Figure 2).

The 10 high-level domains are:

- Knowing the climate science;
- Determining the purpose and scope;
- Understanding the policy context;
- Establishing effective governance;
- Setting objectives;
- Engaging and communicating;
- Assessing the effects of climate change;
- Identifying and prioritising options;
- Deciding and implementing measures;
- Monitoring and evaluation.



Figure 2: The overarching framework of the web-based Adaptation Navigator

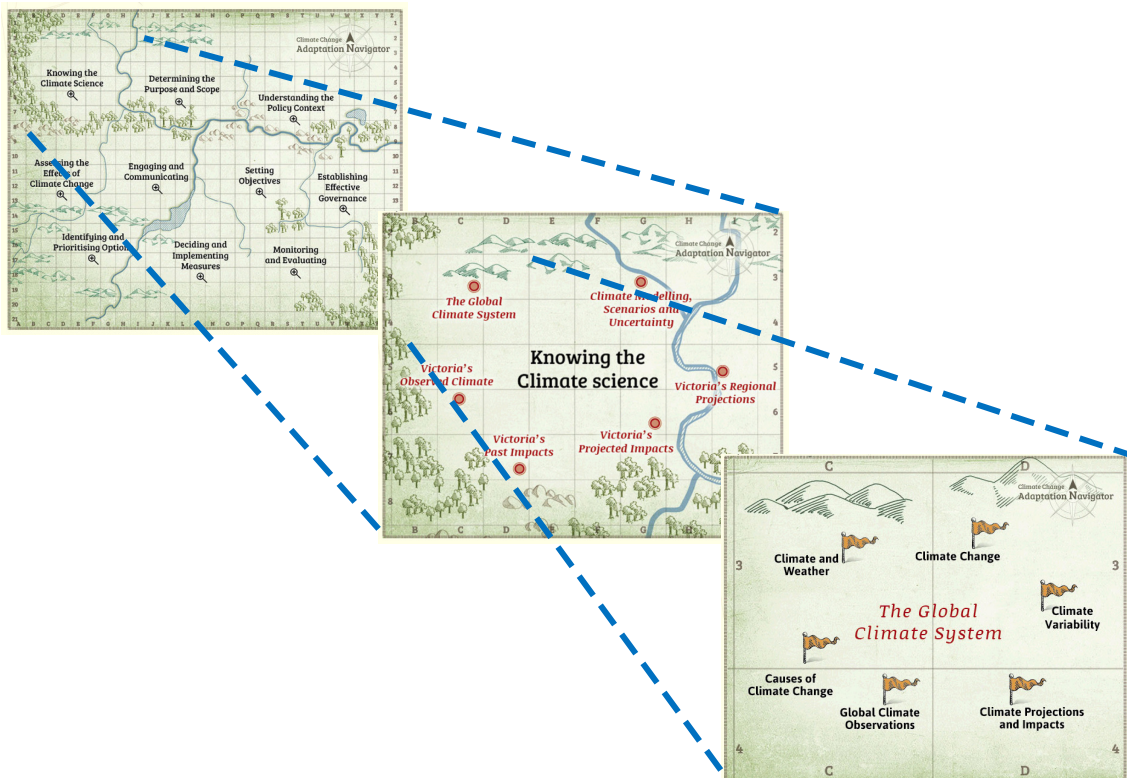


Figure 3: Layering of conceptual maps (example shown: 'knowing the climate science')

### **Functionality and value**

The Adaptation Navigator has been deliberately designed to be a flexible and multi-functional framework that is capable of meeting the needs of a range of different decision makers (these may differ even within a local authority itself e.g. those responsible for health and community wellbeing may be faced with a different set of issues than those involved with urban planning). As a 'one stop' information portal, it not only enables users to learn about different aspects of climate change adaptation processes in more detail but also provides direct access to additional cross-cutting knowledge about adaptation concepts, policy and practice. The application also has the potential to showcase findings from the portfolio of VCCCAR-funded research projects (as well as providing access to the significant climate impacts knowledge-base for Victoria that already exists), hence acting as a useful knowledge brokerage mechanism. The opportunity for increasing the depth and type of content is, however, dependent on funding for a second phase of development beyond the 'proof of concept' tool.

In addition to being a platform for accessing information, the Adaptation Navigator serves as an innovative capacity building resource by enabling organisations to explore different adaptation processes, to track and visualise their own adaptation progress (and how it compares to the mapped journeys of other local authorities), and to facilitate internal discussion either in small groups or in more formal, structured workshop settings. Through these interactive functions it has considerable potential to incentivise peer to peer sharing and learning either within or between organisations (cross-organisational learning of this type is considered a crucial element of more informed adaptation planning).

