



SOUTHERN SLOPES
CLIMATE CHANGE
ADAPTATION
RESEARCH
PARTNERSHIP



IMPACTS & ADAPTATION
I N F O R M A T I O N
FOR AUSTRALIA'S NRM REGIONS



An Adaptive Capacity Guide Book

Assessing, building and evaluating the capacity of communities
to adapt in a changing climate



Jacobs, B., Nelson, R., Kuruppu, N., and Leith, P.

Citation

Jacobs, B., Nelson, R., Kuruppu, N., and Leith, P. (2015). An adaptive capacity guide book: Assessing, building and evaluating the capacity of communities to adapt in a changing climate. Southern Slopes Climate Change Adaptation Research Partnership (SCARP), University of Technology Sydney and University of Tasmania. Hobart, Tasmania.

ISBN: 9781862958272

Copyright

© 2015 University of Technology Sydney and University of Tasmania

Disclaimer

The view expressed herein are not necessarily the views of the Commonwealth of Australia, and the Commonwealth does not accept responsibility for any information or advice contained herein.

Acknowledgements

The project under which this report was produced was funded by the Australian Government's Regional Natural Resource Management Planning for Climate Change Fund Stream 2.

The authors would like to thank other members of the Southern Slopes Climate Change Adaptation Research Partnership (SCARP) team: Phil Wallis, Karyn Bosomworth, Andrew Harwood, Liz Hamilton, Sophie Turner, and Nooshin Toorabin.

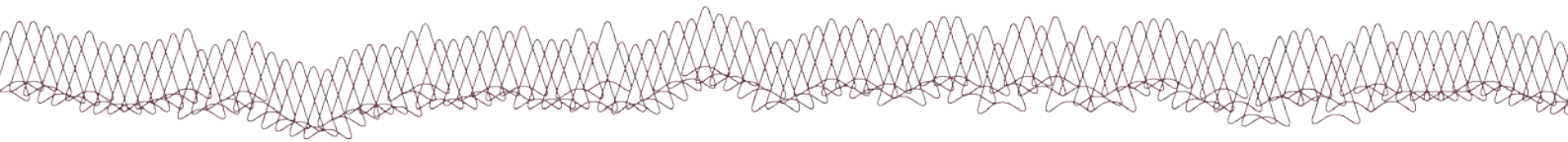
We would particularly like to thank the Southern Slopes NRM planners funded under Stream 1 of the Regional Natural Resource Management Planning for Climate Change Fund: Andrew Baldwin, Paula Camenzuli, Rex Candy, Luke Diddams, Emmaline Froggatt, Marty Gent, Ernst Kemmerer, Kristy Moyle, Chris Pitfield, and Shane Scanlon.

We also thank SCARP's Steering Committee: Rex Candy, Rod Keenan, Christopher Lee, James McKee, Kristy Moyle, Rohan Nelson, Graeme Anderson, and our Chair, Christine Forster.



An Australian Government Initiative





Contents

Executive Summary	1
1. Introduction	2
2. What is adaptive capacity?	3
2.1 What is adaptation?.....	3
2.2 Types of adaptation	3
3. How to assess adaptive capacity	5
3.1 Flexible frameworks for assessing adaptive capacity	5
3.1.1 Sustainable Livelihoods Framework.....	5
3.1.2 Top-down	7
3.1.3 Bottom-up.....	8
3.1.4 Blended approaches	8
3.1.5 Participatory self-assessment.....	9
4. Building the capacity to adapt	11
4.1 Natural, physical and financial capitals	11
4.2 Social capital.....	12
4.3 Human capital	12
4.4 Summary	13
5. How do you monitor and evaluate adaptive capacity?	15
5.1 Detection of change.....	15
6. Conclusion.....	17
References	18

List of Tables

Figure 2.1: Types of adaptation (derived from Pelling 2011)	3
Table 2.1 Examples of resilience, transition and transformation options.....	4
Table 3.1 Five capital framework (Ellis 2000)	5
Table 4.1 Elements of effective NRM groups Source: Roberts and Lacey (2008).....	13

List of Figures

Figure 1.1 A vision of a transformed community. Source: www.planningobserver.com	2
Figure 3.1 Maps of the adaptive capacity of Australian farmers created from national farm survey data (Nelson et al 2010).....	7

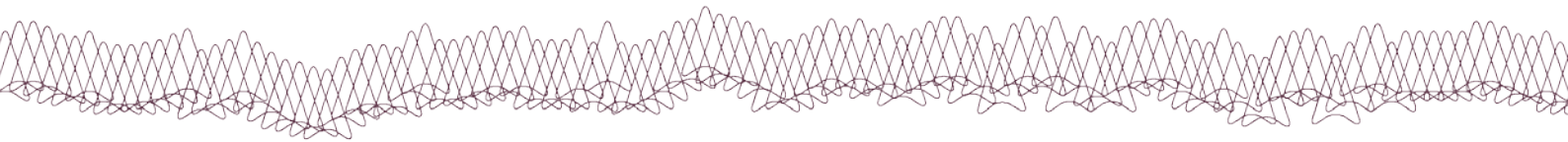
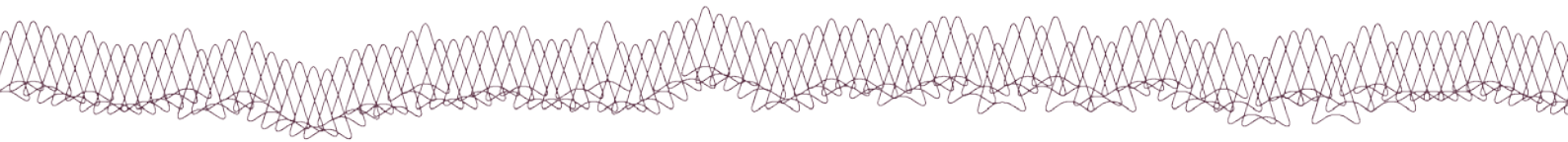


Figure 3.2 Livelihood pentagons from across the Hawkesbury-Nepean region showing self-assessed ratings averaged for each capital. (Jacobs unpublished data).....	9
Figure 4.1 Interrelationships between capitals and institutional constraints on their use (Campbell et al 2001).	11
Figure 4.2 Actions identified through self-assessment by natural resource managers to build adaptive capacity for effective NRM. Actions are grouped into five activity themes with overlapping geographical, governance, and temporal scales (Brown et al 2012)	14
Figure 5.1 Project level adaptive management cycle (Mazur et al 2013).....	15
Figure 6.1 Overview of major steps in the capacity assessment, building and monitoring.	17



Executive Summary

A capacity to adapt to change is essential for managing Australia's natural resources. The individuals, communities and organisations who manage our natural resources all have an innate capacity to adapt to change. Changes in climate, markets and technology have shaped the way we adapt the management of natural resources in urban, rural and coastal landscapes. Some of these changes are predictable and easy to manage. Others are expected, but their timing and magnitude are uncertain. Whatever the future holds, this guide can be used to build our capacity to meet future change with confidence.

1. Introduction

The ancient Greek philosopher Heraclitus (535-475BC) said 'the only constant in life is change'. This remains true more than 2500 years later. Today the pace of change is relentless. Technology, innovation and globalisation fill our lives with change. The natural environment and our relationship to it are similarly subject to change. Over millennia indigenous Australians became attuned to the natural rhythms of the landscape as they managed natural resources to meet cultural, nutritional and other needs. Many of today's landholders aspire to a similar degree of harmony with the natural environment as they manage natural resources to create sustainable livelihoods.

Climate change poses a real and immediate threat to natural resource management and the viability of communities that depend on natural resources for their livelihoods. Hotter summers, more frequent droughts and more intense storms and flooding are already adding to the risks associated with rural livelihoods. Past greenhouse gas emissions mean that significant climate change is now unavoidable. While landholders and other natural resource managers can participate in collective global efforts to combat climate change, they will continue to experience impacts of climate change that are outside their immediate control. This means that the sustainability of rural livelihoods depends on our capacity to adapt to change we cannot avoid.

