



Indigenous climate change adaptation in the Kimberley region of North-western Australia

Final Report

Sonia Leonard, John Mackenzie, Frances Kofod, Meg Parsons, Marcia Langton, Peter Russ, Lyndon Ormond-Parker, Kristen Smith and Max Smith

Indigenous climate change adaptation in the Kimberley region of North-western Australia

Learning from the past, adapting in the future: Identifying pathways to successful adaptation in Indigenous communities

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Cover image Miriwoong children playing in waterhole near Bubble Bubble Community, Keep River National Park, NT © Sonia Leonard.

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LIST OF SHORTENED FORMS

| AIATSIS | Australian Institute of Aboriginal and Torres Strait Islander Studies |
|----------------|--|
| CBA | community-based adaptation |
| BOM | Bureau of Meteorology |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DAF | Department of Agriculture and Food (Western Australia) |
| DFES | Department of Fire and Emergency Services |
| FESA | Fire and Emergency Services Authority of WA (now DFES) |
| FPIC | free, prior and informed consent |
| IAPP | International Association for Public Participation |
| ID | integrated development |
| ILUA | Indigenous Land Use Agreement (under the Native Title Act 1994) |
| KDC | Kimberley Development Commission |
| KLC | Kimberley Land Council |
| KLRC | Kimberley Language Resource Centre |
| KTLA | Karajarri Traditional Lands Association |
| MDWg | Mirima Dawang Woorlab-gerring Language and Culture Centre |
| MG | Miriwoong and Gajirrabeng; also, Miriuwung and Gajerrong |
| MG Corporation | Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation; also Miriwoong Gajirrabeng Corporation, and Miriuwung Gajerrong Corporation |
| MLDRIN | Murray Lower Darling Rivers Indigenous Nations |
| NCCARF | National Climate Change Adaptation Research Facility |
| NCU | National Copyright Unit |
| NEMP | National Emergency Management Project |
| NRM | natural resource management |
| NT | Northern Territory |
| OFA | Ord Final Agreement |
| PBC | prescribed body corporate |
| PBCs | prescribed bodies corporate |
| RM | risk management |
| RNTBC | registered native title body corporate |
| SEMC | State Emergency Management Committee |
| TEK | traditional ecological knowledge |
| UN | United Nations |
| UNESCO | United Nations Education, Scientific and Cultural Organization |
| UoM | The University of Melbourne |
| WA | Western Australia; Western Australian |
| WAC | Warmun Art Centre |
| | Indigenous climate change adaptation in the Kimberley region vii |

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ABSTRACT

Aboriginal communities in north-western Australia are likely to be disproportionately affected by climate change. Direct environmental impacts from predicted outcomes will exacerbate present difficulties in many Indigenous communities beset by social and economic disadvantages.

In 2012 Indigenous people held land interests in about 80 per cent of northern Australia. Their land management responsibilities for this substantial portion of the Australian land mass include normal obligations, as well as distinct Indigenous forms of stewardship over areas of special Aboriginal and Torres Strait Islander freehold and native title. The effective management of this land and its ecologies requires adaptation planning and strategies for capacity building involving Indigenous people and their traditional ecological knowledge.

Insufficient research exists into potential climate change impacts on Aboriginal and Torres Strait Islander communities at a local level, and even less on how Indigenous people perceive climate change and their capacity to plan responses to these changes. Further, there is significant variation across the Kimberley region among the social groups who participated in this research project and how they understand climatedriven ecological changes and the extent to which their livelihoods will be affected.

This report presents the findings of an investigation into the capacity of Indigenous people in north-western Australia to respond to climate risks and develop adaptation pathways, as well as their understanding and perceptions of climate and climate risks. Case studies were conducted in three targeted communities – the Kununurra community in the Keep River district (Western Australia/Northern Territory), the Warmun community (Western Australia) and the Bidyadanga community (Western Australia). This report provides an overview of the role of Indigenous people in developing adaptation strategies and the potential for these communities to build partnerships in these endeavours.

