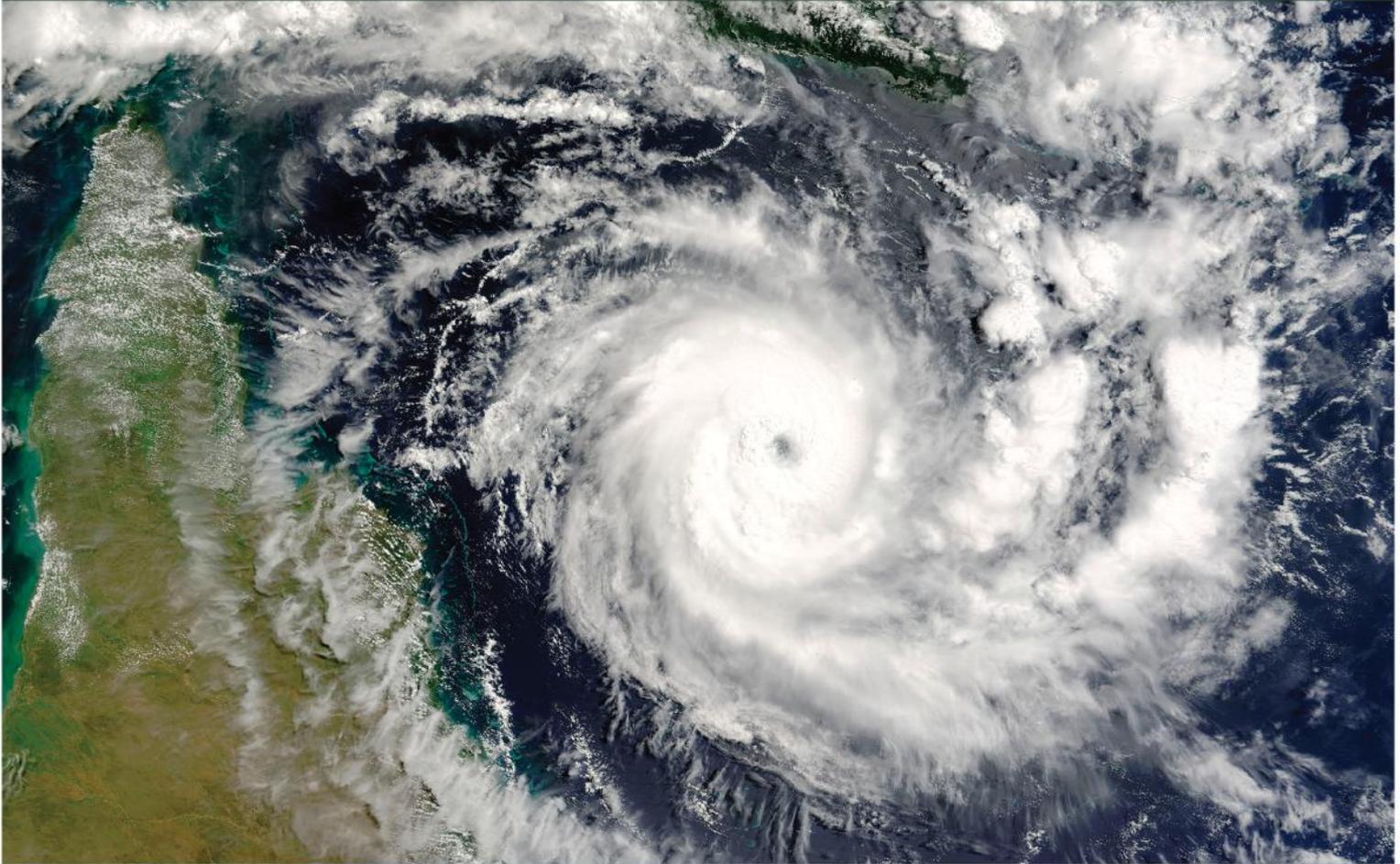




WET TROPICS
NRM CLUSTER

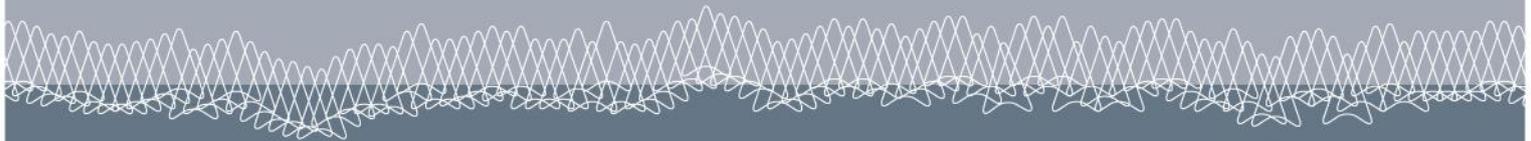


IMPACTS & ADAPTATION
I N F O R M A T I O N
FOR AUSTRALIA'S NRM REGIONS



Adaptation Pathways and Opportunities for the Wet Tropics NRM Cluster region

Volume 2. Infrastructure, Industry, Indigenous peoples, Social
adaptation, Emerging planning frameworks, Evolving
methodologies and Climate adaptation planning in practice.



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7. Social adaptation: minimising impacts through enhancing adaptive capacity

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IN A NUTSHELL

- The actual impacts of climate change on communities will be strongly influenced by the capacity of individuals and industry sectors to detect and respond to the associated challenges. This capacity is currently relatively low in some primary industry sectors.
- Adaptive capacity is related to i) risk assessment and management; ii) adaptive planning; iii) financial and psychological buffers; & iv) the level of interest and proactive behaviour.
- Strengthening communication, trust and social support networks will build community adaptive capacity.

Precis

Adaptive capacity can be a major influence on what social and economic impacts actually eventuate. This chapter aims to inspire NRM planners within the Wet Tropics Cluster to consider strategies to enhance adaptive capacity across scales: within individual landholders such as cattle graziers and farmers, within agricultural industries and within the NRM organisations themselves. The chapter introduces and defines the concept of adaptive capacity, describes what successful adaptation might look like, refers to case studies within the region, and offers suggestions to enhance adaptive capacity. The key messages associated with each of the topics addressed in this chapter are:

TOPIC	KEY MESSAGES
What does successful adaptation look like for landholders?	132. Adaptive success depends on maximising productivity during any one season and minimising impact on the future ability of the land to produce.