Adapting to climate change can take many forms. It can mean taking action to reduce the impacts of climate change as it occurs, or taking actions to avoid or manage the future impacts of climate change. Some types of change can be adapted to with relatively small changes to the way we manage natural resources, whereas other types of change may require completely new ways of doing things. The capacity to adapt includes the knowledge, skills and resources required to identify and implement adaptation effectively.

This guide is designed to help Australia's natural resource managers understand the building blocks of adaptive capacity, and to set local priorities for building it.

Figure 1.1 A vision of a transformed community. Source: www.planningobserver.com



2. What is adaptive capacity?

2.1 What is adaptation?

Our ability to survive or prosper under the impacts of climate change relies on adaptation. 'Adaptation is the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects' (IPCC 2014, pg. 118).

Adaptation is important because the management of natural resources is subject to change from a range of sources including the environment, markets, and technology. Our vulnerability to these changes depends on our degree of exposure, and our capacity to adapt. Adaptive capacity has been defined as the 'resources available for adaptation to climate change and variability or other related stresses, as well as the ability of a system to use these resources effectively in the pursuit of adaptation' (Brooks and Adger, 2004, p.168). For example, landholders may be highly vulnerable to even small changes in the market price of a commodity if there are no immediate viable alternatives. In contrast, many of Australia's landholders are highly exposed to climate variability, but have adapted their management strategies to minimise vulnerability. Deliberate and renewed effort to build adaptive capacity becomes critical when we become exposed to changes outside our existing capacity to adapt.

Adaptation is a means-to-an-end, and not an end in itself. Australia's natural resources are managed for a range of purposes including generating rural livelihoods, conserving biodiversity and maintaining the amenity and other cultural values of rural landscapes. The impacts of climate change pose a threat to our continuing ability to achieve these goals. Adaptation involves taking action to manage the impacts of climate change so that current goals can continue to be met, or working out which goals we are prepared to trade off against each other as climate change alters opportunities and imposes constraints.

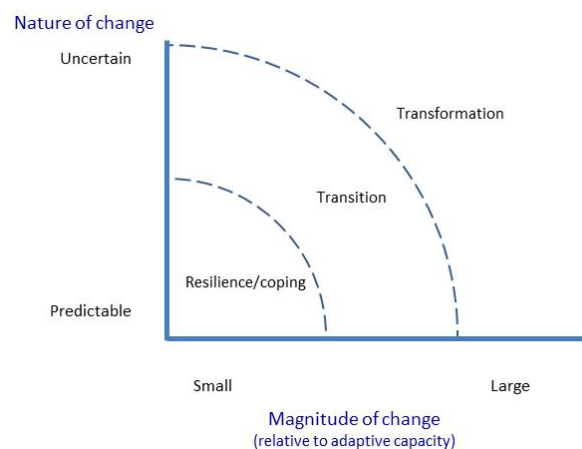
2.2 Types of adaptation

Climate change is likely to have many different impacts on natural resource management, and these impacts are likely to combine in locally specific ways over time. Similarly, local opportunities and constraints shape opportunities for building adaptive capacity. This means that adapting to climate change is likely to involve sequences of actions that evolve locally in response to current and expected future change. These sequences of actions are known as adaptation pathways.

Adaptation options and pathways tend to be shaped by the degree of uncertainty and magnitude of change (figure 2.1, table 2.1):

- **Resilience/Coping** - the magnitude of change is small and predictable, and adaptation can take place as incremental changes to existing ways of doing things
- **Transition** - change is sufficiently large and unpredictable to push current ways of doing things to their limits of capability
- **Transformation** - Change is large and uncertain enough to require new ways of doing things

Figure 2.1: Types of adaptation (derived from Pelling 2011)



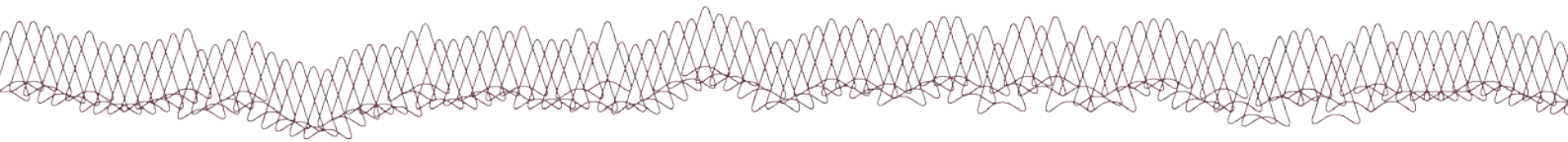
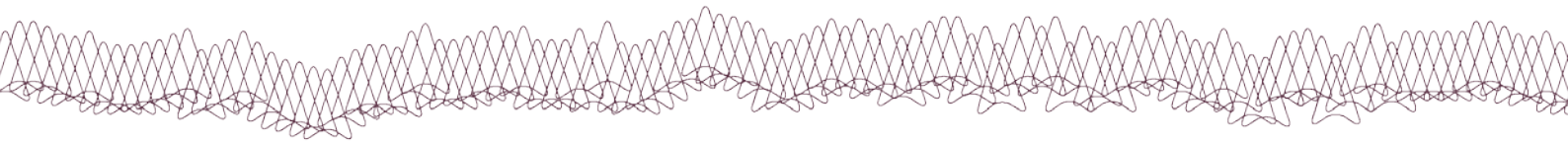


Table 2.2 Examples of resilience, transition and transformation options.

	Resilience	Transition	Transformation
Agriculture	Economic recovery between droughts to create reserves that can buffer business through dry periods	Diversifying farm business to develop multiple income streams	Shift from extensive cropping/grazing to small scale intensive high-value irrigated agriculture and nature conservation / tourism
Coastal systems	Construction of sea walls	Uphill drift of settlements	Retreat and relocation of coastal settlements
Water quality	Upgraded water treatment facilities	Improved management of non-point source pollution	Extensive catchment and riparian revegetation
Biodiversity conservation	Environmental Protection and Biodiversity Conservation Act (1999) is applied as regulatory mechanism to maintain species	Development of market-based instruments to incentivise biodiversity conservation on private property	Collective governance of landscape scale biodiversity corridors to enable migration, through public-and philanthropic trust



3. How to assess adaptive capacity

Assessments of adaptive capacity are an essential step in understanding vulnerability to different drivers of change, including climate, and for evaluating the need to strengthen our capacity to adapt to future expected change. Adaptive capacity cannot be measured directly, in the way that components such as agricultural productivity or biodiversity can be. Most approaches to assessing adaptive capacity involve identifying the factors that contribute to our capacity to adapt, and our ability to use these when needed.

Some factors that contribute to adaptive capacity are mostly external to the individuals, communities and organisations managing natural resources. These can include the development of new technologies, levels of government funding, linking forms of social capital that facilitate access to ideas and opportunities, cultural values, policies and governance processes, economic wealth, information and skills, infrastructure, institutions, and equity (Nelson et al 2010). Other contributing factors are more internal to the individuals, communities and organisations managing natural resources. These include risk perceptions, self-efficacy beliefs and perceived adaptation costs (Grothmann and Patt 2005). They also include local factors such as the supportive or bonding forms of social capital, the condition of natural resources, locally adapted technologies and competing funding priorities. All of the factors contributing to adaptive capacity are interlinked; it is the ability to combine and apply these in times of need that determines our capacity to adapt.

