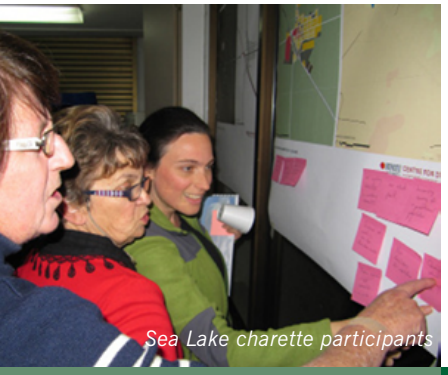
vcccar
victorian centre for climate change adaptation research

April **2014**
Climate Adaptation for **Decision-makers**


Sea Lake charette participants

Sustainability appraisals of design-led responses to climate adaptation

Policy Brief

Contributors
Stephen Clune, Ralph Horne, Paula Arcari, Rob Roggema, John Martin

Overview

This policy brief is a milestone from the VCCCAR project Design-led Decision Support for Regional Climate Adaptation. The project explored a new approach to climate change adaptation at the local government scale, addressing the question 'What could a climate-proof future look like?' using a design process to address problems of future uncertainty and risk.

A design approach enables new ideas to arise, emphasising uncertainty as part of future thinking whilst allowing a departure from incremental approaches. Design charettes (a form of intensive workshop) were central to this exercise. Charrettes were held in Bendigo and Sea Lake, engaging community members, local government and state government staff and academics in an intensive process of envisaging and designing alternative futures for their locality based on an understanding of local conditions and potential future climate conditions. Those involved in the charrettes found the process challenging and satisfying. Reports from the charrettes are available on the VCCCAR website: www.vcccar.org.au

Key points

This project identifies several features of a successful appraisal of responses to good climate adaptation. Based on these features, these key points are designed to assist policymakers to design frameworks and processes for adaptation.

- The appraisal of good adaptation offers most value at the concept generation phase. It should therefore occur within the design planning process to improve outcomes for climate adaptation.
- Participatory processes involving key stakeholders and the community are effective in helping identify climate adaptive criteria within the regions that are adapting.
- It is effective, achievable and practically realisable to engage relevant stakeholders, including the community, in the appraisal of the adaptive capacity of climate adaptation solutions.
- In addition to informing the development of adaptive responses, appraisal at the planning concept generation phase is effective in highlighting potentially maladaptive features that require attention.
- Embedding climate adaptation design processes into existing planning processes by aligning with strategic plans and involving strategic planners in charrettes is important to the success of adaptive planning. A clear role for a climate adaptive design process should be established and resourced within planning processes.

These recommendations are based on an appraisal process developed to assist Victorian local governments to better understand and plan for climate change related events within their local government area. The methodology is suited to appraising context specific climate adaptive solutions at a regional scale. When applied in two case studies, the process effectively highlighted strengths and weakness of proposed scenarios, not as a definitive appraisal of which scenario should proceed, but rather as a means to strengthen the adaptive capacity of the proposed solutions for a sustainable community.

Introduction

This policy brief describes an appraisal method for responses to climate change adaptation based on a concept scoring approach. The method was developed as part of the VCCCAR Design-led Decision Support for Regional Climate Adaptation project.

Traditional hazard, risk and vulnerability assessments commonly produce a Cost Benefit Analysis (CBA) of the effects of one climatic stressor on an obviously vulnerable area. This suggests a reason to act, however it does not suggest what form this action should take to deliver good adaptation outcomes.

The design-led charrettes process was applied to this project to test the capacity of the technique to assist in developing good adaptation responses to climate hazards and threats at a local level. To date, there has been no effective way to assess the outcomes of designs for good adaptation; defined as adaptation that:

- decreases climate risks, hazards and community vulnerability while increasing resilience within the region
- is sustainable from a triple bottom line perspective
- avoids maladaptation (where a particular response to an actual or predicted disturbance weakens the system's overall resilience, for example, by decreasing the effectiveness of mitigation strategies).