Several capabilities are critical in developing adaptation planning frameworks in Aboriginal and Torres Strait Islander communities. In particular, incorporating climate change research findings and education into community-level and regional planning initiatives is essential to improve local understanding of concepts of predictability and the ability to project future change.

The potential for partnerships and collaborations with institutions that can contribute to capacity building is critical; such partnerships can transfer knowledge and enrich local understanding of climate change risks and assist Aboriginal people to critically evaluate scientific predictions in their own languages and cultural terms and test adaptive capacity at a community level. Capacity building provides opportunities for equitable roles in climate change planning and assists in developing adaptation tools to contribute to the sustainability of Aboriginal communities over future generations.

Little knowledge exists on how Australia's Aboriginal communities have responded to climate variability and change historically and currently, nor on the lessons that can be learned from those responses. This project seeks to address this gap in understanding, at least in part.

EXECUTIVE SUMMARY

This report, *Indigenous Climate Change Adaptation in the Kimberley Region of Northwestern Australia: Final Report: Learning from the past, adapting in the future: Identifying pathways to successful adaptation in Indigenous communities*, presents the main findings of a National Climate Change Adaptation Research Facility (NCCARF) funded research project conducted in the Kimberley region of north-western Australia in three targeted case-study sites – Kununurra community in the Keep River district (Western Australia/Northern Territory), Warmun community (Western Australia) and Bidyadanga community (Western Australia).

The objectives of this study were twofold – to identify and evaluate strategies to enhance the capacity of Indigenous communities to adapt to extreme weather events and climate change, and to understand how Indigenous individuals, households, communities and institutions understand and respond to climate variability and change. The project also aimed to investigate the effectiveness of such strategies to identify potential adaptation pathways (using climate change scenarios) that may be available to those communities.

Specifically, the report presents findings on how Aboriginal worldviews and traditional ecological knowledge (TEK) can inform community-based adaptation (CBA) pathways to assist these communities address their vulnerabilities and specific risks in the context of the pending impacts of climate change in the Kimberley region of north-western Australia.

The study used a mixed-method multidisciplinary approach to enable the full participation of local Aboriginal people in the design and conduct of the project and in the refinement of research questions during workshops at the case-study sites. This report presents the research findings and makes recommendations for future research, CBA plans and for a participatory consultation approach that engages local Aboriginal institutions and communities in planning.

The impacts of climate change in the Kimberley are poorly understood due to a lack of baseline data and the remoteness of the region. Climate models suggest that the Kimberley will become warmer, with more hot days and fewer cold nights, with a predicted temperature increase of 2 °C to 2.5 °C over the next 60 years. Heat waves and the number of days above 35 °C will also increase, with inter-regional variation. Extreme events, such as more intense cyclones and associated flooding, could increase in the monsoonal region. As a result the spread of both insect-borne diseases, such as dengue fever, and water-borne diseases is likely to increase.

Aboriginal people in this region are likely to be disproportionately affected by climate change, given the potential for direct environmental impacts, such as increased extreme cyclonic events, which would exacerbate the present difficulties in Indigenous communities beset by social and economic disadvantages.

Any targeted response to climate change in this region needs to involve Indigenous people in developing pathways to adaptation. Of key importance to this project is the question of how Indigenous communities perceive and respond to climate risks. An understanding of climate risks, strategies to adapt to those risks and awareness of the need to adapt are all significant determinants of adaptive capacity. With our insights into the worldviews of Miriwoong, Gija and Karajarri peoples, and how their knowledge systems determine the relationships with the environment in which they live, we can consider how this influences their perceptions of climate risk. Accordingly, we examine

the capacity of Aboriginal community members, as individuals and members of wider formal and informal institutions, to adapt to climate events and climate change, specifically to more intense cyclones and flooding, and how this capacity can be enhanced in each location. This in turn offers important insights into the entry points for CBA.

Incorporating climate change research findings and education into community-level and regional planning initiatives to ensure local understanding of concepts of predictability and the ability to project future change are critical capabilities for the development of adaptation planning frameworks in Aboriginal and Torres Strait Islander communities.