3.1 Flexible frameworks for assessing adaptive capacity

Because adaptive capacity is often locally defined and cannot be measure directly, conceptual frameworks are used to provide consistent, repeatable and useable assessments. These frameworks provide a way of organising complex information about the factors contributing to adaptive capacity without losing sight of the big picture. One conceptual framework used widely to assess natural resource management capacity in Australia is the Sustainable Rural Livelihoods Framework of Ellis (2000) (Table 3.1). This framework has been widely tested in Australian NRM at different

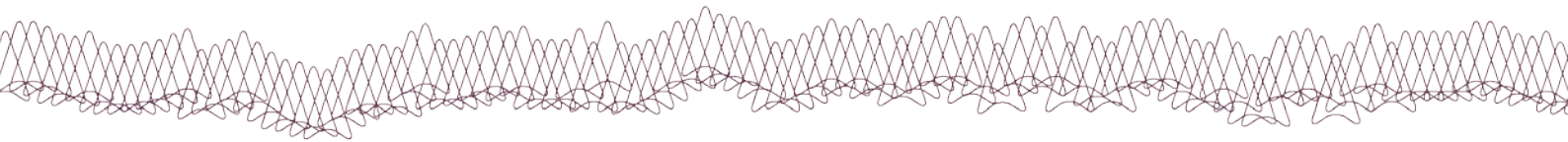
scales and for different purposes (Nelson et al 2010, Leith et al 2012, Brown et al 2010, Jacobs and Brown 2014, Jacobs et al 2014).

3.1.1 Sustainable Livelihoods Framework

The Sustainable Rural Livelihoods Framework (SRLF) of Ellis (2000) has been widely used as a tool for assessing adaptive capacity from both bottom-up and top-down perspectives (Nelson et al 2010). The framework conceptualises rural livelihoods as a process of accessing, transforming and substituting between human, social, natural, physical and financial capitals (or assets). Land managers with a greater diversity of assets and livelihood options are more likely to be resilient because of a greater capacity to substitute between alternative livelihood strategies in times of stress. The balance between the five capitals is equally if not more important to adaptive capacity than the amount of any one type of capital. This is because the five capitals often complement each other in the process of generating livelihoods. For example, minimum levels of human and social capital are necessary to effectively make use of natural, physical and financial capital. Viewing adaptive capacity as a balance between the capitals is also useful for capturing the transformative nature of the capitals.

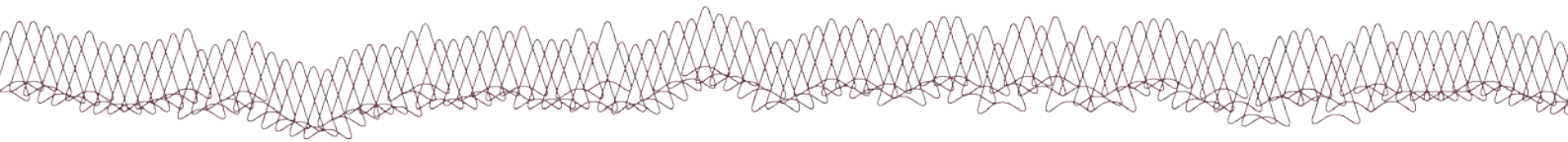
Table 3.1 Five capital framework (Ellis 2000)

Capital	Description
Human	Health, skills, education, knowledge, confidence, ability to work, physical capability
Social	Family links, groups, support networks, leadership, influences over political decisions, conflict
Natural	Natural resource stocks and environmental services - soil, water, forest, environmental assets
Physical	The built environment, infrastructure and equipment - houses, schools, clinics, roads, farm machinery, producer goods accessible by community, improved genetic resources (crops & livestock)
Financial	Cash, credit, debt, savings, sources of income, assets which can be traded or sold, financial services



The SRLF framework recognises the mediating effect of social relations, institutions and culture on the ability of households to access and transform capitals. Variants of the framework applied at scales beyond the household often treat these factors as capitals that can be transformed and substituted between.

Extensions to the SRLF framework recognise that different types of capitals are valued differently by different communities. In farming communities, the sustainable transformation of natural capital into physical and financial capital may be a priority. For Indigenous communities, the mediating influence of culture on the ability to access and transform the other types of capital is critical and often overlooked in assessments of adaptive capacity (Gadgil et al 1993). As discussed below, self-assessment and bottom-up approaches accommodate this diversity by enabling local interpretation of capitals and mediating influences.



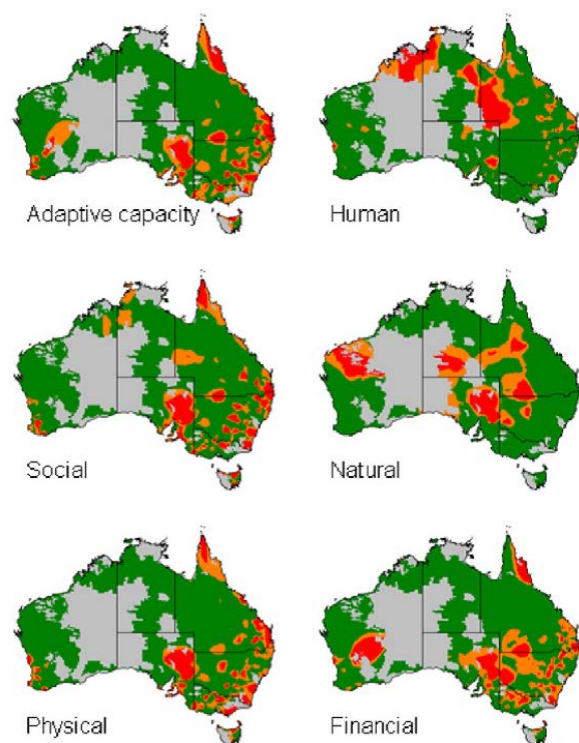
3.1.2 Top-down

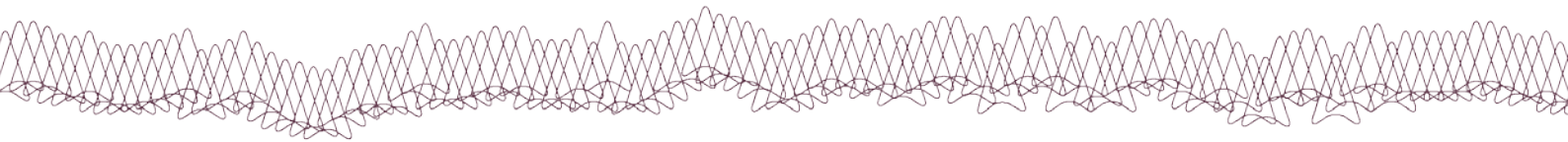
Top down approaches are often used to prioritise policy options for building adaptive capacity across broad regional scales (Nelson et al, 2010). Secondary data from national surveys can be used to represent the capacity to adapt to unspecified or generic drivers of change. A common flaw of these approaches is combining social and economic data taken from different groups in society, making it difficult to understand who the results apply to.

Figure 2.2 shows a top-down analysis using consistent farm survey data from the Australian Bureau of Agricultural and Resource Economics (ABARE) to map the adaptive capacity of Australian broadacre farmers (Nelson et al 2010). This research enabled a nationally consistent comparison of regions in terms of the adaptive capacity of rural landholders, and a preliminary discussion of the primary causes of vulnerability of natural resource managers in the agriculture sector.

For dealing with specific issues of local and regional NRM, broad scale approaches relying on secondary data rarely help to illuminate the underlying constraints and opportunities for developing adaptive capacity (Brown et al 2010). Adaptive capacity for NRM often requires a local understanding of specific threats and opportunities in a specific context, just as planning for climate change requires consideration of local impacts. Also top-down approaches often fail to trigger capacity building action because they provide no specific information about local needs (Leith et al, 2012). These sorts of questions often require other approaches to understand specific adaptive capacity (Brooks et al 2005).