What is adaptive capacity?	133. Adaptive capacity is the ability to respond to challenges through learning, managing risk and impacts, developing new knowledge and devising effective approaches. 134. Enhancing adaptive capacity is not about providing additional resources. 135. Adaptive capacity can be measured through assessing; <ol style="list-style-type: none"> how people assess risks and manage for uncertainty, extent of planning, reorganising, experimenting, financial and psychological buffers, and the level of interest and extent of proactive behaviour.
How can adaptive capacity	136. At all scales, adaptive capacity can be enhanced through better networks, increasing

TOPIC	KEY MESSAGES
be enhanced?	<p>environmental awareness, recognising and responding to feedbacks, developing strategic/business skills, developing an interest in science and technology and fostering a culture of shared learning. In sum: any action would likely lead to adaptive capacity.</p> <p>137. Adaptive capacity can be enhanced by NRM organisations through facilitating workshops, partnerships, communications and monitoring. Topics to share with landholders include identifying potential adaptations, and pressing for ambitious co-funded management actions to be progressed by industry groups</p> <p>138. Education of the next generation of leaders is vital to enhance adaptive capacity of the region. Mentoring, job placement, training in adaptive thinking and scenario development, recognising environmental feedbacks developing strategic/business skills, developing an interest in science and technology and fostering a culture of shared learning are all be important.</p>

Introduction

Managing the climate and its impacts on natural resources is not a new challenge. Ever since the inception of agriculture some 4-10,000 years ago, human civilisations have had to contend with ‘good’ years and ‘bad’ years. In addition to more recent economic, social and environmental demands humans must now also contend with climate change in which rainfall patterns and mean temperatures in particular are likely to be significantly altered and unprecedented in human history (Howden *et al.* 2007). Climate change acts to push natural resource systems and those dependent on them towards their thresholds of tolerance, testing whether they can absorb the impacts and adapt (Marshall *et al.* 2012).