To devise community adaptation options and priorities, we sought Aboriginal perceptions of climate change in the two of the three case-study areas and compiled rich data on local traditional knowledge of weather and climate. The integration of such traditional knowledge into local and regional planning is necessary for Indigenous peoples to develop, initiate and collaborate with climate change adaptation measures.

Partnerships and collaborations with institutions to provide expert advice and contribute to capacity building is critical; such partnerships can transfer knowledge and enrich local understanding of climate change risks, and importantly, assist Aboriginal people to critically evaluate scientific predictions in their own languages and cultural terms and test adaptive capacity at a community level. Capacity building provides opportunities for equitable roles in climate change planning and assists in developing adaptation tools to contribute to the sustainability of Aboriginal communities over future generations.

This report concludes with a focus on the following priorities to develop Indigenous adaptation planning:

- participatory planning processes that incorporate Indigenous traditions and customs
- the use of linguists, translators and interpreters for effective communication and research that accurately reflects Indigenous values
- the importance of stakeholders, collaborations and partnerships
- the need to address identified research needs and gaps
- the capacity of disaster management agencies.

There is insufficient research into potential climate change impacts on Aboriginal and Torres Strait Islander communities at a local level, and how communities perceive and respond to these changes. It is important to understand the extent to which different social groups comprehend climate-driven ecological changes and the extent to which their livelihoods are, and will be, affected by such changes. This impact will vary according to their economic dependence on local environments. For communities that retain subsistence activities, such as hunting, fishing and traditional food harvesting, their livelihoods and the cultural and social aspects of their way of life are vulnerable to climate-driven environmental changes.

1. INTRODUCTION

Climate change is one of the most significant issues facing humanity in the twenty-first century. The impacts of climate change will affect all sectors and levels of society, but certain groups of people are at greater risk than others (Parry et al. 2007). Climate change is likely to exacerbate current inequalities that exist within and between nation-states and between males and females, and in classes, ethnicities, age groups and places. Indigenous peoples worldwide are likely to face a heavier burden from climate change than many other groups, due to their connection to particular landscapes, the extent to which their livelihoods depend on natural resources, and, in many cases, their occupation of marginal and climate-sensitive environments (Parry et al. 2007).

Researchers and policymakers are increasingly concerned about the impacts of climate change and, by extension, the vulnerability and adaptation pathways for indigenous peoples in the world. Climate change impacts are likely to affect all aspects of indigenous life, with complex implications for the natural, social and cultural domains of indigenous populations and detrimental consequences for health, sustainability of livelihoods, resource availability, access to and use of land areas, community infrastructure and access to government services. These risks and vulnerabilities present challenges and opportunities for researchers. The research community has the opportunity to arm indigenous communities with research to strengthen their capacity to participate in adaptation planning. The challenges for researchers include designing multidisciplinary approaches appropriate to these communities and their contexts, synthesising existing knowledge to form a database for adaptation planning, identifying and addressing important research gaps and discerning commonalities across case studies.

It is widely recognised that although indigenous populations worldwide, including Aboriginal and Torres Strait Islander peoples, are at heightened risk of climate change due to a combination of environmental and socioeconomic vulnerabilities, they are under-represented in the published literature on climate change adaptation.

The Intergovernmental Panel on Climate Change Fourth Assessment report (Adger et al. 2007) noted that the detrimental impacts of climate change will disproportionately affect poor and marginalised populations, including indigenous peoples worldwide. Since this report, more than 50 academic journal papers on the impacts of climate change on indigenous peoples, and their actions to mitigate and adapt to climate change, have been published (2007–12). Despite the increased research in this broad area, the literature clearly demonstrates that our knowledge about the ways in which climate change will affect Indigenous peoples in Australia, and how these Indigenous communities can or will respond, is still limited.