This project used the appraisal process of concept scoring, where the outcomes of design charrettes for climate adaptive landscapes were assigned a score against criteria for good adaptation. The process highlighted strengths and weakness of proposed scenarios that were discussed and amended in later charrettes. For example, demand side management was not explicit in Bendigo Charrette I but became a key criterion for a proposed industrial zone on the outskirts of Bendigo Charrette II.

This appraisal of good adaptation offers most value at the concept generation phase of a design process and is also most successful if participatory – where the adapting community contributes to developing the criteria for good adaptation, as well as to appraising the adaptive capacity of the resulting design concepts. Rather than providing a definitive process that identifies which scenario should proceed, the appraisal process highlights future design challenges that require responses.

The design-led approach: generating responses to climate change

The design-led approach to climate adaptation aims to accommodate population and economic growth, as well as expected climate change impacts. The collective design approach is an opportunity to inform growth and enhance the spatial quality and sustainability of a community.

Design thinking is a process for solving complex (or wicked) problems that has origins in product design and architectural processes. It involves the synthesis of various often disparate ideas into multiple plausible solutions. Swann describes the synthesis process as 'intuition, inspirational guesswork and holistic thinking' (2002, p.51). Cross (1989) articulates the difference between design and engineering suggesting that designers solve complex problems through synthesis in the generation of multiple solutions – many quick solutions are generated until one works, while science or engineering solves problems through analysis.

The design process relies on 'continuous on the fly reflection' and the generation of multiple solutions. An appraisal process is required to narrow the field of multiple solutions towards those that are good adaptation solutions. This relies on an understanding of what good adaptation may be.

What is good adaptation?

Good adaptation promotes:

(1) adaptive capacity

(2) sustainability

(3) absence of maladaptation. Participant scores were then collated. The appraisal results for the Bendigo charrette are presented in Figure 1.

Adaptive capacity

Adaptive capacity is 'the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences' (IPCC 2007). Adaptation is often approached from a perspective of risk, hazard, vulnerability or resilience (Fünfgeld and McEvoy 2011). The four approaches can be understood as follows:

- **Hazard** is defined as threats to a system, comprised of perturbations and stress (and stressors), and the consequences they produce (Turner, Kasperson et al. 2003).
- **Risk** is the product of hazards and vulnerability with consideration for consequence and likelihood (Fünfgeld and McEvoy 2011).
- **Vulnerability** is understood as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. It is 'a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity' (McCarthy, Canziani et al. 2001).
- **Resilience** is defined as the magnitude of disturbance that can be absorbed within a social-ecological system before the system changes to a different state, as well as its ability to reorganise and adapt to new circumstances. In a climate change context it is the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change (Adger 2000).

Sustainability

Good adaptation should also provide positive outcomes for sustainability based on the triple bottom line of social, economic and environmental sustainability indicators. 'Adaptation measures are seldom undertaken in response to climate change alone but can be integrated within, for example, water resource management, coastal defence and risk-reduction strategies' (IPCC 2007). Solutions that avert risks but are unsustainable are maladaptive.

Absence of maladaptation

The most undesirable outcomes are design solutions that could be deemed to be maladaptive, defined as 'action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups' (Barnett and O'Neill 2010). These would include measures that:

- increase greenhouse gas emissions
- place a burden on the most vulnerable social groups
- come with high opportunity costs, e.g. high social, economic or environmental costs in comparison with alternatives
- reduce the incentive for positive adaptation
- create path dependency by adopting systems (e.g. energy infrastructures) that are difficult to change in the future due to high costs involved.

A participative charrette-based approach - who and why?

Traditional climate adaptation policy is based on risk assessment and often completed by external parties. This project is unique in that the design-led decision support process (the charrette project) acknowledges the tacit knowledge and capacity of the community. The collective approach allows multiple perspectives to be positioned regarding the complex multi-dimensional problem of climate change adaptation planning. Participants should include but not be limited to; planners, policy makers, community members and representatives, development industry members and representatives, and subject experts external to the community. Charrette facilitators should be experienced and expert in their field.