Primary industries and enterprises, which include the sectors of agriculture, forestry, fisheries and tourism, are especially vulnerable to climate change because they are dependent on resources that are highly climate-sensitive (Fleming and Vanclay 2010, Stokes *et al.* 2010, Chapter 5, this report). Resource dependency can make resource-users especially sensitive to changes that occur in the resource as a result of climate change. However, while resource dependency may describe the sensitivity of people to climate change and the likely associated impacts, adaptive capacity can be a major influence on what impacts actually eventuate (Marshall *et al.* 2013b).

Adaptive capacity also becomes important to meet the demands of an ever-increasing human population. Industries and enterprises dependent on climate sensitive resources must enhance their productivity without compromising their capacity to be productive in the future if they, and the communities dependent on them, are to be sustained (Marshall *et al.* 2012). Recognising and enhancing adaptive capacity becomes increasingly important for resource-dependent industries facing significant climate change, and for the communities dependent on them (Kelkar *et al.* 2008). Defining adaptive capacity and exploring ways to enhance adaptive capacity for adaptive success are the main aims of this chapter.

What does successful adaptation look like?

Adaptive success depends on maximising productivity during any one season and minimising impact on the future ability of the land to produce.

Success not only depends on maximising productivity during any one season, but also on minimising impact on the future ability of the land to produce (McKeon *et al.* 1990, Anderies *et al.* 2002). Of particular concern is that degradation processes within the region are especially accelerated during drought periods, especially on the grazing lands (Briske *et al.* 2010). In drought situations, which are becoming more ‘normal’,

cattle producers for example need to know when to alter stocking rates, when to supplement feeding, when to agist (move livestock to other properties), when to burn and when to alter water supplies if they are to be successful (Hansen 2002, Marshall *et al.* 2011). If stocking rates are too high at the onset of drought, for example, soil sustainability will be diminished and the productivity of future years will be impacted. Yet, different strategies are used by different people to different effect. Successful people and successful organisations are those that do not necessarily subscribe to what everybody else is doing, but are able to listen to feedbacks (environmental, economic, social), and experiment, learn, plan, reorganise, refine, monitor and reflect.

The capacity of farmers, fishers, foresters and graziers to individually undergo climate adaptation and succeed may be vital to the success of their respective industries and regions: in most situations a critical mass of individuals will need to adapt for regional or industry-wide adaptation to occur. Yet, not all individuals or organisations will have the same capacity to adapt; some are likely to face considerable barriers that make embarking on their own too challenging, consequently reducing the chances for regional and/or industry adaptation success (Chapter 5, this report). Primary producers that can anticipate or effectively react to climate change events including climate extremes are more likely to adapt to new climate conditions and be successful (Reed *et al.* 2007). Some people, some organisations are likely to do better than others (Adger 1999, Adger *et al.* 2009). In fact, a recent study of cattle producers across Northern Australia suggested that only 15% of the industry were well positioned to meet the challenges of the future. An aim of this chapter is to inspire NRM planners within the Wet Tropics Cluster to consider strategies specifically to enhance adaptive capacity across scales within the region.

What is adaptive capacity?

Adaptive capacity is the ability to respond to challenges through learning, managing risk and impacts, developing new knowledge and devising effective approaches

Adaptive capacity is the ability to convert resources (natural, physical, financial, human, social) into useful adaptation responses (Brooks and Adger 2004, Smit and Wandel 2006). This might translate, using commercial fishers in the Great Barrier Reef as an example, as the ability of fishers to recognise that they need to reorganise themselves as they are no longer able to continue fishing in the places that they know well. Fishers that plan and experiment with new ways of running their fishing business such as investing in alternative fishing gear, acquiring new skills through learning or forming a cooperative and increase profit yields to compensate for travel further afield are more likely to be successful in the future than fishers whom have always been able to remain viable in the past and assume that they can continue on as always despite conditions becoming untenable (Marshall and Marshall 2007).