Figure 3.1 Maps of the adaptive capacity of Australian farmers created from national farm survey data (Nelson et al 2010)



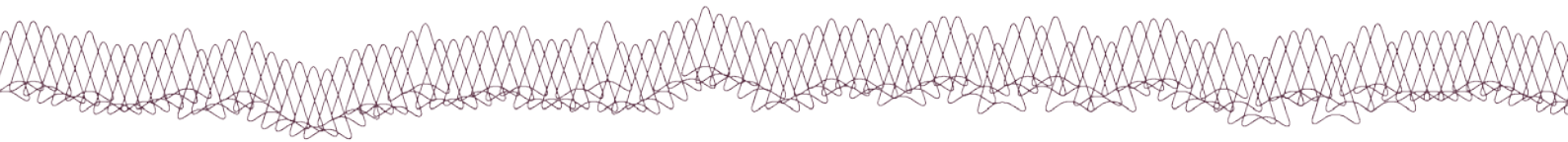


3.1.3 Bottom-up

Bottom up approaches are used to identify and prioritise local actions to build adaptive capacity. They start from the lowest level of a hierarchy or process in order to piece together a larger view of a system. These approaches recognise that some aspects of adaptive capacity can be understood only through a local lens to consider the experiences, perceptions, and values that are difficult to include in top-down approaches (Boyd and Charles 2006). The data and modelling systems needed to support building adaptive capacity at local scales are often not available and may need to be constructed locally (Campbell et al 2001). A weakness of locally derived measures of adaptive capacity is that they may be difficult or impossible to repeat, and may not be consistent enough to enable learning about adaptive capacity between similar communities.

3.1.4 Blended approaches

Other approaches attempt to use bottom-up engagement processes to inform the development of indices of vulnerability or adaptive capacity that may have wider geographical application (e.g. Hahn et al 2009). The SRLF of Ellis (2000) has been used to translate regional indicators of adaptive capacity into local priorities for building adaptive capacity (Leith et al 2012). A weakness of this approach is a tendency to fixate on the development of indices. Our experience is that the value of creating local indicators of adaptive capacity lies in the narrative generated through the process about options, barriers and opportunities for building adaptive capacity.



3.1.5 Participatory self-assessment

Participatory self-assessment approaches can be used to build awareness of the importance of adaptive capacity in reducing vulnerability to expected future change, and to identify specific opportunities for building it. Indicators developed through self-assessment are context specific and emerge from various forms of community engagement such as key stakeholder interviews, workshops or focus groups (Vernooy and McDougal 2003; Reed et al 2008). These indicators can be aggregated across a region or even a state to provide or inform broader scale indicators of adaptive capacity (Leith et al 2012).

While this guide focusses mostly on capacity within local communities (communities of place), similar approaches are applicable to communities of practice (people working on Australia-wide connectivity for biodiversity, for example) and communities of interest (for example, Coastcare groups).

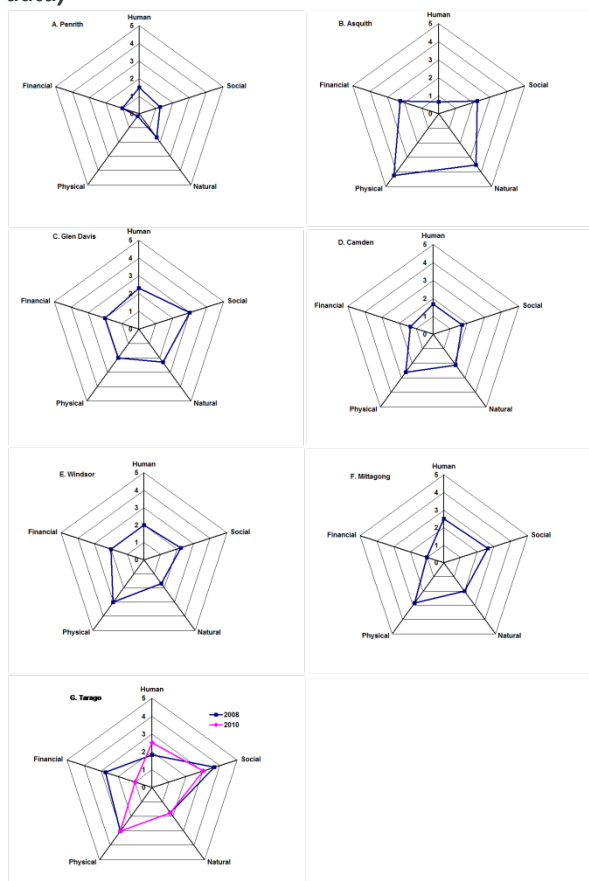
Components of adaptive capacity that are important for NRM vary between regions, community groups and resource issues (Brown et al 2010). Similar indicators can have contrasting meaning at different locations with different NRM groups. Figure 3.2 illustrates the differences in adaptive capacity for improved NRM from a series of self-assessment workshops conducted in a range of locations in the Hawkesbury-Nepean Catchment in NSW. Participants assigned a value corresponding to the level of support (0=not supporting to 5 =strongly supporting) for adaptive capacity each indicator provides. Mean values for each capital are shown as a *livelihood pentagon* for each location.

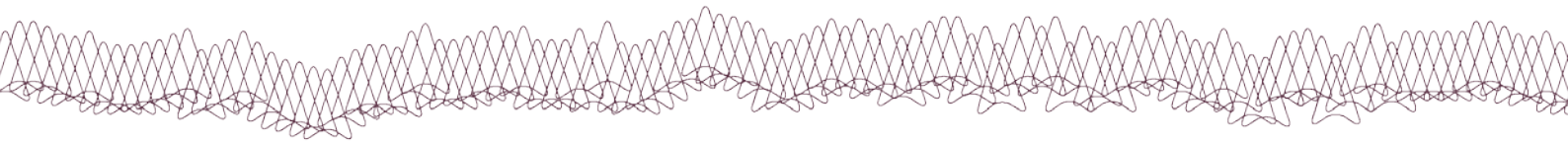
While the livelihood pentagons of the individual workshops provide a useful depiction of which capitals, on average, have the greatest impact on NRM, they may mask large differences in the ratings of individual indicators at specific locations. As such the pentagons are just an entry point into understanding adaptive capacity. For example, *relationship with government* was widely identified as an indicator of NRM capacity under social capital. It was most often rated to indicate the health of the relationship between landholders and state or federal governments as not supporting NRM. However, sometimes participants used the same

indicator but applied a much higher rating to describe the high levels of support for NRM from local government.

The major criticism of self-assessment processes is that numerical ratings of constraint generated in this way, cannot be validly compared among locations or measured objectively. However, the importance of the psychological (subjective) dimensions of capacity should not be discounted. Feeling that you are unable to act, even in a capital rich environment, can be debilitating. This is often observed where natural resource managers fail to take advantage of available funding programs because they feel isolated or lacking in the capability to achieve improvements.

Figure 3.2 Livelihood pentagons from across the Hawkesbury-Nepean region showing self-assessed ratings averaged for each capital. (Jacobs unpublished data)





In summary, many techniques are available to assess adaptive capacity. The technique selected should match the need for information – top-down for broad scale, general issues, and bottom-up for finer-scale specific questions that about local NRM capacity.

4. Building the capacity to adapt

Assessments of adaptive capacity provide information on the types of capitals available to support natural resource management, and constraints on our ability to access, combine or apply these capitals to adapt to change. These assessments can be used to identify opportunities for collective local action and/or government intervention to build adaptive capacity (Bellamy et al 2002). Some asset deficits, such as the construction of public infrastructure, are beyond the scope of collective local action and are likely to require cooperative interventions by governments.

4.1 Natural, physical and financial capitals

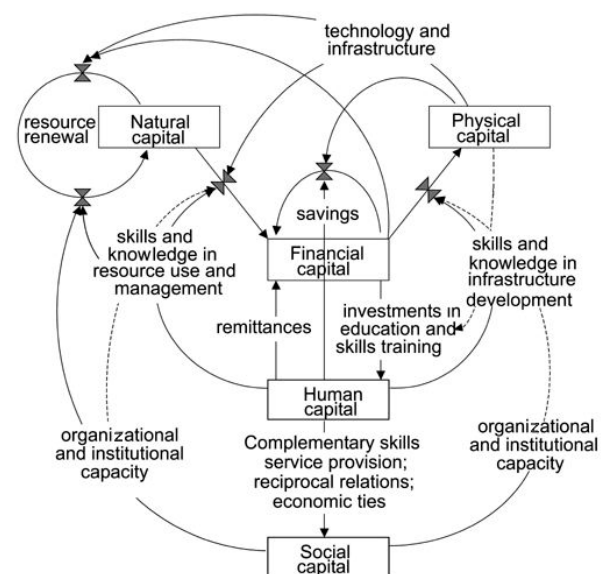
Natural resource dependent livelihoods involve making a living from the conversion of natural capital to other forms of capital (Ellis 2000). In agricultural systems, natural capital is managed for the production of plant and animal products. These products are then converted, through markets, to financial capital, which is easily convertible to many other forms: physical capital in the form of purchased farm inputs, machinery and improved genotypes of plants and animals; human capital in the form of skills improvement and educational opportunities for farmers and children; and, social capital by supporting involvement in NRM networks, sports clubs and other organisations. Climate is an aspect of natural capital that can fundamentally alter the use of other natural assets. For example, high soil fertility is of little use for the maintenance of ground cover during a prolonged drought.