The VCCCAR design-led charrettes invited participants from multiple backgrounds and levels of governance. Participants held diverse skill sets including academics, landscape designers, creatives, climate scientists, local council participants from a diverse range of planning areas, local community organisations, industry, State Government officers from DSE together with DPCD and DPI. Identification of appropriate stakeholders is not only critical for the successful outcome of the charrette, but is also valuable in creating momentum for its delivery.

Appraisal of good adaptation

The methodology developed for appraising designs for adaptation in the VCCCAR design-led project involved the following four stages:

1. development of the appraisal criteria in a participatory process
2. appraisal of the design outcomes in a participatory process
3. assessment of the design outcomes against the good adaptation appraisal criteria
4. comparison of the results to identify solutions for further development or amendment.

1. Develop the appraisal criteria in a participatory process

By discussing within the charrette the regional economy, people, environment, climate and technology at past, present and future time scales, e.g. 1982, 2012, and 2042; favourable and unfavourable elements can be identified. These elements contribute to the development of criteria for good adaptation.

2. Appraisal of the adaptive capacity of design outcomes in a participatory process

Stakeholders and community members share and discuss their views, and collaboratively identify adaptive features of the design solutions that they consider good or bad, to be accepted or rejected accordingly. This process acknowledges the importance of local knowledge and expertise, and recognises that projects designed and developed with community support and engagement are more likely to be successful.

3. Measure the design outcomes against the good adaptation appraisal criteria

The design concepts are qualitatively and quantitatively appraised against measures of adaptation, sustainability and maladaptation, predetermined by the research team and incorporating criteria from the first step.

An overview of the questions informing the appraisal is presented in the maladaptive matrix in Table 1. The maladaptive matrix is framed from a negative perspective. Inverting each question allows the table to be used as an adaptive framework (given that adaptation is the polar opposite of maladaptation). For this project, each impacted system (transport, shelter, food, energy, water etc.) was assigned a metric of:

- -2 identified as having a high risk or being unsustainable (maladaptive)
- 0 neutral
- +2 identified as averting a risk, creating resilience or being sustainable (adaptive)

Table 1 Maladaptive assessment matrix

Impacted systems	Social sustainability	Environmental sustainability	Economic sustainability	Hazard and risk
General questions	Does the design increase burdens on vulnerable social groups? Does the design decrease incentives to adopt? Does the design increase path dependency?	Does the design increase CO2-eq emissions? Does it increase spatial footprint? Does it impact on biodiversity?	Does the design have high opportunity costs, i.e. what does the design prevent from happening? What are the costs/ benefits of the proposed solution? Does the design create externalities?	Does the design increase the susceptibility to or consequences of climate change impacts (e.g. severe wet, drought, heat stress)
Transport	Does it increase car dependence, reduce accessibility, exclude social groups? Is it unsafe or difficult to use? Is the cost of the design evenly distributed?	Does it increase CO2-eq emissions?	Does the design increase total transport costs compared to BAU?	As above
Food:	Does it decrease food security? Does it increase poor lifestyle factors?	Does it increase CO2-eq emissions? Does it impact on biodiversity?	Does the design increase total food costs?	As above
Energy:	Does the design lead to prohibitive costs?	Does it increase CO2-eq emissions?	Does the design increase total costs associated with energy? Does the design increase total costs associated with energy?	As above
Water/sewer:	Does it decrease the quality of social spaces?	Does it impact on biodiversity?	Does the design decrease the productivity of land across time?	As above
Land use & Agriculture	Does it decrease the quality of social spaces?	Does it increase soil degradation, salinity or acidity? Does it decrease water quality and/or biodiversity?	Does the design increase the total cost of shelter?	As above
Shelter:	Does the design lead to higher energy use? Does it create path dependency for particular energy sources (e.g. Gas)? Is the design future proof?	Does it increase CO2-eq emissions? Does it increase spatial footprint?	Does the design increase the total cost of shelter?	As above

4. Compare the results to identify solution to develop further or amend

Locating the concept scoring appraisal within the initial design process enables the potential synthesis (or merging) of multiple good adaptation design elements into future designs to strengthen their adaptive potential. This synthesis would occur in the follow up charrette.