Adaptive capacity describes the ability to respond to challenges through learning, managing risk and impacts, developing new knowledge and devising effective approaches. A key ingredient is the flexibility to experiment and adopt novel solutions (Olsson and Folke 2001, Olsson *et al.* 2004a). In ecosystems, adaptive capacity is related to genetic diversity, biological diversity, and heterogeneity within landscapes (Carpenter and Gunderson 2001). In social systems, adaptive capacity can be a conscious or inadvertent characteristic, enhanced by the existence of institutions and networks that learn and store knowledge and experience, and create flexibility in problem solving without compromising the ability to cope and adapt to future change (Armitage 2005).

Enhancing adaptive capacity is not about providing additional resources

Adaptive capacity is not just about the possession of resources. Given equal resources, not all individuals, communities or NRM groups will be equally able to convert resources into successful adaptation strategies. The presence of resources; be they natural, physical, financial, human, or social, does not guarantee that adaptation will succeed. Resources will certainly be important in climate adaptation processes; given all other aspects are similar, a person with more resources

is better able to experiment with their options for the future, but the *capacity* to cope and adapt to change and its translation into a tangible strategy, can occur irrespective of the resources available. Readers familiar with capacity investment in adaptation in developing communities will know that financial aid does not always assist with adaptation, and can indeed result in cases of maladaptation.

Adaptive capacity can be measured through assessing; i) how people assess risks and manage for uncertainty, ii) extent of planning, reorganising, experimenting, iii) financial and psychological buffers, and iv) the level of interest and proactive behaviour.

The capacity of individuals to adapt to a range of change events has been assessed using a variety of approaches. For example, Brown *et al.* (2010) use self-assessments, while Frank *et al.* (2011) refer to socio-cognitive frameworks. Grothmann and Patt (2005) apply the Model of Private Proactive Adaptation to Climate Change. In this chapter, we offer an established framework based on longitudinal data sets for operationalising adaptive capacity that was initially developed within the Great Barrier Reef region and that may be useful to NRM planners in the Wet Tropics Cluster. Here, adaptive capacity is regarded to be determined in large part by the characteristics and circumstances of resource users and by their capacity to take advantage of other opportunities; these 'preconditions' are summarised into four dimensions including: (i) how risk and uncertainty are perceived and managed, (ii) the development of skills for planning, learning, reorganising and experimenting, (iii) the degree of financial and psychological flexibility, and (iv) the level of interest in and willingness to proactively undertake change (Marshall and Marshall 2007).

These dimensions were developed with commercial fishers in Queensland and have been tested within a range of communities, resource-dependent industries and nations (Cinner *et al.* 2009, Marshall *et al.* 2010c, Marshall 2011, Sutton and Tobin 2011). Commercial fishers were originally asked to respond to 75 statements about various and generic change events and indicate how strongly they agreed or disagreed with each statement. Responses clustered into the four

dimensions described above. Fishers and cattle producers across northern Australia are currently being monitored through time. We describe the four dimensions of adaptive capacity here:

1. **The perception of risk and managing for uncertainty:** How individuals and organisations perceive the risks associated with change and manages for uncertainty is key in determining their ability to cope and adapt. Some will find ways to plan that are consistent with the range of likely futures and possible desired outcomes. This necessarily involves a degree of uncertainty, but need not be a barrier to planning (Adapt NRM 2014). How risk is managed reflects individual and cultural differences in experiences, knowledge, beliefs, values, attitudes and judgements as well as differences in abilities to plan and execute plans (Ritchie *et al.* 2004).
2. **The ability to plan, learn and reorganise:** This component reflects the capacity to anticipate the future. The capacity to plan, learn and reorganise in the face of change is dependent on novelty, creativity, experimentation, learning and planning (Harris *et al.* 1998, Colding *et al.* 2004, Olsson *et al.* 2004b). Without it, any response to climate changes will be reactive and there will be less opportunity for input from others (Marshall *et al.* 2010b, Marshall *et al.* 2010d).
3. **The ability to cope with change:** In social systems, the ability to cope is a measure of the proximity to emotional and financial thresholds. All change is expensive and people that have a financial buffer or access to credit are better able to absorb the costs of change. Examples of emotional or psychological barrier to adaptive capacity include health, divorce, death in the family or trauma. A serious emotional issue can significantly undermine the best laid intentions. NRM planners may already know that suicide is the main killer of men living in rural Australia, and recent research has observed that more suicides occur during drought periods. This, together with knowledge that domestic violence is the biggest killer of women in rural Australia, indicates the extreme emotional conditions under which rural people can live and work (Berry *et al.*

2011a,b). Regardless of how adaptive people are on all other dimensions, this dimension can significantly outweigh all others in determining adaptive success. NRM organisations may wish to consider the level of community support networks that exist within their region.