The Adaptation Navigator was formally launched by Donna Petrovich MP, Parliamentary Secretary for Sustainability and Environment, at the VCCCAR Annual Forum in Melbourne in 2012. It is intended that the framework will be further developed (quality and depth of content, enhancing user experience, promoting collaborative activity, and improving the case study pathway feature), with the latest version now accessible at: <http://www.adaptation-navigator.org.au/>

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### 3. Economic analysis of current and future climate impacts

#### ***Introduction***

Being able to assign dollar values to the costs of climate impacts (and alternative adaptation options) would greatly assist all levels of decision-making in the State of Victoria. However, whilst highly desirable, there are many obstacles to quantifying the costs of responding to current and future climate-related impacts (Working Paper 2). Framing adaptation through an economic lens, the research first carried out an evaluation of the existing approaches used for economic impact assessment in order to better understand the strengths and weaknesses of different methodologies. This was then followed by an analysis of the estimates of the costs of climate change to vulnerable sectors in Victoria, both in the current context and under future climate change scenarios; with important caveats highlighted where relevant. Finally, research attention focused on how best to address the costing of adaptation responses under conditions of uncertainty.

Due to time and resourcing constraints, the project was not able to generate quantitative figures for the costs of climate change and adaptation in the Victorian context, though the analysis carried out does provide the necessary foundations for a more detailed examination of economic costings in the future.

The economic analysis component of the research activity was framed by four discrete, though interlinked, objectives:

1. To undertake an assessment and critique of existing approaches and frameworks for climate change economic impact assessment;
2. To establish indicative estimates of the current cost of climate anomalies where practicable for vulnerable Victorian sectors;
3. To identify and assess future potential losses under a range of different climate change scenarios;
4. To set the foundations for a more detailed cost benefit analysis of adaptation.

#### ***Critique of existing assessment approaches***

Three broad approaches for assessing the impacts of climate related events were identified in the literature. These were critiqued according to their suitability for estimating the costs of climate change impacts and adaptation in the Victorian context. The assessment approaches considered were:

- a) General equilibrium analysis;
- b) Partial equilibrium analysis; and
- c) Integrated assessments.

***General equilibrium (GE) analysis:*** involves a top down approach to assessing economy-wide impacts using computer models based on multiple sectors of the economy. It considers the impacts and interactions arising from the 'shocks' or economic shifts associated with events between two given points in time and shows how resources may be reallocated, in this case when perturbed by climate-related impacts. This approach is seen as having greatest value when complex flow-on or

indirect impacts to an economy need to be assessed or when multiple markets / sectors need to be considered in a holistic manner.

The Garnaut Climate Change Review utilised this type of model when examining the cost of the impacts of climate change on the Australian economy and was the largest modelling of the Australian economy ever undertaken. However, many adaptation responses, e.g. relating to land-use planning or behavioural change, are not well accommodated for by GE analysis. Furthermore, in relation to increased frequency and severity of extreme events expected due to climate change, GE analysis has limited value to policy-makers due to the fact that impacts are dispersed throughout an economy-wide model and as such localised impacts can seem relatively insignificant.

***Partial equilibrium (PE) analysis:*** is a disaggregated, bottom-up approach that doesn't require overly complex economic models (and hence can be appealing to policy makers), and is also well suited to exploring the impacts of extreme events (increased frequency and intensity of extreme events are a key climate change adaptation concern particularly in the short to medium term). This approach also has the benefit of utilising various and flexible valuation methodologies that can be applied to a variety of impacts, sectors or markets.

As such, PE analysis is best suited for local or regional scale climate change impact assessment, particularly when considering the short to medium term. It is locally contextualised because it uses actual observed data and considers impacts by specific market or sector. However, it is important to note that PE analysis only captures the impacts on a single market or sector i.e. analysis assumes that impacts in that sector will not have significant flow-on effects to the rest of the economy. Therefore, PE analysis alone will not provide an accurate picture of the costs of climate change impacts within a region, even if numerous sectors are analysed.

***Integrated assessments:*** capture the strengths of both forms of equilibrium analysis mentioned by including an evaluation of both specific sectoral circumstances and the flow-on and feedback effects within the economy as a whole. They may also incorporate socio-economic projections, for example relating to population and land use, and how these interact with climate change impacts; as well as utilising qualitative decision-support tools in conjunction with economic analysis. However, on the negative side, due to their relatively comprehensive nature they are often also much more resource intensive.