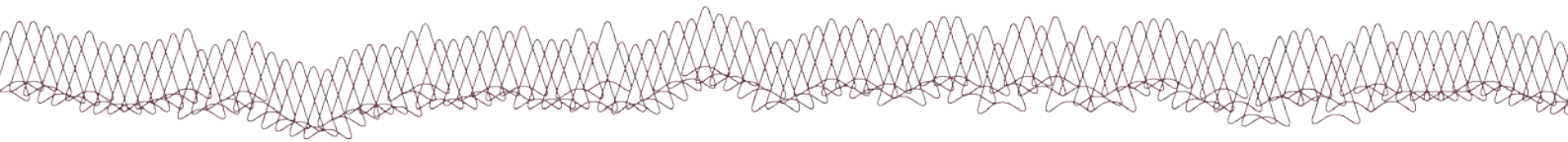
Sustainable transformation of natural capital is an implicit part of modern agricultural systems that frequently rely on its substitution over time with physical (or man-made) capital to replenish many natural resource stocks. However, critical natural capital, such as biodiversity, is often considered to be less substitutable with other forms of capital, underpinning the concept of 'strong' sustainability (Brand 2009, Norton 1992).

For adaptive capacity in NRM, conversion of capital at local (farm) scale is important but the use of local assets to support improved natural resource practices and rural livelihoods often depends on the provision of

public assets and institutional arrangements at wider scale (Leith et al 2012; Jacobs and Brown 2014). For example, major infrastructure improvements such as roads, railways and ports, telecommunications and high speed broad-band services, nationally-sponsored research and development efforts, international free-trade agreements, and funding schemes such as Landcare create opportunities for change (Figure 4.1). This type of capacity building is beyond the scope of local intervention but can enable local innovation by allowing local assets to be used in new ways that can create community wealth (e.g. Bandias and Ram Vemuri 2005). However, local innovation is most likely to occur where support is also available for local social and human capital (Shaw and Newby 1998).

Figure 4.1 Interrelationships between capitals and institutional constraints on their use (Campbell et al 2001).





4.2 Social capital

Social capital includes reciprocal claims on others by virtue of social relationships, the close social bonds that facilitate cooperative action, and the social bridging and linking via which ideas and resources are accessed.

The relational dimension of social capital has three components: bonding, bridging and linking (Woolcock 1998). *Bonding* refers to interactions based on personal trust and shared experience with other people similar to us. *Bridging* refers to interactions based on trust and shared experience extended beyond our immediate social networks. *Linking* social capital encapsulates a broader sense of trust and shared experience throughout communities that facilitate socio-economic development. A number of past studies have drawn attention to the critical role that social capital plays in the adoption of sustainable farming practices by landholders (Cary and Webb 2000, Kilpatrick 2003, Prior 2004, Webb and Cary 2005). A balanced mix of the bonding, bridging and linking forms of social capital is most conducive to the adoption of improved NRM practices.

Social capital is recognised as providing one of the foundations upon which much NRM activity is built (Pretty, 2003; Pretty and Smith, 2004) because it is about the behaviour of groups that facilitate action (Armitage et al 2005). It is an essential component of capacity to manage natural resources. People who are members of social groups have access to resources that are not available to non-members (Bodin and Croner 2009). In particular, inclusive forms of social capital support the actions of individuals through the sharing of knowledge, labour (human capital), equipment (physical capital) and finances (financial capital) (e.g. Pelling and High 2005).

Political and institutional capitals are often considered as sub-sets of social capital (Webb and Cary 2005), and are recognised as factors mediating access to other forms of capital in the SRLF. Political capital includes the influence of groups or individuals with high social standing, which allows them to leverage outcomes or resources. Institutional capital similarly relates to the legitimacy and effectiveness of rules and processes. These two elements can be summed up broadly as the

power and policy that provide an institutional environment supportive of collective action. For example, the political capital of a group of NRM or industry advocates can affect a change in policy, which in turn changes rules about how a specific issue is managed.

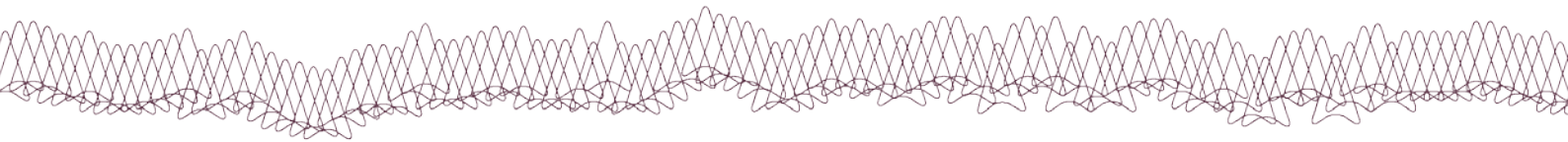
Constructing social groups is easier where people can come together for a common cause. This often occurs in the wake of real or potential threats (e.g. dry land salinity, weed invasion, soil erosion, bushfires) supported by organisations (such as the Australian Government) through funding arrangements (e.g. Landcare).

It can be a challenge to sustain collective action in the absence of a threat. Events creation is often a particularly powerful tool for bringing communities together for a common cause in a positive light and is frequently used among rural communities to create social capital (Arcodia and Whitford 2006). Events such as a 'No Harvest Drought Party' have been used by some rural communities in times of drought to relieve stress through social engagement.

4.3 Human capital

Human capital includes the skills, health (including mental health) and education of individuals that contribute to the productivity of labour and capacity to manage land.

Many past interventions to build adaptive capacity in NRM have attempted to improve knowledge using traditional approaches to agricultural extension. These traditional approaches assume that human capital needs to be created by educating individuals (Vanclay 2011), on the presumption that knowledge is limiting action. However, most landholders report suffering from information over-load rather than a lack of knowledge. A common complaint from natural resource managers is that information provided in publications and web-sites is too general and not focused on local issues. More effective approaches to NRM knowledge brokering simultaneously build social and human capital through forms of social learning in group situations (Ison et al 1997; Leys and Vanclay 2011). Such situations



require interventions to build effective groups as a first step (Table 4.1).

Group approaches allow co-learning among resource managers, planners and scientists (Plummer 2009). They can also facilitate deliberation on approaches to transforming natural capital in to physical and financial capital to ensure that natural capital is not ‘mined’ or used unsustainably. Groups can, for example, develop material technologies (physical capital) to deal with local problems through effective funding (financial capital) of action research that includes development and extension (social capital). Such process-driven and outcome-oriented work aims to effectively harness the diverse knowledge of the range individuals and backgrounds (human capital) within the group, rather than to provide technical information in a top-down manner to individuals.