4. **The level of interest in change:** This dimension of adaptive capacity corresponds with the degree to which the system is capable of 'self-organisation'. Individuals that have a higher level of proactive interest in adapting to the requirements of the future usually have a higher related financial, social and/or emotional flexibility. An interest in adapting is necessary for individuals to identify the consequences, impacts and possible responses ("adaptation options") to climate change (Howden *et al.* 2007, Bohensky *et al.* 2010, Marshall 2010).

Whilst measures of self-assessments can be useful, they can also be severely limiting. People unaware of their own personal limitations and limitations imposed upon them by the environment may feel completely competent to assess their own level of adaptive capacity and identify their own needs. In one example based in America and Sweden, 80% of car drivers rated themselves above average on a number of characteristics related to their driving skills (McCormic *et al.* 1986) suggesting that people can be unaware of the reality of their own capacity. Similarly, in a recent study in the Burdekin region, graziers' were found to positively perceive their own capacity to cope and adapt to climate variability. This perception may, in fact, make them vulnerable to more extreme and frequent climate events in the future. Climate change is likely to seriously challenge the skills, experience and judgement of resource-users, and unless they use novelty, creativity, experimentation, learning and planning in approaching this change, they are unlikely to cope and adapt (Hiedanpaa 2005).

How can adaptive capacity be enhanced?

Case-study research suggests that there are several characteristics of people that are associated (correlated) with higher adaptive capacity. These

include: possessing creativity and innovation for identifying solutions or adaptation options; testing and experimenting with options; recognising and responding to effective feedback mechanisms; employing adaptive management approaches; possessing flexibility; being able to reorganise given novel information; managing risk and, having necessary resources at hand. We describe some of these below.

At all scales, adaptive capacity can be enhanced through better networks, increasing environmental awareness, recognising and responding to feedbacks, developing strategic/business skills, developing an interest in science and technology and fostering a culture of shared learning. In sum: any action would likely lead to adaptive capacity.

The adaptive capacity of societies is partly determined by their ability to act collectively (Adger 1999, Osbahr *et al.* 2008). This ability is often embedded within the concept of social capital. Social capital and community empowerment reflect the level of social interaction, social networks and social relations that exist within a community (Putnam 1993, Worthington and Dollery 2000, Adger *et al.* 2002). They help to explain the ease with which change events are accepted and incorporated into people's lives. Those with stronger, more informed and more effective networks are regarded as being more resilient to generic change events than those with weaker ties (Mitchell 1974, Flora and Flora 1993, Putnam 1993). Communities with increased stocks of social capital typically have reciprocal networks of community interactions and increased social trust that are directed towards mutual benefit. Social capital includes knowledge and mutual obligation, and is developed through social learning. The level of social capital within a community provides some indication of the capacity for a community to cope with change and adapt (Marshall 2011).

Social networks could be used within each of the NRM regions to develop social capital around climate adaptation. To derive most benefit from the capital developed within a community, it will be important to: (1) build landholder adaptive capacity; (2) facilitate the activity of forums for building relationships between stakeholders and demonstrating the value of a

cooperative ethic; and (3) educating stakeholders about climate change adaptation and create an awareness of the benefits of engaging other stakeholders (Brunckhorst 2002, McAllister *et al.* 2005).