Not every methodology will yield information useful for decisions at every level or site of decision making. Critics have argued that an aggregate analysis of costs and benefits will be of limited use, suggesting that adaptation decision-makers may benefit most from partial equilibrium and integrated assessment type analyses because these explicitly consider local context and stakeholder preferences. These analyses are also considered far more capable of incorporating intangible values and equity dimensions. However, it should be noted that participants at the September 2010 expert workshop pointed out that there may be demand from Victorian Government Departments for high level general equilibrium type analysis to support an assessment of State-wide costs. Clearly, no single cost estimation methodology suits all purposes.

### ***Key issues when attempting to cost climate change impacts***

Previous experiences of attempting to assess the economic implications of future climate change impacts have shown that it is not a straightforward process. Attaching dollar values to the impacts of climate change is not only challenging and resource intensive but also requires subjective

judgements. Some of the key issues compounding the complexity of applying an economic lens to impacts and adaptation include:

- The use of a static baseline;
- The valuation of impacts on intangibles (such as environmental or amenity values);
- The selection of an appropriate discount rate;
- Dealing with uncertainty;
- The analysis of low probability, though high impact, events;
- The distributional impacts between different parts of the community (equity); and
- The need for transparency.

**Static baseline:** To estimate the costs of climate change a static baseline scenario, i.e. projections of a future where all other environmental and socio-economic conditions remain as they are today, is most commonly used. Indeed, most analyses regardless of their type take a static approach, looking at the impacts of a discreet change in climatic conditions on the current socio-economic system. While this type of analysis provides a useful starting point it is important to remember that complex socio-ecological interactions are dynamic and will continue to change over time. A dynamic baseline attempts to account for projected changes in non-climate variables. Whilst the use of a dynamic baseline increases the uncertainty of the model, this increase is no more so than in any other economic forecasting.

**Intangibles:** An assessment of the costs of climate change would ideally include all things that are valued by society – including things such as the value of human lives, environmental amenity, ecosystems and the services they provide, cultural heritage and community cohesiveness. However, including the value of intangibles in future climate change impact assessments is a significant challenge because ultimately it involves attributing a dollar value to them; a feature that is both technically difficult and resource intensive. Even when it is impossible to assign a dollar value to an impact it is essential for that impact to still be part of the analysis. In practice, the use of qualitative impact assessments that describe the impacts on intangible assets under various scenarios is the main option for dealing with ‘un-costed’ intangible impacts. This further emphasises the fact that economic analysis is only one of many types of input that will be required for adaptation decision-making processes.

**Discount rates:** Discounting is used in economics to convert future costs (and benefits) into present day values. The selection of the discount rate is a contentious issue in the climate change policy arena as it is the primary way in which costs and benefits to future generations are weighted against costs and benefits to the current generation. If a discount rate is zero this indicates that costs in each time period are valued equally; the higher the discount rate, the less future costs are valued. It is important to note that small changes in the discount rate can have enormous impacts on net present value. [Experts at the September 2010 workshop suggested that presentation of results under various discount rates (i.e. discount rate sensitivity analysis), within a range based on positive (based on observation, description and explanation) and normative (considers values and ethics) approaches would be useful to policy-makers].



**Uncertainty:** To varying degrees, uncertainty exists for all projections about the future, not just climate change. Specific to climate change impacts there is not only uncertainty about the biophysical impacts but also how these will translate into socio-economic impacts. When considering the potentially profound impacts of future climate change, decisions should be made now despite the inherent uncertainty. One approach would be to favour initiatives that increase the flexibility of systems or enhance adaptive capacity. Often, this will involve consideration of ‘soft’ adaptation options that increase capacity to respond to a range of possible outcomes, though these measures are much more difficult to cost than ‘hard’ options such as engineering solutions.

**Low probability / high impact:** Due to their nature, low probability yet high impact climate-related extreme events are often omitted from economic impact analysis (or given inadequate treatment) because of modelling difficulties. This results in lower damage estimates. That said, it has been argued that it may not actually be possible to adequately address these issues due to deep structural uncertainty, and that economists should not attempt to do so. Others have suggested that the impacts of extreme events ought to be treated separately from mean impacts because they require different analytical treatments and, ultimately, different adaptation initiatives. This position is reflected in the IPCC reporting structure which treats disasters separately from slower onset climate impacts.

**Distribution and equity:** Climate change impacts (and hence costs) will not be borne uniformly between sectors, regions, communities or income groups; hence it is argued that aggregate estimates which do not take account of the distribution of impacts are likely to be of limited value. Furthermore, there is the vexed question of who pays and who benefits. Adaptation will require public expenditure as well as spending by firms and individuals - allocation of the responsibility for the costs of climate related events to different levels of government and between the public and private sectors is the subject of continuing debate. Whilst the public sector would prefer to see a greater degree of self-reliance, and business or individual responsibility for risk management, in many cases the costs of impacts of extreme events is likely to fall to state or Federal Government.

