



Limits to climate change adaptation: Key findings

Purpose of the project

Adaptation is essential to address the unavoidable impacts of climate change. However, the capacity of natural and human systems to adapt is limited by the severity of the climatic perturbation, by the nature of the social and ecological systems at risk, or by some combination of the two. This project brings together six regional case studies of the limits to adaptation, to explore the underlying causes and potential to transcend these limits.

Assessing limits to adaptation supports understanding of:

1. which responses to climate change are practicable and legitimate, and the time scales over which adaptation may be considered to be effective;
2. how people may respond to the damage to, or the loss of, things that are important to them, for which there may, in some cases, be substitutes or ameliorating policy measures;
3. which adaptation strategies should be prioritised, their likely outcomes, and the communities of interest that will be served by them.

Projects were conducted by multidisciplinary research teams. The main methods of data collection were desktop reviews of existing information about present and future climate and other drivers of risk and management responses in the case study areas; and interviews and workshops with key informants and stakeholders.

The four types of limit:

Limits to adaptation can usefully be classified into four types, although there are often complex and dynamic overlaps between the types:

Ecological limits when ecosystems and species are unable to adapt and experience a decline in function or diversity - for example under high rates of warming it seems little can be done to avoid repeated and severe coral bleaching, with subsequent impacts on species diversity and function;

Economic limits, where the financial costs of adaptation exceed the costs of direct impacts averted - for example, the costs of protecting small settlements from sea-level rise may be higher than the costs of the impacts;

Technological limits, where technology cannot avoid impacts - for example in warmer climates snow making may be unable to sustain snow cover for the purposes of skiing;

Social limits, where people judge that an adaptation has failed because it fails to protect things that they value - for example no amount of adaptation can avoid damages to cultures that will be incurred when coastal lands are submerged by sea-level rise.

The six case studies

The six case studies were selected purposefully. Each is a well-studied place or system where adaptation seems likely to reach its limits. The studies are:

The **Great Barrier Reef**, where there may be limits to adaptation aiming to sustain the health of the reef and the businesses, communities and cultures that depend on it (Evans et al., 2011).

Alpine areas, where there may be limits to adaptation aiming to sustain the plants and animals, and businesses, settlements and cultures that depend on winter snow (Morrison et al., 2011).

Wetlands, where there may be limits to adaptation aiming to sustain the health of ecosystems, and the businesses, communities and cultures that depend on them - studies on the **Coorong and Lower Lakes** (Gross et al., 2011) and on the **Macquarie Marshes** (Jenkins et al., 2011).

The Torres Strait islands, where there may be limits to adaptations aiming to sustain human settlements and cultural values (McNamara et al., 2011).

Small inland communities in the Murray-Darling Basin, where drying and droughts, coupled with changes in water management regimes pose risks to the viability of small communities (Kiem et al., 2012).



Five Key Findings:

1. Adaptation goals can be met through portfolios of adaptation strategies

All projects identify portfolios of strategies to achieve the goals of adaptation. In the Great Barrier Reef, for example, multiple strategies are identified that can help sustain tourism enterprises, including a range of strategies that are not obviously related to climate change, such as business planning, marketing, currency devaluation, and industry support packages; as well as diverse strategies designed to sustain the reef ecosystem. In Alpine regions, technological solutions include snow making and super grooming, ecological solutions include controlling/limiting invasive species and rehabilitating disturbed sites, and economic solutions include diversifying recreational activities

Because any single strategy may fail, achieving adaptation goals is likely to require portfolios of multiple strategies.

These multiple strategies must be well integrated to ensure they are not maladaptive.

2. Barriers can be limits

Most projects were unable to distinguish clearly between a barrier and a limit to adaptation. Barriers are “obstacles that can be overcome with concerted effort”.¹ Yet there is a strong sense in many projects that despite the possibility of things that *could* be done to support adaptation – such as funding infrastructure to sustain settlements in the Torres Strait, or decisions to increase environmental flows to sustain wetlands – there was no encouraging precedent for this to happen in the required time and at the required scale.

Thus, the economic barrier to the strategy of coastal protection in the Torres Strait seems more like a limit to that strategy, and the institutional barriers to allocating sufficient water to wetlands also seems more like a limit to that strategy. To say that a barrier is institutional – and therefore socially created – is not to say that it can be overcome. There are many examples of undesirable outcomes of institutions that many societies have consistently failed to avoid (such as gender inequity, poverty, and war).

In many cases **the limits to adaptation strategies and goals arise from an inability of institutions to adjust.**

3. Big processes limit local responses

In many cases **the limits to adaptation strategies and goals arise from processes that are distant in space and time.**

>> *Processes that are distant in space:*

In the wetlands examples, upstream uses of water cause reductions in the flows necessary to sustain the ecological values of the wetlands and the social values they support. Local decision makers seeking to find ways to adapt have little power over the institutions that create demand and influence the supply of water in upstream areas. This is true too for inland towns and small farming communities, with farmers reporting frustration at their inability to influence the design of water markets, and the effects of water markets on small communities.

The processes that limit adaptation are often global in scope. The limits to adaptation in tourism enterprises in the Great Barrier Reef and alpine areas, and in commercial fisheries in the Great Barrier Reef, arise from increased competition in global markets and the appreciation of the Australian dollar, which puts pressure on costs and constrains investments in adaptation actions.