Adaptive capacity can be enhanced through increasing environmental awareness

Climate change awareness is an important factor influencing the capacity of primary producers to cope with and adapt to climate changes (Marshall *et al.* 2013a). Climate change awareness is the extent that primary producers accept, understand, relate to, and prioritise climate change as a driver of change within their system. Climate change awareness might also be managed to support adaptation processes. Marshall *et al.* (2013a) sought to understand the influence of a primary producer's climate change awareness on their capacity to adapt to climate change risks. They suspected that primary producers could be limited in their capacity to adapt from the outset if they failed to see the need to adopt novel climate adaptation strategies. Their results indicated that primary producers in Queensland that have higher climate change awareness also have a higher capacity to adapt on at least three dimensions of adaptive capacity.

Education of the next generation of leaders is vital to enhance adaptive capacity of the region. Mentoring, job placement, training in adaptive thinking and scenario development, recognising environmental feedbacks developing strategic/business skills, developing an interest in science and technology and fostering a culture of shared learning are all be important.

Environmentally educated and aware resource-users tend to be more flexible and supportive of resource-protection strategies (Marshall *et al.* 2007). They can develop identities such as 'land steward' or 'marine steward', which makes them less dependent on traditional resource management practices, and more willing to adapt new practices that enhances not only their own resilience to change, but that of the environment. Marshall *et al.* (2013) asked marine-based tourism operators for their level of interest in learning more about marine sustainability (Marshall *et al.*

2010a). They found that adaptive capacity can be enhanced through developing environmental awareness.

Adaptive capacity can be enhanced through recognising and responding to feedbacks

Like active adaptive management increases the adaptive capacity of a system, recognising and responding to environmental and social feedbacks through experimenting with different strategies, learning from strong feedback loops and incorporating new information into the design of new strategies will contribute to greater potential for adaptive success (Gunderson *et al.* 1995, Folke *et al.* 2002a, b, Olsson *et al.* 2005).

Educating landholders within the NRM regions of the Wet Tropics Cluster to recognise land degradation and to respond appropriately is a vital influence on enhancing their adaptive capacity.

Adaptive capacity can be enhanced through learning to manage for uncertainty.

Uncertainty can be managed and accommodated for in planning and should not be seen as a barrier to action, as inaction has been shown to be more detrimental than assessing risk and making decisions based on that risk calculation. Below we outline some different types of uncertainty and where they come into the planning process, as well as basic ways in which they can effectively be tackled in planning (These types of uncertainty are listed in the Adapt NRM 2014 brochure).

1. Natural variability – “ the ecological conditions, and the spatial and temporal variation in these conditions, that are relatively unaffected by people, within a period of time and geographical area”
2. Observation/Data error - Observation error is the failure to properly observe, measure or estimate processes and quantities. It results both from imperfect methods of observation (or simply not measuring key factors) and from sampling error, i.e. the statistical differences between a sample of individuals and the population that the sample is meant to represent

3. System uncertainty - our system understanding is limited by the understanding of all the links – thus, even with complex models, any projections (qualitative or quantitative) will have uncertainty
4. Inadequate communication - Inadequate communication relates to the difficulty of effectively conveying information between scientists, managers and stakeholders. When communication is ineffective, information is lost, which can manifest itself as uncertainty
5. Unclear objectives or lack of goal setting - Unclear management objectives are ones that are expressed vaguely, not fully conceived, scaled improperly, or difficult to quantify
6. Outcome uncertainty – when actions not implemented properly; Outcome uncertainty can be referred to as “implementation error” or “implementation uncertainty” because it is commonly associated with differences between a management goal and the implementation of the management plan. A typical example in fisheries is when actual catches of a fished stock are not equal to the model-derived allowable catch limit. Outcome uncertainty can be especially critical to NRM because it undermines the ability to determine whether management actions and recommendations are truly working—that is, if models and other tools recommend policy X, but the resource users instead implement practice Y, then the research and management communities cannot conclude that policy X was either effective or ineffective, because it has not actually been implemented yet.

Adaptive capacity can be enhanced through better planning.

We highly advise that NRM planners be aware of the “Adapt NRM” guide associated with this project. This guide provides a ‘checklist’ for NRM planning frameworks. The framework is built around five common stages or planning components; (i) assessment, (ii) strategic planning, (iii) implementation planning and action, (iv) monitoring, and (v) reflection. These are built into an iterative process – necessary because the most effective responses to climate change

problems may not be known and outcomes may only be achieved after trying a range of options, assessing the responses and making appropriate changes. From this a series of self-reflective questions are posed to assist NRM planners to discuss the ways in which planning to adapt to climate change may need to be done differently compared to what might have been done traditionally.