Case study

The VCCCAR design-led charrettes involved participants from academia (landscape design and climate), community organisations, industry, and local and state government (DSE together with DPCD and DPI).

The above methodology and sustainability appraisal has been applied within the Design-led Decision Support for Regional Climate Adaptation project. Through two, two-day design charrettes – with the City of Bendigo and Sea Lake – numerous design solutions for climate adaptation were produced for each region. Figure 1 provides an overview of the appraisal outcomes for the final four concepts from the City of Bendigo charrette. The appraisal indicates that the majority of concepts were sustainable from a social and environmental perspective, but it also highlights differences between them. The risk impacts of fire, flood, water scarcity and heat stress on particular systems such as transport, food or energy vary between each concept. Reducing risk is seen as adaptive and it is clear from the appraisal that none of the concepts reduce risks for all potential threats.

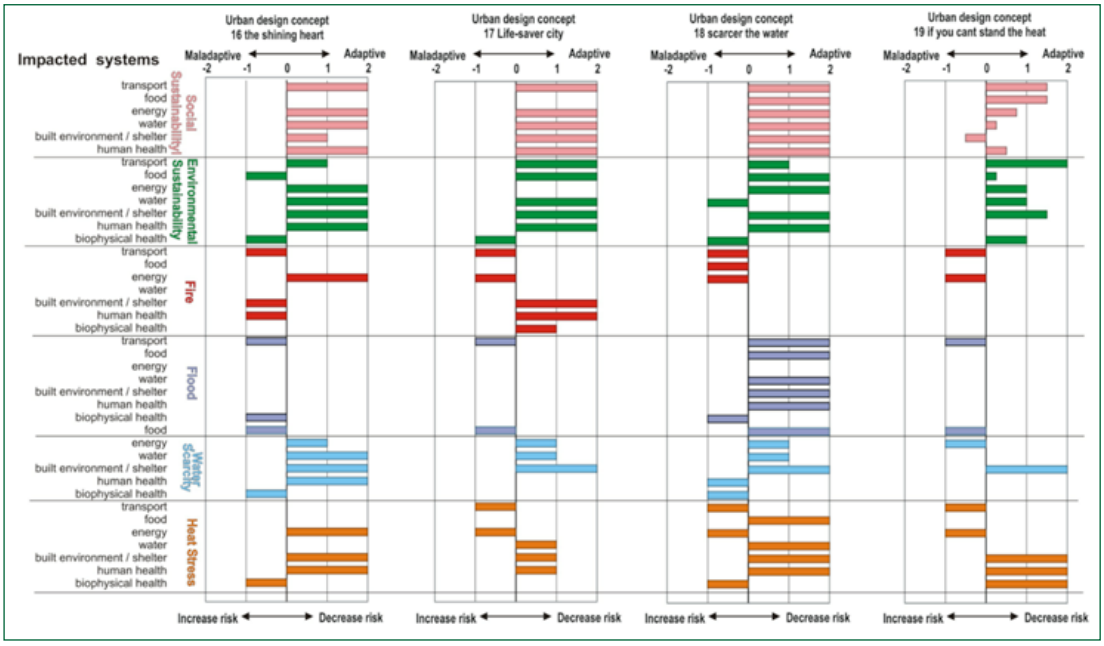
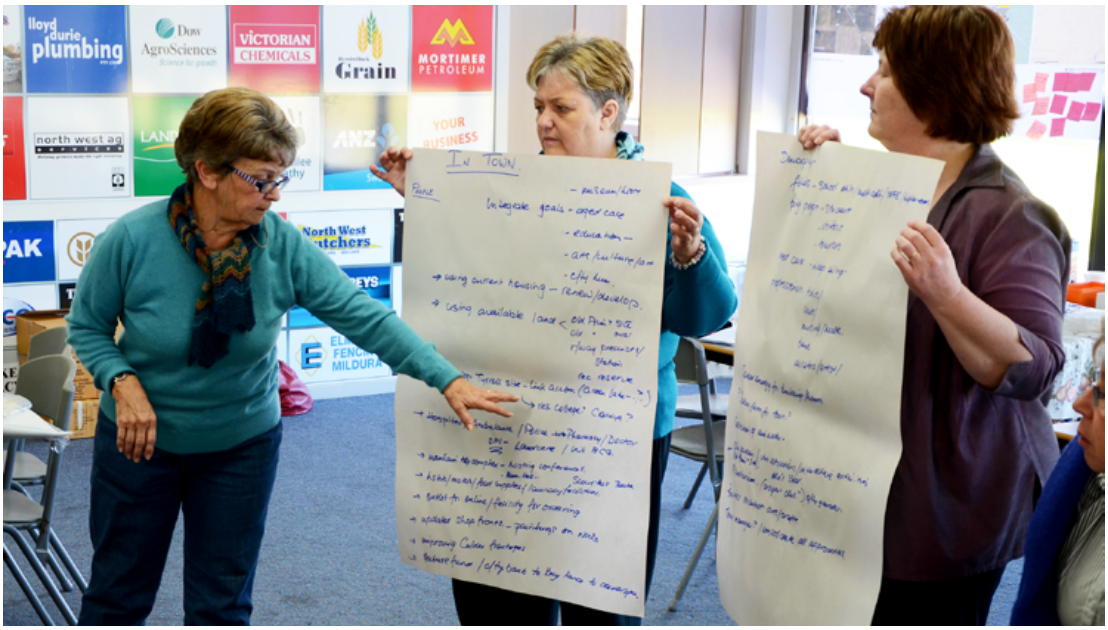