Table 4.1 Elements of effective NRM groups Source: Roberts and Lacey (2008)

Element	Comments
Participants have expressed / endorsed a need for assistance	Impetus from a project team or potential participants - not imposed.
Groups are self-selected	Various approaches to self-selection.
Facilitators are selected or endorsed by the group participants	Could be public or private or community people.
A planning cycle and reflection on progress is incorporated in processes.	A planning cycle helps ensure issues will be dealt with in a systematic way.
Group members have opportunity to receive training in empowerment skills	Skills include: critical thinking, planning, communication, facilitation, building networks, leadership.
Groups meet regularly	Affected by localities and types of issues facing the groups.
Boundaries for use of	Assists funders in

funder resources are negotiated and agreed by funders/project team and group members.	monitoring and accountability. Objectives, type and level of reporting should be clear.
Opportunities are made for professional development of group members	Facilitators connected to each other and develop facilitation and technical knowledge to provide maximum benefit.
Opportunities are made for group members to meet and share experiences	Actions and learning of other groups can provide significant stimulus to like-groups progress and growth.
Benchmarking knowledge, attitudes and practices of group members is encouraged.	Benchmarking measures and reinforces individual and group progress and growth.
Group members contribute an increasing level of their own resources to group activities.	Assists with ownership and sustainability beyond the life of a project.
Courses and workshop opportunities are made available to facilitators and group members.	Ensure potential training opportunities are communicated.

4.4 Summary

In summary, for capacity building to be effective it needs to recognise that there are interdependencies that operate across scales in the ability of communities to transform and substitute between different forms of capital. Innovation in the use of local resources requires a broad array of interventions that range from local support for social networking and skills development to foster practice change, through to the provision of modern telecommunications and support for national research and development that can help to drive rural and regional wealth creation (Figure 4.2)

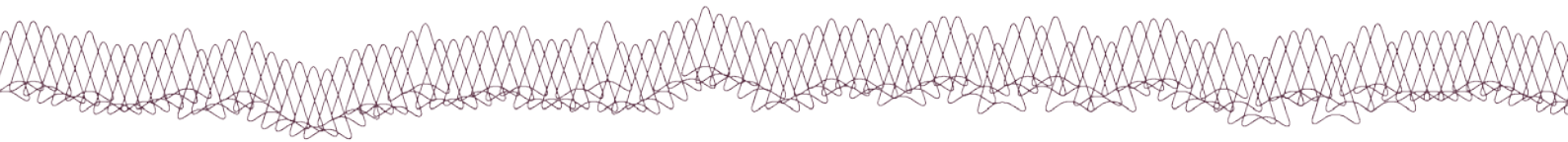
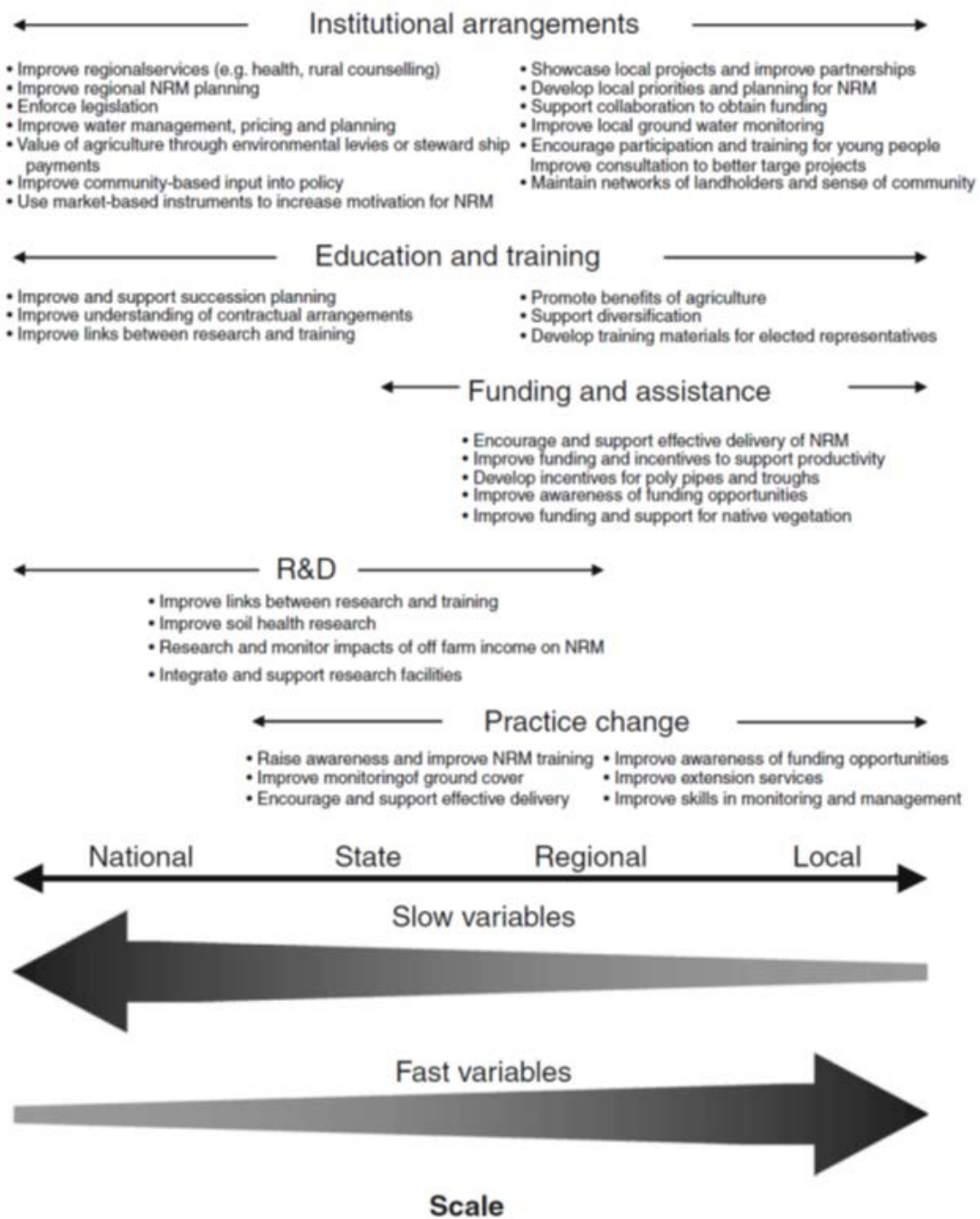


Figure 4.2 Actions identified through self-assessment by natural resource managers to build adaptive capacity for effective NRM. Actions are grouped into five activity themes with overlapping geographical, governance, and temporal scales (Brown et al 2012)



5. How do you monitor and evaluate adaptive capacity?

Much investment in NRM is concentrated on spatial prioritisation. Environmental assets that contribute to landscape resilience are assessed to determine whether interventions by governments and NRM groups are likely to deliver substantial NRM outcomes. In contrast, bottom-up capacity assessment does not lend itself to spatial prioritisation. Instead it assists in determining how to invest in NRM to provide landholders in spatially prioritised areas with the capacity they need to deliver the desired NRM outcomes. Figure 4.2 illustrates the range of activities that were identified through a self-assessment process as contributing to capacity building for NRM.

5.1 Detection of change

If adaptive capacity is largely intangible and often relies on the perceptions of barriers to action by people in discrete locations, how can you tell if intervention to build capacity has been successful? The ability to detect change is a critical component of any monitoring program because it facilitates adaptive management (Allan and Curtis, 2005).

There have been limited attempts to monitor the improvements from capacity building interventions in livelihood outcomes for local communities in international development aid projects (Strele et al. 2006, Bond and Mukerjee, 2002). A requirement of most public investments in natural resource improvements, including capacity building, is that project managers use techniques such as program logic, or theory of planned change (Davidson et al 2008). These techniques assist demonstration of causal links between chosen interventions and desired longer term and intermediate outcomes for their target assets and attempt to evaluate progress towards the achievement of those goals (Mazur et al 2013) (Figure 5.1).