Strategies to enhance adaptive capacity

Adaptive capacity can be enhanced by NRM organisations through facilitating workshops, partnerships, communications and monitoring. Topics to share with landholders include identifying potential adaptations, and pressing for ambitious co-funded management actions to be progressed by industry groups.

All four dimensions of adaptive capacity are important in endowing adaptive success on individuals, organisations and industries. Fortunately, all dimensions can be managed or learned and adaptive capacity be enhanced. There are surprisingly few research studies that describe case studies in which interventions have been successful, so here we present some ideas that NRM planners within the Wet Tropics might want to consider.

1. Practice active adaptive management. Adaptive capacity can be strengthened through practising active adaptive management. Active adaptive management can help to increase adaptive capacity through experimenting with different strategies, learning from strong feedback loops and incorporating new information into the design of new strategies
2. Hold NRM workshops (or provide learning opportunities) for landholders. Risk, uncertainty, strategy, planning, experimenting, learning and financial buffers are all critical factors for adaptation. These factors can all be learned. Providing opportunities for landholders to explore these factors within their own working lives may prove to be a useful strategy. The study of these

factors with colleagues may also stimulate an interest in adaptation and pro-active behaviour. In these ways, NRM workshops addressing adaptive capacity may address all dimensions simultaneously

3. Partner with community services. Psychological or emotional buffers relating to health issues or financial crises need to be explicitly addressed. Developing partnerships with counselling services for example for advice and support may assist to develop adaptive capacity on the third dimension
4. Communicate about climate change. Extension services, communication outputs, community discussions on local radio are some ideas that NRM planners may consider to develop an interest in change, and encourage proactive behaviour
5. Assess adaptive capacity within your region. Design and administer very simple surveys and collect data to inform you of the current status of adaptive capacity within your region. By monitoring the adaptive capacity of your landholders, stakeholder organisations, and your own organisation, you may be able to evaluate if and when you can devote fewer resources specifically to adaptation planning. Partnering with scientists can be a great way to monitor adaptive capacity, particularly to get started and to reduce the work load
6. Involve people in the strategy to enhance adaptive capacity. Many research studies have shown that meaningful involvement in the decision-making process is essential to foster feelings of satisfaction, understanding, trust and confidence in the future. These feelings are necessary for a successful transition to adapting to change – and in particular policy change (Becker and Carper 1956). Kallstrom and Ljung (Kallstrom and Ljung 2005) convincingly argue that people must be satisfied with their situation in terms of control over decisions in order for social sustainability and environmental goals to be achieved. They believe that by participating in decisions regarding the future, and by taking part in the public debate, day-to-day life becomes more meaningful and social identities are strengthened around the resource itself. In contrast, resource users that do not have the opportunity to be meaningfully involved in the process tend to feel

that policy changes, at least, are ‘unfair’, ‘unnecessary’, ‘wrong’, ‘immoral’ and/or ‘illegal’, where some people do well out of them, and others do poorly. If people feel confident about their future and the future of the resource, then they are more likely to positively assess the risks associated with change and their ability to cope: both of which are important in maintaining adaptive capacity.

Summary and conclusions

Humans can influence the impacts that climate change might have through adaptation: through building the capacity of people to adjust to plausible future climate scenarios. Whilst human communities may be sensitive to changes in the climate that affect the resources upon which they depend, their vulnerability may be moderated by the extent of their adaptive capacity. The specific challenge faced by people living in the Wet Tropics Cluster region will be to ensure community security and build the productivity and profitability of their resource-based industries and enterprises where possible without degrading the natural resource services on which they depend. People, industries and organisations that tend to display higher levels of adaptive capacity and success often are better able to manage the risks associated with change, can plan, experiment, reorganise, and learn, are more likely to have financial and psychological buffers and are more proactive. We know this from a range of case-studies, many of which occur locally.

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