Although the existing body of climate change research on Aboriginal and Torres Strait Islander people focuses on their vulnerability to climate change and the degree to which socioeconomic disadvantage serves to decrease their ability to respond to climate change (Green, Jackson & Morrison 2009; Petheram et al. 2010), limited research has focused on how Australian Aboriginal people can adapt to climate variation and change, and develop ways to harness their knowledge, skills and agency to enhance their adaptive capacity. Little knowledge exists on how Australia's Aboriginal communities have responded to climate variability and change both historically and currently, nor on the lessons that can be learned from those responses. This project seeks to address this gap in understanding, at least in part.

1.1 Developing adaptation strategies based on participatory research and Indigenous knowledge

International research demonstrates how direct experience and knowledge of climate variability and change can inform climate change adaptation undertaken by indigenous groups (Ford et al. 2010; Byg & Salick 2009; Turner & Clifton 2009). This is an emergent area of research internationally and in Australia there has been limited research of this kind (Veland, Howitt & Dominey-Howes 2010). The absence of locallevel empirical studies of Aboriginal and Torres Strait Islander peoples' experiences of both slow- and fast-onset climate events – particularly seasonal flood events, drought, heat waves and tropical cyclones - has been identified by researchers and decisionmakers as a significant knowledge gap and presents a major barrier to the development and implementation of inclusive, efficient and effective adaptation plans and policies (Ellemor 2005; Green, Jackson & Morrison 2009; Prober, O'Connor & Walsh 2011). Moreover, there is limited research on the relationship between exposure to variable climate conditions and adaptive capacity in the Australian context, and how exposure influences perceptions of risk. For instance, no research exists on whether the regular exposure of Aboriginal communities in northern Australia to seasonal flood events increases their capacity to adapt to extreme floods and changing climate conditions.

Over the past decade or so, it has been widely reported in many parts of the world that indigenous peoples are increasingly concerned about the impacts of anthropogenic climate change, including:

- changes in seasonal weather patterns
- increased and/or more intense extreme weather events
- changing distribution and availability of biodiversity
- sea-level rise
- increased frequency and/or depth of coastal inundation events
- increased coastal erosion
- decreased sea ice cover
- decreased snow cover
- increased thawing of permafrost.

Indigenous peoples' observations of changing climate conditions are generally consistent with Western scientific observations (Cruikshank 2001; Huntington et al. 2006; Crate 2008; Turner & Clifton 2009). For example, Inuit and First Nations communities in Canada have recorded declines in their traditional food sources, such as ringed seals, caribou and walrus (Metcalf & Robards 2008; Kapsch, Eicken & Robards 2010). Inuit hunters observe that the weather is becoming less predictable and more variable (Ford et al. 2010; Pearce et al. 2011). Thinner and less extensive ice cover reduces the safety of travel, and hunters are increasingly forced to make difficult (and high-risk) decisions about how to hunt migratory animals (such as walrus and whales) that are highly prized in these communities and available only during particular times of the year (Pearce et al. 2011).

In the Australian context, Green, Billy & Tapim (2010), Petheram et al. (2010) and Leonard et al. (2013) describe Indigenous Australians' observations of changing environmental conditions related to climate change. In the Torres Strait Islands, for example, Green, Billy & Tapim (2010) report that Indigenous people have observed impacts such as changing weather patterns, increased inundation events and decreased rainfall. Similarly, Petheram et al. (2010) report that the Yolgnu people of Arnhem Land in the Northern Territory (NT) – who are members of a group of people who speak more than 20 closely related languages – are witnessing 'strange changes' within their traditional lands. They attribute these changes to climate change, among other impacts (such as those they perceive to be caused by mining and tourism activities). In the Keep River district of north-western Australia, Miriwoong people of the Kununurra community have recorded shifts in seasonal weather patterns and have observed the subsequent shifts in the phenology of flora and fauna (Leonard et al. 2013). Such observations of the impacts of climate change by highly knowledgeable Aboriginal people may serve to enhance Western scientific understanding of climate change at local and regional levels, particularly how it affects the phenology of plants and animals (Turner & Clifton 2009; Jacob, McDaniels & Hinch 2010).