>> *Processes that are distant in time:*

There are processes that operate over long time scales. Many of the institutions that create limits to adaptation are path dependent: for example the institutions of water governance have to manage the expectations of supply that tens of thousands of users have come to expect over past decades of water resource management. In the Torres Strait Islands too, history matters. Many Indigenous people in these and other communities have strong negative associations with the idea of government involvement in resettlement, as in the past this has been the cause of enormous harm to individuals, families, communities and cultures: this makes them reluctant to consider resettlement as an adaptation option.

‘Adaptation entails trade-offs between values; limits to adaptation arise through trade-offs in the way resources are allocated and places are managed.’



It also leads to mistrust of governments – a perception not helped by repeated studies of the risks climate change poses to their islands, with a repeated failure to invest in identified solutions.

4. Limits arise through trade-offs

The resources that are required for adaptation are finite. In a drying climate, there will be increased competition for water between the environment and users such as ski fields, irrigators and the public supply. Where water is scarce, decisions about its allocation imply trade-offs among demands.

In creating markets as distributional mechanisms, the *economic* value of water is given preference - water is allocated to those who can afford to pay most for it. Other values of water – such as its *ecological* and *cultural* values – are traded off against its market value. Adaptation goals that rely on water are therefore also traded off: users that can pay for water can adapt, users that cannot pay, or cannot otherwise influence the allocation of water, face limits to adaptation.

Other examples of trade-off in adaptation, and their selective effect on limits to adaptation are:

- In the Australian alps, ski resorts may want to adapt by moving locations to more elevated areas, but this would impinge on conservation areas. There is therefore a trade-off between the adaptation goal of conserving alpine ecosystems and ski-tourism in the alps.
- In the Great Barrier Reef, increasing the resilience of the reef requires reducing land-based sources of sediment and pollution, much of which comes from agricultural practices. There is arguably a trade-off between the ability of farming systems to adapt and the ability of reef ecosystems to adapt.

Adaptation entails trade-offs between values; limits to adaptation arise through trade-offs in the way resources are allocated and places are managed.

'Choices about what to protect and what to let go should be made explicit, and the subject of deliberation by stakeholders.'

5. Adaptation goals and trade-offs can be made explicit

When adaptation reaches its limits things that are valued will be lost. When those limits arise because of trade-offs in which the interests of some groups prevail over others, then adaptation becomes a matter of social justice. To take some examples from the case studies:

- small inland towns and wetlands, together with their environmental and cultural values, may lose while high agricultural producers adapt;
- reef ecosystems and the tourism and fisheries industries that depend on them could lose, while farmers in the coastal hinterland adapt; and
- winter tourism operators in the alps lose, while aquatic systems are given a greater chance to adapt.

The case studies show that most of the trade-offs that create limits to adaptation arise through institutional behaviors.

For example:

- water markets are shaping the trade-offs between economic and environmental and cultural values;
- a commitment to farming implies losses to the Great Barrier Reef; and
- an unwillingness to invest public money in Indigenous affairs seems likely to imperil Indigenous settlements in the Torres Strait.

At present we have not had to make hard decisions between these things – all of which are important to many people both nearby (for example in local communities in the case study areas) and distant (for example people from across the country and around the world value Indigenous culture, the Great Barrier Reef, and Ramsar wetlands). Yet, given current emissions trajectories, and institutional behaviours, it seems likely that choices between these things that are valued will be necessary.

Theories of justice advise that these ***choices about what to protect and what to let go should be made explicit, and the subject of deliberation by stakeholders.*** In this way adaptation can arise through active (and admittedly sometimes hard) choices rather than *de facto* institutional processes.



Three implications for decision makers

1 *There is utility in assessing the limits to adaptation*

These projects suggest that there is utility in assessing the limits to adaptation actions. Most conventional guides to assessing vulnerability and adaptation to climate change fail to take the next step of thinking through what adaptation may not be able to achieve, what the drivers are of these limits, and what their implications are for decision making.

2 *Portfolios of strategies can provide the diversity and flexibility needed to overcome barriers and limits to adaptation*

The projects each identify goals of adaptation, and strategies to achieve them. They suggest that goals can be best met through identification and implementation of diversified portfolios of strategies, which provide the necessary flexibility to overcome barriers and limits at different thresholds of climate change.

3 *Identifying and deliberating on potential value trade-offs is key to a fair response to climate change*

Many of the limits to adaptation goals arise through exclusive allocations of resources and exclusive use of spaces and places. For example, demands for water are increasing while runoff seems likely to decrease and/or to become more variable under climate change; under these circumstances not all demands for water can be satisfied.

Identifying and discussing the trade-offs associated with adaptation decisions in advance can help focus attention on potential winners and losers from climate change adaptation, reveal public preferences with respect to acceptable and unacceptable losses from climate change, and stimulate thinking about changes that can be made now to avoid having to make these trade-offs.

Failure to identify these trade-offs and limits will mask the power of existing institutions and interests in adaptation processes, marginalise less powerful actors, and may lead to climate change impacts that the public finds morally unacceptable.

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References and further reading

This brochure summarises key findings from the six Limits to Climate Change Adaptation projects. Complete reports are available at www.nccarf.edu.au



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