**Transparency:** Each of the challenges mentioned above heighten the importance of transparency regarding assumptions in the way these issues are treated, the sensitivity of results to these assumptions, and the combining of quantitative and qualitative data. The following section provides a useful illustration of the need for transparency, with findings from the research indicating that the selection of methodology and data has a significant impact on the estimates of even current day disaster impacts in Victoria.

### ***Indicative costings for current day climate-related events***

Analysing current day costings of climate impacts consisted of two approaches. In the first instance, research to compare methodologies, data sources, and cost estimates of different assessments was carried out; with analysis focusing on the aggregate cost and relative impact of three previous Australian and Victorian disasters, supplemented by further analysis of six estimates for the 1983 Ash Wednesday bushfires. This was then followed up by a review of assessments for the economic impacts to different sectors of the Victorian economy, in order to highlight key current day vulnerabilities that have been identified by existing studies. [It is important to note that disaster cost estimates in Australia are largely drawn from insurance data (Insurance Council of Australia’s National Disaster List) or from insurance data with some augmentation (Emergency Management Australia – EMA – disasters database). However, as argued in Working Paper 3 estimates based on

insurance data are a limited proxy for the real cost of the disaster (the 'cost' of a disaster is not a straightforward concept, as indicated by the wide range of estimates that were found for the same events)].

The aggregate cost of weather-related disasters to Victoria and Australia was first investigated by comparing three major studies – BTE (2001) *'Economic costs of natural disasters in Australia'*, Blong (2004) *'Natural hazards risk Assessment: an Australian perspective'*, and Crompton & McAneney (2008) *'Normalised Australian insured losses from meteorological hazards: 1967-2006'*. A key finding was that each report had utilised different data and, perhaps not surprisingly, come to different conclusions (full details can be found in the working paper). As an example, BTE (2001) ranks the average annual cost of hazard types to Victoria as: 1) flood – 38.5%; 2) bushfires – 32.4%; and 3) severe storms – 22.8%. Blong (2004), on the other hand, ranks total building damage by hazard type to Victoria as: 1) bushfires – 60%; 2) flood – 25%; and 3) thunderstorms – 15%. While these numbers are not strictly comparable they do highlight the way in which reports with different methodologies give very different answers to the question: "What are the relative impacts of hazard types to Victoria?"

An important omission of all databases and analyses is that of heat waves. Heat waves have been estimated to have caused more deaths than any other disaster type (BTE, 2001), and have been particularly acute for Victoria in recent times e.g. the heat wave that accompanied the devastating February 2009 bushfires in Victoria killed 374 people, whereas the bushfire itself caused 173 deaths. For recording purposes, the bushfire is listed as a disaster, whereas the heat wave is not. The omission of heat waves from these aggregate disaster cost estimates is a relevant point for policy makers, especially when taking future climate change into account.

The bushfires of 1983 was one of the most devastating disasters in Victoria's history. A comparison of several analyses of this event illustrates how data and methodology can impact on outcomes. Six cost / loss / impact estimates were compared, with estimates of the cost of the bushfires ranging from \$465 - \$1320 million (2009 AU\$). This variation is directly due to the data sources and methodologies used - insurance data being a conservative estimate of some costs; full economic impact assessments resulting in much higher estimates.

A review of the economic impacts of climate-related hazards according to different sectors highlighted a lack of available data, clearly an important gap in knowledge (Working Paper 4). Notable exceptions included: Stephenson (2010) who undertook a thorough assessment of the cost of bushfires to Victoria, with particular attention paid to agriculture and the timber industry. This report makes conservative estimates of the current costs of bushfires to the Victorian agricultural and timber industries, the cost of heatwave mortality to Victoria, and the costs of climate anomalies to the Victorian public sector. The report estimates that:

- Bushfire costs the Victorian agricultural industry approximately \$42 million per annum (including business disruption, the total annual cost to the economy rises to \$92 million).
- Bushfire costs the Victorian timber industry approximately \$74 million (including business disruption, the total annual cost to the economy is \$185 million).
- Heatwave mortality in Melbourne costs Victoria between \$80 million and \$1 billion per annum. This large gap is due to different estimates of the number of heatwave deaths.

- Climate-related disasters cost the Victorian public sector approximately \$424 million per annum (accounting for direct expenditure in terms of output and asset investments only).