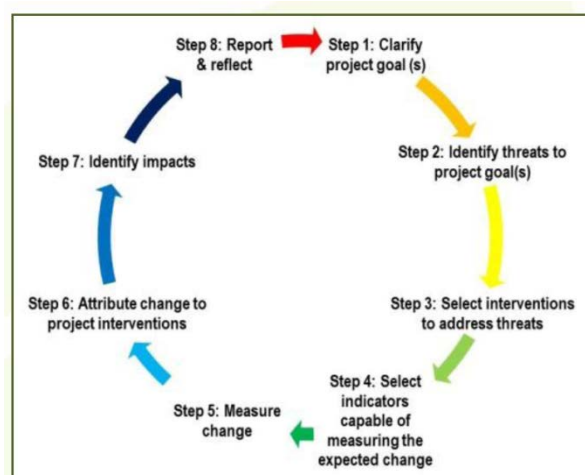
The above approach is useful to monitor change within the limited context of a specific project. However, given that adaptive capacity is also influenced by multiple, inter-related factors at national and global scales, can their influence through time be determined on NRM capacity at local scale? It is possible to show the dynamic nature of adaptive capacity through time and its sensitivity to changes in both large external drivers,

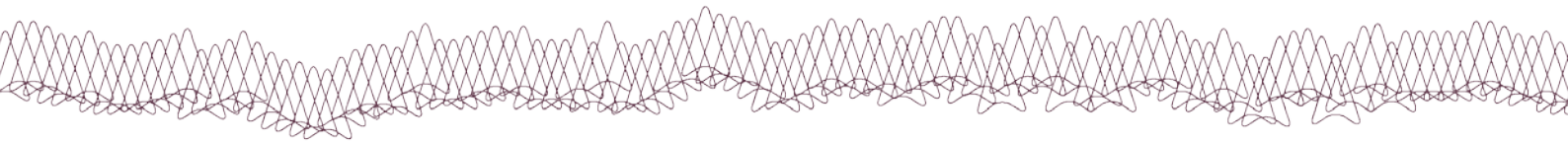
such as national NRM policy and economic disruptions, as well as local capacity building through repeated self-assessment. Jacobs and Brown (2014) showed changes in NRM capacity at two locations in NSW determined through self-assessments done 2-3 years apart. For the groups of natural resource managers in this study NRM capacity responded to two external influences:

1. The end of the Millennium Drought, which was a major constraint to capacity affecting the level of support provided by natural, social and, in particular, financial capital to NRM, and
2. Changes to NRM funding arrangements that saw less funding flow to these NRM groups, which limited the range of activities local NRM groups could undertake and undermined their social capital.

Consistent approaches to recruiting participants and

Figure 5.1 Project level adaptive management cycle (Mazur et al 2013)





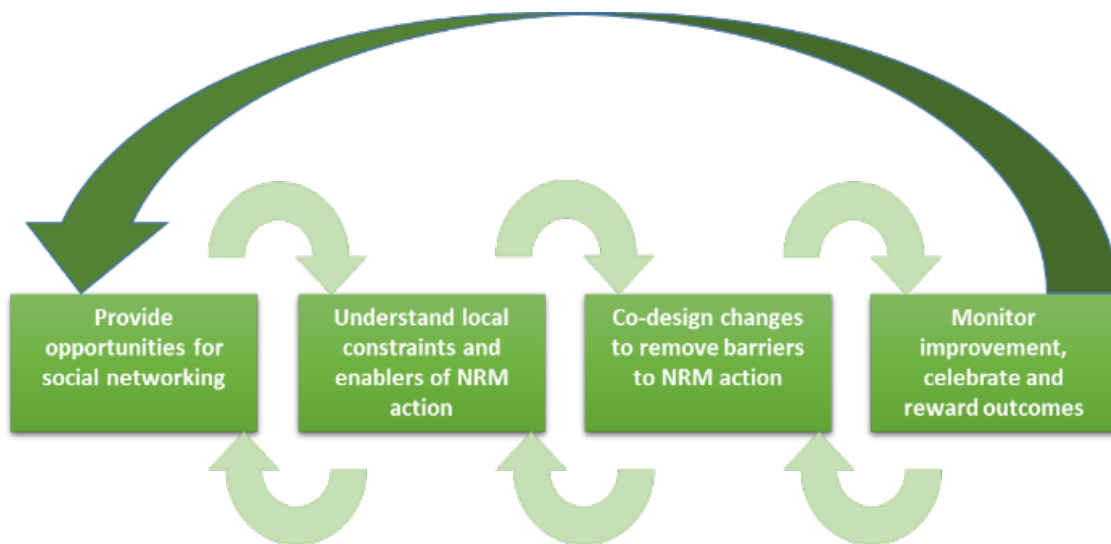
evaluation of capacity are critical to detection of change over time. As indicated above, change may be related to cyclical fluctuation (e.g. climate variability) or to step-wise change (institutional or policy changes, demographic shifts). This means that evaluation needs to consider which aspects of capacity are faster or slower to change. Slow variables are elements that are more likely to be indicative of long term shifts in capacity (e.g. age of farmers). Faster variables may be more indicative of seasonal or shorter term fluctuations (e.g. cash flow) and may in time aggregate to affect slow variables.

6. Conclusion

The livelihoods of communities throughout Australia depend on sound decision making in the management of natural resources. Many different groups are involved in NRM from farmers to policy makers to planners and they need to work together to improve natural resource management in the face of ongoing environmental, social and economic change. Understanding, assessing, building and monitoring the capacity of natural resource managers to adapt to

change is fundamental to sustainable management of natural resources (Figure 6.1). While methods to assess adaptive capacity may vary they all seek to create opportunities for innovation in the use of available resources, either at local, state or national scales. For NRM, it is the local scale changes founded upon the collective actions of social groups and supported by resources from higher levels of governance that will ensure continuing improvement NRM capacity.

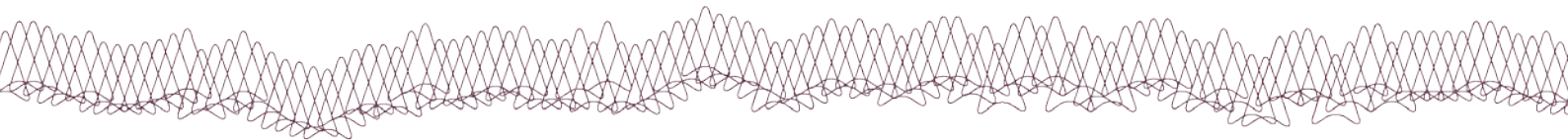
Figure 6.1 Overview of major steps in the capacity assessment, building and monitoring.