There are significant benefits of using TEK in helping Indigenous communities respond to and monitor environmental fluctuations. The integration of traditional knowledge into climate change adaptation planning allows communities to evaluate positive and negative fluctuations and feedback in their immediate environment. Bio-temporal indicators of seasonal changes that Indigenous people relied on in the past have fundamentally shifted with the impact of European agricultural expansion, mining activities and climate change. These indicators historically determined the arrival of weather events and the availability of plants and animals. The traditional indicators must now be monitored and assessed to judge whether they too have changed with climate change events. That is, they need to be understood by reference to Indigenous knowledge of changed environments (Leonard et al. 2013).

In addition to enhancing scientific understanding of climate change, TEK provides a repository of wisdom and experience that may be useful in the development and implementation of adaptive planning frameworks to address climate change impacts (Ford et al. 2010). Participatory research into these bodies of traditional knowledge, particularly of climate and weather, is critical to the task of integrating Aboriginal knowledge with scientific knowledge to develop adaptation strategies, so that local Aboriginal groups are able to understand, contribute to and implement adaptation plans suited to their circumstances.

1.2 Research objectives

The objectives of this study were twofold:

- to identify and evaluate strategies to enhance the capacity of Indigenous communities to adapt to extreme weather events and climate change
- to understand how Indigenous individuals, households, communities and institutions understand and respond to climate variability and change, in the context of community priorities.

The project also investigated the effectiveness of such strategies to identify potential adaptation pathways (using climate change scenarios) that may be available to those communities.

Several research questions were proposed in the initial design of the project.

- 1. How do Indigenous people in Australia (at an individual, household and community level) perceive and respond to climate variability and extreme weather events? Is equity in adaptation resources an issue in their capacity to respond?
- 2. How do the cultural values of Indigenous people contribute to adaptation pathways and to what extent, and how would they contribute to adaptation options under both short- and long-term climate change scenarios?

- 3. What policies and strategies do government and non-government institutions employ to plan for and manage climate risk, variability and extreme weather events?
- 4. How can institutional, legal and cultural factors facilitate or impede effective adaptation to the impacts of climate change?
- 5. What are the economic dimensions of climate change adaptation for Indigenous households, communities and businesses under different climate change scenarios?

Following our initial workshops to scope these objectives, the objectives were refined to reflect the research priorities identified by Aboriginal participants from each of the three case-study areas. We therefore shifted our research priorities to focus on a more fundamental problem – assisting Aboriginal people to comprehend climate science and predicted impacts, and for us to understand how they perceive their environment, weather and climate phenomena in terms of their own worldviews.

From these initial discussions, three key research questions were developed to address these problems, and guided our further inquiry.

- 1. How do Aboriginal people interpret climate risks in terms of their own belief systems and traditional knowledge about the weather and climate and to what extent could TEK systems contribute to understanding climatic change and their responses to such change?
- 2. How do Aboriginal people understand climate change science, their vulnerability to climate change and the impact of extreme weather events in the Kimberley? Is equity in access to, and understanding of, available resources an issue in their capacity to respond?
- 3. How might cultural values facilitate or impede the development of effective adaptation planning frameworks for Aboriginal communities in the Kimberley?

1.3 Report structure

This report is structured into eight chapters, and covers research methods, key participatory research results on Indigenous priorities, theoretical analysis of CBA, and findings and discussion about Aboriginal worldviews and TEK, and institutional arrangements for emergency management issues. The project study first presents the key priorities of three Aboriginal communities in north-western Australia arising from the participatory research process, followed by a literature review and discussion about adaptation planning approaches informed by and in the context of Indigenous community priorities and requirements. The study then introduces Aboriginal worldviews on climate patterns and weather events, examines the effects of Western concepts of climate change on their views and addresses how their responses can be used to inform existing and future adaptation planning frameworks.

Chapter 2 sets the research scene by describing the three site areas for the participatory research, including the communities, geography and climate, and socioeconomics of the region.