An earlier study by Jones and Webb (2008) assessed the vulnerability of nine major Victorian sectors to climate change. They adopted a qualitative, triple bottom line approach to assessing the vulnerability of the following sectors for 2030 and 2070: primary production; minerals and resources; manufacturing; energy; building, construction and infrastructure; tourism and services; water; natural resources and biodiversity; and health. The authors argue that by 2030 most vulnerability will be encountered through increases in the frequency and extent of extreme events; while in 2070 vulnerability will arise from the limits of adaptation being exceeded in a range of systems. They found that although the potential economic impacts of climate change may not be high on a state-wide basis, a high degree of economic impact is possible at the regional scale for the water, manufacturing, and primary production sectors. The sectors most vulnerable to social impacts include water (high level of vulnerability), primary production (moderate to high), energy (moderate), natural resources and biodiversity (moderate), and health (moderate). Vulnerability to environmental impacts was found to be greatest in the water (high), natural resources and biodiversity (high) and primary production (moderate) sectors.

Both studies were selected for analysis because they addressed vulnerable sectors and utilised cost and impact data; however the studies covering the Victorian context are in the minority. The estimates provided indicate that the costs of climate anomalies to vulnerable Victorian sectors are indeed very significant despite being considered underestimates.

### ***Assessment of future potential losses and consideration of adaptation cost benefit analysis (CBA)***

The final piece of the puzzle, from an economics perspective, was to scope and document some of the key challenges faced when attempting to apply a costs and benefits approach to adaptation. As discussed, the discrepancies of placing a monetary value on even current day impacts, and the problems associated with costing future impacts, means that adaptation CBA remains far removed from being an operational concept.

A primary barrier is simply the complexity of adaptation. It can manifest itself in many ways across different spatial and temporal scales, as well as involving a multitude of different actors. Indeed, much attention has been placed on adaptation as a process – the institutional dimension being difficult to quantify (changes in management practice, behaviour etc.). In the case of different actors, issues of private versus public measures and the vexed question of who pays and who benefits are particularly pertinent. Further complexity is introduced when considering the localised context of both the hazard and vulnerability components of the potential climate impact, or the fact that adaptation to climate change may not actually be the primary driver for change in the context of other emergent social, economic or environmental influences.

CBA has also been criticised for giving little importance to the impact of low probability, though high consequence, extreme events. Arguably, it is the experience of these that acts as a stimulus for adaptation action. In such instances, issues such as thresholds or tipping points and uncertainties need to be accounted for. However, CBA works on the assumption that the probabilities are known. This has led to increased interest in analysis that includes real options, an approach that is considered by advocates to be more flexible; as well as keeping options open for making a more

appropriate decision once additional information becomes available (emphasising the appropriate timing of adaptation intervention).

The project scoping activity also examined other assessment methodologies for considering the costs and benefits of adaptation. The most widespread of these is multi-criteria analysis, incorporating social, economic and environmental considerations, which has its promoters and critics. On the positive side, the approach is seen as useful as it allows for the explicit consideration of intangibles; however others consider the introduction of subjective weighting as a bias that undermines the robustness of analysis. Other assessment frameworks include those based around 'low-regrets' or 'precautionary' approaches, both of which reduce the importance of future climate scenarios and give greater emphasis to options that address current day or near future criteria.

A review of published literature covering the economic costs and benefits of adaptation found only limited examples. In response, some broad brush analysis of how costs in Victoria may increase under climate change was undertaken for the examples of bushfires and the agricultural and timber industries, heatwave mortality, and the cost of disaster response to the Victorian State Government. Further details are available in Working Paper 5.

Given the scarcity of costings information for Victoria, conclusions from the research suggest that the next step in developing some basic foundations in support of decision-making from an economics perspective would be to determine the common climate and economic scenarios to underpin an authoritative state-wide assessment of the costs and benefits of impacts and adaptation. In cases where probabilities are more certain (e.g. near term impacts) CBA analysis could be used; where there is greater uncertainty alternative methodologies which incorporate subjective assessments could be deployed. In such instances, expert judgement about the range of scenarios to be used would be needed.

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## 4. Social narratives

### ***Introduction***

People's willingness to adapt to future climate change and variability is strongly influenced by their perceptions of the risks involved. This in turn is driven by a complex interaction of a range of factors; including underlying value and belief systems, embedded historical institutional arrangements and practices, and recent personal experience of weather-related extreme events. How different actors perceive climate risks, as well as dealing with issues of uncertainty (and how they think these will impact their activity), will ultimately be a critical influence on how individuals and organisations respond to the challenge of a changing climate.

The social narratives research component of the 'Framing Adaptation' project therefore analysed different narrative settings and the historical institutional basis which major stakeholder groups bring to their engagement with the climate change adaptation agenda (Working Paper 6). 'Stories' of risk perception (and adaptation) were explored for two case study locations; eliciting insights into the values and perceptions, practices and knowledge of different stakeholder groupings with regards to both past and anticipated change as applied to local settings. The two case studies were *Port Fairy* and the *City of Melbourne (Carlton and Docklands)*. These were selected to represent different characteristics, vulnerabilities, and climate-related threats.