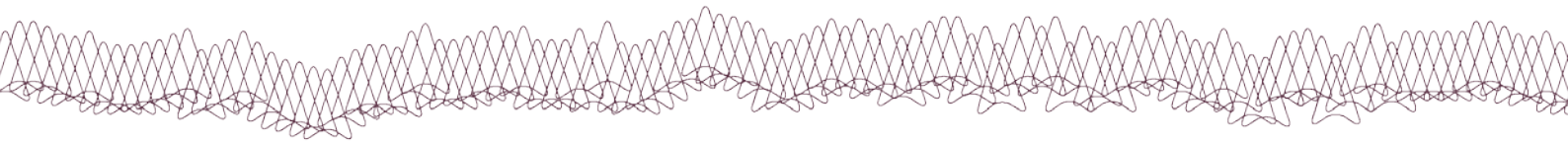


References

- Allan, C., and Curtis, A. 2005. Nipped in the bud: Why regional scale adaptive management is not blooming. *Environmental Management*, 36 (3), 414–425.
- Arcodia, C. and Whitford, M. 2006. Festival attendance and the development of social capital Fairness in Adaptation to Climate Change. *Journal of Convention and Event Tourism*, 8 (2), 1-18
- Armitage, D., Plummer, R., Berkes, F., Arthur, R., Charles, A., Davidson-Hunt, I., and Diduck, A. 2008. Adaptive co-management for social-ecological complexity. *Frontiers in Ecology and the Environment* 7 (2), 95-102.
- Bandias, S., and Ram Vemuri, S. 2005. Telecommunications infrastructure facilitating sustainable development of rural and remote communities in Northern Australia. *Telecommunications Policy*, 29 (2), 237-249.
- Bellamy, J., Ross, H., Ewing, S., and Meppem, T. 2002. Integrated catchment management: learning from the Australian experience for the Murray-Darling Basin. Sustainable Ecosystems, CSIRO, Canberra, Australia, p 227
- Bodin, Ö., and Crona, B. I. 2009. The role of social networks in natural resource governance: What relational patterns make a difference? *Global environmental change*, 19 (3), 366-374.
- Bond, R., and Mukherjee, N. 2002. Livelihood asset status tracking: an impact monitoring tool? *Journal of International Development*, 14 (6), 805-815.
- Boyd, H., and Charles, A. 2006. Creating community-based indicators to monitor sustainability of local fisheries. *Ocean and Coastal Management*, 49 (5), 237-258.
- Brand, F. 2009. Critical natural capital revisited: Ecological resilience and sustainable development. *Ecological economics*, 68 (3), 605-612.
- Brooks, N., and Adger, W. N. 2005. 'Assessing and enhancing adaptive capacity'. In Burton, I., and Lim B. (Ed.) *Adaptation policy frameworks for climate change: Developing strategies, policies and measures*, United Nations Development Programme. Cambridge: Cambridge University Press.
- Brooks, N., Adger, W. N., and Kelly, P. M. 2005. The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. *Global environmental change*, 15, (2), 151-163.
- Brown, P., Nelson, R., Jacobs, B., Kocic, P., Tracey, J., Ahmed, M. and DeVoil, P. 2010. Enabling natural resource managers to self-assess their adaptive capacity. *Agricultural Systems* 103, (2010), 562-568.
- Brown, P. R., Jacobs, B., and Leith, P. 2012. Participatory monitoring and evaluation to aid investment in natural resource manager capacity at a range of scales. *Environmental Monitoring and Assessment*, 184 (12), 7207-7220.
- Campbell, B., J. A. Sayer, P. Frost, S. Vermeulen, M. Ruiz Pérez, A. Cunningham, and R. Prabhu. 2001. Assessing the performance of natural resource systems. *Conservation Ecology* 5(2): 22. [online] URL: <http://www.consecol.org/vol5/iss2/art22/>
- Cary, J., and Webb, T. 2000. Community Landcare, the National Landcare Program and the Landcare Movement: The Social Dimensions of Landcare. Bureau of Rural Science, Canberra.
- Davidson, J., Lockwood, M., Griffith, R., Curtis, A., and Stratford, E. (2008) *Status and good practice in Australian NRM governance*. Report No. 5 University of Tasmania, Hobart.
- Ellis, F., 2000. *Rural Livelihoods and Diversity in Developing Countries*, Oxford: Oxford University Press.
- Gadgil, M., Berkes, F., and Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio*, 22 (2/3), 151-156.
- Grothmann, T., and Patt, A. 2005. Adaptive capacity and human cognition: the process of individual adaptation to climate change. *Global Environmental Change* 15 (3), 199–213.
- Hahn, M. B., Riederer, A. M., and Foster, S. O. 2009. The Livelihood Vulnerability Index: A pragmatic approach to assessing risks from climate variability and change - A case study in Mozambique. *Global Environmental Change*, 19 (1), 74-88.
- IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

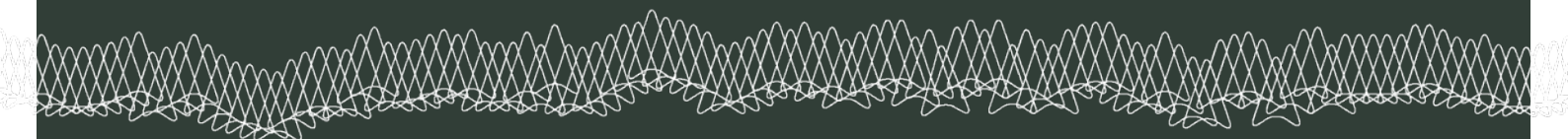


- [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, pp. 117-130.
- Ison, R., Maiteny, P. and Carr, S. 1997. Systems methodologies for sustainable natural resources research and development. " *Agricultural systems* 55 (2), 257-272.
- Jacobs, B. C., and Brown, P. R. 2014. Drivers of change in landholder capacity to manage natural resources. *Journal of Natural Resources Policy Research*, 6 (1), 1-26.
- Jacobs, B., Lee, C., O'Toole, D., and Vines, K. 2014. Integrated regional vulnerability assessment of government services to climate change. *International Journal of Climate Change Strategies and Management*, 6 (3), 272-295.
- Kilpatrick, S., Bond, L., Bell, R., Knee, J., and Pinkard, G. 2003. Effective farmer groups for defining best practices for sustainable agriculture. In *Proceedings: APEN National Forum*, Hobart.
- Leith, P., Jacobs, B., Brown, P., and Nelson, R. 2012. A participatory assessment of NRM capacity to inform policy and practice: Cross-scale evaluation of enabling and constraining factors. *Society and Natural Resources*, 25 (8), 775-793.
- Leys, A. J., and Vanclay, J. K. 2011. Social learning: A knowledge and capacity building approach for adaptive co-management of contested landscapes. *Land use policy*, 28 (3), 574-584.
- Mazur, N., Bodsworth, A., Curtis, A. and Lefroy, E.C. 2013. Applying the principles of adaptive management to the application, selection and monitoring of environmental projects, University of Tasmania, Hobart, Tasmania.
- Nelson, R., Kocic, P., Crimp, S., Martin, P., Meinke, H., Howden, S. M., and Nidumolu, U. 2010. The vulnerability of Australian rural communities to climate variability and change: Part II—Integrating impacts with adaptive capacity. *Environmental Science and Policy*, 13 (1), 18-27.
- Norton, B. 1992, Sustainability, human welfare and ecosystem health, *Environmental Values*, 1(2), 97-111.
- Pelling, M. 2011. *Adaptation to climate change: from resilience to transformation*. London, Routledge
- Pelling, M., and High, C. 2005. Understanding adaptation: what can social capital offer assessments of adaptive capacity? *Global Environmental Change*, 15 (4), 308-319.
- Plummer, R. 2009. The adaptive co-management process: An initial synthesis of representative models and influential variables. *Ecology and Society*, 14 (2), 24.
- Pretty, J. 2003. Social capital and the collective management of resources. *Science*, 302 (5652), 1912-1914.
- Pretty, J., and Smith, D. 2004. Social capital in biodiversity conservation and management. *Conservation biology*, 18 (3), 631-638.
- Reed, M. S., Dougill, A. J., and Baker, T. R. 2008. Participatory indicator development: what can ecologists and local communities learn from each other. *Ecological Applications*, 18 (5), 1253-1269.
- Roberts K. and Lacey J. 2008. What is the relationship between human and social capital: What transfers to whom? *Rural Society* 18 (2) 103-116.
- Shaw, P. E., and Newby, L. 1998. Sustainable wealth creation at the local level in an age of globalization. *Regional studies*, 32 (9), 863-871.
- Strele M., Holtge K., Fiebeger M., Were, J., and Schulmeister, A., with contributions from Weingartner L., 2006. *Participatory Livelihoods Monitoring. Linking Programmes and Poor People's Interests to Policies Experiences from Cambodia*. FAO LSP WP 21.
- Vanclay F., 2011. Social principles for agricultural extension in facilitating the adoption of new practices In: D. Pannell and F. Vanclay, eds. *Changing Land Management: Adoption of New Practices by Rural Landholders*. Collingwood, Victoria: CSIRO, pp. 51-67.
- Vernooy, R., and McDougall, C. (2003). Principles for good practice in participatory research: Reflecting on lessons from the field. In: Pound, B., Snapp, S., McDougall, C., and Braun, A. *Managing natural resources for sustainable livelihoods: Uniting science and participation*, pp. 113-141.
- Webb, T., and Cary, J. 2005. Social capital and natural resource management: An application to Landcare. *Rural society*, 15 (2), 119-131.
- Woolcock, M. 1998. Social capital and economic development: toward a theoretical synthesis and policy framework. *Theory and Society* 27: 151-208.



Contact Details

For more information about SCARP,
please go to:
<http://www.climatechangeinaustralia.gov.au/en/impacts-and-adaptation/southern-slopes/>





Contact Details

Dr Peat Leith
Tasmanian Institute of Agriculture
University of Tasmania
Ph. +61 3 62262560
Peat.Leith@utas.edu.au