Chapter 3 provides a summary of the mixed-method multidisciplinary approach adopted in undertaking this research project. It discusses how the research framework was designed using a participatory consultation model, which involved the engagement of local Indigenous institutions, field visits to the traditional estates of the Miriwoong and Gija peoples, and a series of workshops with community stakeholders. This approach was adopted to enable stakeholders to identify priority issues for their communities and to develop CBA plans.

Chapter 4 summarises the key priorities identified by participants from each of the three communities in workshops on climate change and adaptation planning, which the participants broadened to include many other issues impacting on climate change issues.

Chapter 5 defines and describes three general approaches to climate adaptation planning – risk management, integrated development and CBA. These in turn are examined to inform a framework to adaptation planning attentive to the context and needs of Aboriginal communities in northern Australia. The lessons learned in this project, particularly around community priorities and community-based action, are collated to present a framework for adaptation planning. We discuss participatory planning processes that can incorporate Aboriginal worldviews and knowledge systems, and which can lead to the development of CBA tools and strategies to respond to both the short- and long-term impacts of climate change.

Chapter 6 presents the research findings on the study of Aboriginal perceptions of climate change, traditional knowledge of weather and climate, and the implications for the populations at two case-study sites – the Miriwoong people of the Kununurra community in the Keep River district and the Gija people of the Warmun community. The role of cultural values and Indigenous worldviews are explored and community adaptation options based on TEK systems are discussed. We identify the linguistic barriers to effective adaptation planning, including cultural differences in communities where English is a second language and where the capacity to participate in adaptation planning is limited. Working with the local Indigenous communities, we elicited the climate and weather lexicon of the local Miriwoong and Gija languages, and sought to develop a pathway by which climate change concepts could be better understood among the Elders and other influential adults attending the community stakeholder workshops. We explored with the research participants the potential for developing a climate change and adaptation lexicon in their languages.

The opportunities that such work presents for Aboriginal participation in planning are described in this chapter. The TEK systems of the Miriwoong and Gija peoples are explored, especially in relation to their understanding of climate and weather phenomena, and how this shapes their understanding of climate risks. An understanding of these knowledge systems is important in harnessing social capital and strengthening the capacity of communities to adapt to changing climatic conditions. Effective adaptation strategies need to address institutional needs while preserving cultural values. The application of this Indigenous knowledge to adaptive management tools would allow Indigenous people in northern Australia to assess their vulnerability, resilience and adaptive capacity to climate change.

Chapter 7 presents the findings of research on climate change adaptation planning and emergency management in remote Indigenous communities, in the context of a critical analysis of the barriers and enablers of institutional arrangements, both Indigenous and mainstream, impacting on Aboriginal communities in the region. The central objective of implementing an Indigenous adaptation planning process for northern Australia is to establish a set of priority actions to reduce vulnerability to, and derive benefits from, the impacts of climate change – priority actions that are owned and endorsed by the traditional owners and wider Aboriginal community. Adaptation action is defined broadly to include a wide range of initiatives, such as adapting existing policies and programs, or creating new ones; the initiation of community development projects; or

the implementation of technical, administrative, infrastructural or economic adjustments.

Specifically Chapter 7 provides a description of Indigenous and mainstream institutions and governance, and their role in adaptation planning – understanding the complex governance structures of Aboriginal institutions, and the roles and responsibilities of an array of government organisations, is essential in adaptation planning for climate change. A critical analysis of the various institutional arrangements is provided. The findings on the degree to which communities are vulnerable to climate change are presented, together with a summary of observations on resilience and community capacity to respond to extreme weather events. Findings from two case studies are presented, including an assessment of the risk from severe tropical cyclones to the Bidyadanga community on the edge of the Great Sandy Desert and the impact of an extreme flood event on the Warmun community in the East Kimberley. The factors that promote adaptive capacity and community resilience are identified, including the role of social networks, access to resources, institutional arrangements, Aboriginal peoples' knowledge of the environment, and historical experiences of climate extremes and change. In particular, the chapter explores how Aboriginal people gain access to weather warnings and understand emergency management resources, and the availability of tools to plan and respond to extreme events. Finally, existing strategies used in Aboriginal communities to respond to extreme events, and suggested response priorities, are examined.