### ***Objectives***

The social narratives research activity was guided by the following objectives:

- To describe the cultural context, demographics, risk perceptions, awareness of municipal service availability, and existing adaptive capacities; with regard to urban heatwaves - City of Melbourne (Carlton and Docklands) - and sea level rise and flooding - Port Fairy;
- To test the resonance of terms such as adaptation and resilience, and better understand the value placed on the local environment;
- To identify and map the determinants of adaptive capacity, including an exploration of barriers and enablers that constrain or enhance the goals of climate change adaptation;
- To explore the role of social research in adaptation planning;
- To invite input and feedback from a diverse range of stakeholders, and to communicate research outcomes to the community;
- To translate the research findings into policy-relevant messages for what makes people vulnerable, adaptive and resilient.

### ***Case studies***

*Port Fairy*: is a coastal community in Victoria's Western District with a permanent population of around 2,600 residents. Due to rapidly progressing beach and dune erosion on its East Beach, Port Fairy is recognised as a high risk location under the projected impacts of future climate change; particularly sea level rise, coastal inundation, and increased storm surges. These impacts will likely exacerbate current environmental pressures, placing additional stress on important recreational and tourist industries, valued environment and wildlife (as found on Griffiths Island, in the South Beach Wetlands and in the Moyne River); as well as affecting real estate and public lands on the East Beach dune, along the river, and on the floodplains surrounding the Belfast Lough.

*City of Melbourne:* The suburbs of Carlton and Docklands were selected as case study areas in order to reflect the cultural, linguistic and socio-economic diversity of the municipality. Demographic groups already identified as particularly vulnerable in the case of heat waves and other weather-related emergencies include transient populations such as international students, tourists and commuters; in addition to elderly citizens.

Carlton, with a population of around 14,090, is located just north of Melbourne's Central Business District. It is one of the city's oldest suburbs, dominated by Victorian and Edwardian era brick or bluestone cottages and two-storey terrace houses. Since the 1960s, public housing estates accommodate low-income residents and recent immigrants in high-rise buildings of up to 22 storeys, some of which are currently being retro-fitted according to new environmental standards or replaced by modern apartment buildings. Since the early 2000s, large-scale student apartment blocks close to the University of Melbourne offer higher-end accommodation to mainly international students. Due to its diverse demographics and architectural substance, Carlton was considered a good case study for investigating urban heatwave risk perceptions.

Docklands is the City's most recent and ongoing urban development complex. It is situated adjacent to the western end of the Central Business District, on the site of Victoria Harbour, Melbourne's former key port on Port Philip Bay with access to the Yarra River. Following subdivision in 1996, seven separate precincts were sold to private developers by the state's urban development agency, Vic Urban (since 2011, Places Victoria). Completion of the site is expected by 2020. High-rise commercial and residential buildings dominate, with the exception of some refurbished historical buildings. In 2008, the population in Docklands had reached 6,160. Projections for 2020 expect up to 17,000 residents and 40,000 commuting workers. More recent census data for this rapidly growing suburb are not available yet, but locals had observed an increase in a more transient and international renter population, such as overseas workers and some international students. [Given Docklands' location on the river and the bay, the interview focus was on residents' risk perceptions in regard to flooding and storm surges, in addition to heatwaves].

As was the case for the project overall, efforts were made to dovetail research activity with existing council activity wherever possible. In this instance, City of Melbourne Council were keen to utilise the narrative data to improve existing community engagement strategies and programs; such as online community forums, the Eco-City Sustainability Campaign, the Sustainability Streets initiatives etc. Understanding and translating community needs and concerns (related to extreme events) into policy is considered an essential part of the 'two-way' dialogue promoted by the Council, as well as being a resource for the design of adaptation strategies and policies that explicitly encourage active participation and input from the community.

### ***A summary of findings***

Engagement with the Port Fairy community uncovered valuable information on what were considered some of the key determinants of local adaptive capacity.

- A major finding was the fundamental importance of language. Scientific labels such as 'sensitivity' and 'vulnerability' were considered far less appealing and articulate to the community than other wording with more positive connotations such as 'strength' and 'resilience'.