Figure 1. Bendigo charrette appraisal results

The results as presented are not definitive. Locating the appraisal within the design process enables the improvement and or merging of concepts into future designs to strengthen their adaptive potential. For example bike paths and an increase in days above 40oC (concept 17, 18 and 19) could potentially be maladaptive (heat stress and transport) despite its merit in terms of sustainability. Landscaping and shading paths to reduce temperatures could be future design solutions that reduce this risk.

The appraisal assisted planners to more explicitly focus on potentially maladaptive measures in the follow up Charrette II. For example, demand side management was not explicit in the Bendigo Charrette I but became a key criterion for a proposed industrial zone on the outskirts of Bendigo in Charrette II.



Sea Lake charette participants

References

Adger, W. N. 2000. Social and ecological resilience: are they related? *Progress in Human Geography* 24(3): 347-364.

Barnett, J. and S. O'Neill 2010. Maladaptation. *Global Environmental Change* 20: 211-213.

Cross, N. 1989. Engineering Design Methods. Chichester, *John Wiley*.

Fünfgeld, H. and D. McEvoy 2011. Framing Climate Change Adaptation in Policy and Practice. VCCCAR Project: Framing Adaptation in the Victorian Context. Melbourne, RMIT University.

IPCC 2007. Summary for Policy Makers. Climate Change 2007: Impacts, Adaptation and Vulnerability. M. L. Parry, O. F. Canziani, J. P. Palutikof, et al. Cambridge, *Working Group II for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*.

McCarthy, J. J., O. F. Canziani, et al., eds. 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. Cambridge, *Cambridge University Press*.

Swann, C. 2002. Action Research and the Practice of Design. *Design Issues 18*(1): 49-61.

Turner, B. L., R. E. Kasperson, et al. 2003. A framework for vulnerability analysis in sustainability science. *Proceedings of the National Academy of Sciences* 100(14): 8074-8079.

Victorian Centre for Climate Change
Adaptation Research

University of Melbourne
221 Bouverie Street,
Carlton, Victoria, 3010
enquiries-vcccar@unimelb.edu.au
+ 61 (03) 8344 3095
www.vcccar.org.au

vcccar
victorian centre for climate change adaptation research

State Government Victoria

ISBN: 978 0 7340 4920 9

Document available from VCCCAR website at:
www.vcccar.org.au/publications

Layout and design by Inprint Design
www.inprint.com.au

LA TROBE UNIVERSITY

MONASH University

DEAKIN UNIVERSITY AUSTRALIA

RMIT UNIVERSITY

THE UNIVERSITY OF MELBOURNE