Chapter 8 discusses the conclusions of the project findings and presents priorities for future action and research.

2. STUDY AREAS IN NORTH-WESTERN AUSTRALIA

The Kimberley region is located in the northern most area of the State of Western Australia (WA). It covers a geographic area of approximately 424,500 km². It extends eastwards from its long coastline on the Indian Ocean, dotted with islands, to the NT border. Its southern border transects the northern part of the Great Sandy Desert, while the northern part of the region extends into to the tropical savannahs of the Kimberley Plateau (Figure 1). The region is almost twice the size of the State of Victoria (Masini et al. 2009:4; KDC 2011). The region was recognised in 2011 for its rich and diverse cultural heritage, with parts of the western and northern Kimberley nationally listed for their unique cultural heritage values. Evidence of the antiquity of Aboriginal presence in the region abounds. Archaeologists have established that the oldest human occupation of the Kimberley region dates to about 42,000 years ago. The wealth of evidence from the sites excavated show that 'the people using these sites had wide ranging and sophisticated social networks' (O'Connor 2011; see also O'Connor 1992, 1999; O'Connor & Veth 2000). The protection of the region's cultural and environmental values is of great importance to the many Aboriginal groups whose traditional territories lie within the region. The region is rich in natural resources, including mineral ores and gas. The spectacular landscapes, Aboriginal sites, especially rock art sites, and unique ecological features attract visitors from around the world.

The three case-study sites chosen for this project lie within the region:

- the southern section of the Great Sandy Desert, which is home to the Karajarri people of the Bidyadanga community
- the East Kimberley, which is home to the Gija people of the Warmun community
- the Keep River district on the WA/NT border, which is home to the Miriwoong people of the Kununurra community.



Figure 1: Aboriginal communities of the Kimberley region, WA (Source: DAA 2013)

10 Indigenous climate change adaptation in the Kimberley region

The first European explorers reached the East Kimberley region in the late 1800s and, soon after, pastoralists set up cattle stations along the Ord River and later the Fitzroy River valleys. A gold rush in the Halls Creek region in 1885 brought early Afghan traders, and in the West Kimberley coast Japanese and Chinese pearling fleets started to settle in Broome. These settlers had a significant impact on the local Aboriginal population, and many reports exist of violent clashes and struggles as the pastoralists moved across the Kimberley landscape and took up land for their cattle operations. Aboriginal people were removed to administered reserve settlements, many to Rottnest Island in the south of the colony. Aboriginal children in the Kimberley were stolen from their families and placed in missions. Some were forced to the margins of their traditional lands and later moved to established camps near station homesteads. usually on or near their traditional lands. Aboriginal men performed station-hand duties, and women were engaged as domestic helpers, in exchange for rations and the right to live in the camps. Yet others in the Kimberley were not rounded up, and they lived on country on cattle stations, where they practised their cultural beliefs and retained their strong connection to country.

Colonisation, the expansion of European settlement and the introduction of large cattle herds into the Kimberley region, and subsequent treatment there of Aboriginal people, had a detrimental impact on Aboriginal societies, including removal and displacement of groups; incarceration in a variety of institutions; high death rates as a result of disease, starvation and violence; loss of connection to traditional land; and loss of economic traditions. These impacts have had a cross-generational burden, with loss of economic capacity and social capital enduring across the population. This historical burden has a visible effect on community capacity and resilience, both important factors in adaptation planning for climate change in the region.

In the 1960s many Aboriginal people in the region were forced from their traditional lands into townships and small communities across the region following the award of equal wages to Aboriginal people by the Arbitration Commission (which pastoralists refused to pay) and the advent of mechanisation, including the use of trucks and helicopters, in the cattle industry, displacing the Aboriginal stockmen. There are many stories of pastoralists 'rounding' people up on the back of trucks. This happened on Newry and Ivanhoe stations in the East Kimberley, and people were dumped near Kununurra on the Mirima Reserve, where they still reside today.