- A community that has a strong emotional connection with, and commitment to, the local environment will be more willing to engage with adaptation objectives. However, this community commitment needs to be empowered by formal processes in order to be strengthened (rather than divided) by it. Importantly, a sense of vulnerability was more often linked to a perceived inability to act (e.g. feeling excluded from adaptation processes) rather than to the climate change driver or impact.
- Community resilience is strongly supported where residents maintain a high level of involvement and participation in local groups. A lively and involved (year-round) 'club' culture (that is driven by locals) can help to consolidate the skills, networks and knowledge base of the community in question.
- Strong communities have their own experts and champions, and will mobilise behind them.
- Adaptation planners need to ensure that champions are kept informed of / involved in activity (in climate change risk assessments for example).
- Exclusive language (as commonly used by 'experts') was considered a significant barrier to a community's understanding and willingness to adapt to the impacts of climate change (rather than outright scepticism). The practice of clearly delineating between climate change mitigation and adaptation action is one such example, where the community remain confused by the distinction. Communication is clearly an issue to be resolved.
- Being able to relate to the local causes of change is an important psychological driver of adaptation action as it makes responses appear more achievable (counteracting the sense of uncertainty and powerlessness described in the context of global climate change).
- If a community has already shown that it can initiate and manage effective local action, Government agencies should seek to utilise these skills and experience, where possible, to further underpin collaborative adaptation activity.
- Communities are strengthened when involved in the measurement and interpretation of climate change impacts – it transforms scientific knowledge to local knowledge.
- The calibre of information provision – ideally transparent, timely and regular – was considered a critical determinant in building and retaining the trust of the community.

Research carried out for the Melbourne case study found that the community understanding of resilience related closely to the ability to act both individually and collectively in order to reduce vulnerability to extreme events and longer-term changes; highlighting the need for decision-makers to also consider the psychological and institutional barriers that often inhibit the strengthening of community resilience. Other key findings include:

- There was overall consensus that we are already witnessing the effects of global climate change in Australia and overseas, however opinions were divided on whether climate change was due to human causes or part of natural cycles. That said, there was broad agreement that human activity negatively impacts the planet (and the climate).
- The sense of personal - and collective - ability to act in the face of environmental change was considered a key determinant of the community's resilience. It is within this context that respondents expressed their opinions as to the major barriers to local adaptive action. Important issues were considered to be: accessing information and exchanging knowledge between members of the community, and clarifying the role of external environmental and planning professionals, state and local government authorities.
- Most stakeholders were of the opinion that adaptation responses should include mitigation measures (i.e. a holistic climate change response). Saving water and energy, recycling and

consuming in environmentally sensitive ways were all mentioned as existing everyday practices. However, participants also expressed the need for improved infrastructure which allows for a portfolio of adaptation as well as mitigation responses: such as recycling, cycling, public transport, retrofitted buildings, access to alternative energy sources, and the expansion and improved accessibility of urban green spaces.

- There is a sense of frustration in the community at a perceived lack of action and this is adding to community tensions. In particular, locals do not feel listened to by the different levels of government nor do they feel that their own agency to act is adequately facilitated by current institutional arrangements and practice.
- There is an absence of environmental assets or 'objects' for local people to coalesce around. Community gardens were suggested as one possible innovative solution.

### ***Implications for policy and practice***

Engagement with stakeholders through interviews and workshops highlighted a range of suggestions that policy-makers should consider which would help to improve community well-being and enhance local adaptive capacity to respond to a changing climate. These have been grouped together under common headings.

***Recognise the importance of language and communication:*** As previously noted, the use of scientific terminology can often be a barrier – fostering exclusivity for instance - to more effective action. Communicating climate change issues in more understandable ways is needed; including the clarification of differences between mitigation and adaptation activity etc.

***Create spaces for knowledge exchange and consensus building:*** This is reflective of the understanding that adaptation is a learning process and that local adaptive capacity will be strengthened by the exchange of knowledge and experiences, both from expert and local community perspectives. The opportunity for two way conversations was highlighted as important for community empowerment, as well as the exploration of new possibilities that can be co-developed with the local community. Well-facilitated explorations of differences in community settings, which encourage the exchange of ideas and are receptive to the input of local knowledge and expertise, would be useful for resolving conflict and creating a basis for co-delivery policy models.

***Ensure access to authoritative, timely and salient climate (as well as non-climate) information:*** Credible information and accessible, salient language, storylines, 'tangible' examples, and scenarios are needed to better engage the community in discussions about adaptation options in the face of possible climate change impacts. The provision of information will also help to support a community's ability to develop informed opinions and strengthen their capacity to adapt. In particular, the timing of providing the information was cited as important to retaining community trust and maintaining strong interpersonal relationships.

***Consider community well-being as a starting point for climate change action:*** Community well-being was a central theme arising from the narratives research. Using this as the starting point when prioritising climate change action was seen as a useful approach for informing both mitigation and adaptation options that would generate greater resonance with local communities.

***Clarify the roles and responsibilities of different actors:*** With climate change such a complex issue, greater clarity of roles and responsibilities was considered important for more effective adaptation



processes (including improved lines of communication). For adaptation planning to be trusted, it was also suggested that agencies and outside experts require the skills and capabilities that provide people with the experience of being genuinely listened to.

**Recognise the value of existing local institutional arrangements:** Whilst community coherence differs according to rural and urban contexts, well-functioning community groups and initiatives were found in all three case study areas. These existing arrangements could be better used by agencies to work collaboratively in the delivery of effective Local Adaptation Planning. Indeed, there is considerable potential for developing co-management strategies by instigating and coordinating processes of measuring and interpreting impact data which involve members of the community. Training of community members would also help to ensure the maintenance of knowledge/information standards.

**Provide incentives:** Government incentives, rewards, and environmental campaigns can assist in changing environmental and cultural values, and hence behaviour, in ways that make active contributions to local climate change goals.

### ***The value of social research***

The research outcomes not only involved theoretical and methodological advances, but also the elaboration of valuable insights into the understandings and practices of key stakeholders, as uncovered through a variety of engagement processes. The work carried out has illustrated the ways in which social research can be utilised beyond merely producing qualitative data, rather also acting as a valuable tool to build adaptive capacity in communities. By contributing to the identification of local knowledge, skills, and champions of action; social research helps to bring people together, promotes awareness raising for shared issues / needs, and enable different actors to find accommodations on some of the more contentious issues.

The use of workshop techniques such as 'conversation mapping' was found to be useful by interviewees. Similar techniques could be used in future to build and strengthen structures of deliberative decision-making and participatory action within communities. This experience can be replicated by agencies to build capacity through knowledge exchange and a process of learning together.

Social research represents an important bridge between planning and effective community-based adaptation to climate change. As such, it can play an important complementary role in adaptation planning by enabling Government to better understand local contexts and needs, as well as contributing to the delivery of specifically tailored climate change adaptation programs and policies that actively encourage local participation in decision-making processes and government activities.

## 5. Concluding remarks

This synthesis has attempted to draw some of the key messages that have arisen from the ‘Framing multi-level and multi-actor adaptation responses in the Victorian context’ project. This was an 18-month project investigating the operational framing of adaptation with the aim of better informing adaptation policy and practice by Victorian authorities at the local and regional levels. The content was informed by four key pieces of research activity:

- the development of an overarching conceptual framework for adaptation (expressed by the Adaptation Navigator), and how this is being translated into local and regional responses in the Victorian context;
- preliminary economic analysis of climate change impacts and adaptation;
- an exploration of local narratives; and
- the testing of these research outputs in three case study locations in Victoria.

The findings arising from the research are not only of scientific interest, but have direct relevance to policymakers and practitioners. Ultimately adaptation is a socially, politically, and culturally-infused process. How decision-makers frame their analysis, which assets are valued by local communities, and the tools used to assess risk and vulnerability (as well as adaptation responses) are all influential in determining local adaptation pathways.

## 6. Project dissemination

### **VCCCAR working papers (available for download from the VCCCAR website)**

Fünfgeld, H. & D. McEvoy (2011) *Framing Climate Change Adaptation in Policy and Practice* Working Paper 1.

Keating A. & J. Handmer (2011) *Options for assessing the cost of climate change for adaptation policy in Victoria* Working Paper 2.

Keating A. & J. Handmer (2011) *The cost of disasters to Australia and Victoria – no straightforward answers* Working Paper 3.

Keating A., J. Handmer & J. Whittaker (2012) *Costing the impacts of current climate extremes for key vulnerable sectors in Victoria* Working Paper 4.

Keating A. & J. Handmer (2012) *Climate adaptation economics* Working Paper 5.

Paschen J. & Ison R.L. (2012) *Exploring local narratives of environmental change and adaptation.* Working Paper 6.

Fünfgeld H., S. Millin & D. McEvoy (2012) *The Adaptation Navigator* Working Paper 7.

### **Case study reports**

Fünfgeld H., S. Millin and D. McEvoy (2012) Case Study Report: City of Greater Bendigo. VCCCAR Framing Adaptation Project Report.

Fünfgeld H., S. Millin and D. McEvoy (2012) Case Study Report: City of Melbourne. VCCCAR Framing Adaptation Project Report.

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### **Other publications**

NetBalance Foundation, RMIT University and City of Greater Geelong (2012): *Climate Change Adaptation Toolkit* (Fünfgeld).

Department of Sustainability and Environment (2011): *Local Adaptation Guide: guidance document for DSE staff*. December 2012, 61 p. (Fünfgeld, internal document, co-authored with Halley McCann, DSE).

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