2.1 Socioeconomic profile

Aboriginal disadvantage persists in the Kimberley, with Aboriginal individuals, families and communities facing widespread poverty, poor health and low educational outcomes. The adult mortality rate is 10 to 12 times higher than non-Indigenous Australians, and the incarceration rate is 15 times the national average (Biddle 2009; Anderson et al. 2007).

In 2011 the total population of the Kimberley was approximately 35,000 people, the majority residing in the region's six towns (Broome, Derby, Fitzroy Crossing, Halls Creek, Wyndham and Kununurra). There are more than 150 remote Aboriginal communities spread across the Kimberley. Aboriginal peoples comprise more than 47 per cent of the Kimberley population (KDC 2012). In the Halls Creek Shire, which includes the Aboriginal community of Warmun, 83.5 per cent of the population is Aboriginal (KDC 2012:2). The Kimberley region is one of the most culturally and linguistically diverse geographical areas in Australia, with approximately 27 traditional Aboriginal languages belonging to five different language families (Leonard et al. 2013). A large proportion of the population in the Kimberley comprises Aboriginal

people; they are significant landowners with native title and other registered rights and interests applying to at least 90 per cent of the region (National Native Title Tribunal 2012).

The gross regional product of the Kimberley is valued at \$2.2 billion for the year 2009– 10. The resources industry is the most dominant, followed by retail, building construction and tourism. The agricultural industry contributes \$186.7 million to the regional economy (KDC 2012:1). Aboriginal people own 30 per cent of pastoral lands in the region and contribute more than \$2.7 million to the regional economy from cultural tourism and community art centres (KDC 2011). The average individual weekly income is \$667, with the median rental cost of \$550 per week. Housing affordability is a major socioeconomic stress for the region's Aboriginal population, with increasing shortages of affordable accommodation, especially in Broome and Kununurra.

In the East Kimberley the Ord–East Kimberley Expansion project and the Argyle Diamond Mine have established benchmark initiatives in Aboriginal employment. This has resulted in the rate of Aboriginal employment in the East Kimberley increasing substantially over the past 25 years (Taylor 2003). The Kimberley Development Commission (KDC) commissioned a report in 2009 to profile Aboriginal employment and to identify opportunities for future expansion of Aboriginal engagement in the labour force. Aboriginal employment in the land management sector is emerging as a significant employment opportunity with the development of Indigenous Protected Area programs and 'Working on Country' ranger programs. The region's growing economy relies on its rich natural resources. Current and future development has the potential to improve social and economic outcomes for the Aboriginal people of the Kimberley (KDC 2011, 2012).

2.2 Weather and climate

The climate of the Kimberley, like elsewhere in northern Australia, is influenced by the north-west monsoon, resulting in defined wet and dry seasons. The equatorial westerlies pushing the monsoonal trough into northern Australia define the weather patterns of the Kimberley wet season (Wende, Nanson & Price 1997). Heavy rainfall is often associated with tropical depressions, cyclones and local thunderstorms (Wende, Nanson & Price 1997:520). The Kimberley has a highly variable climate both spatially and seasonally. Precipitation is highest in the north-west and decreases rapidly inland towards the arid central deserts. Average rainfall variability ranges from 300 mm to 1500 mm annually. The majority of rainfall occurs between December and March. During the dry season of June to October the weather is influenced by south-easterly trade winds and high-pressure systems forming across the Australian continent and bringing cooler temperatures and more stable conditions to the region. Local topography is an important influence on prevailing regional wind patterns. The average daily maximum temperature is 36 °C in January and 30 °C in July (Wende, Nanson & Price 1997:520). Many of the region's remote Aboriginal communities experience sustained temperatures in excess of 40 °C throughout much of the wet season.

According to the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the climate record for the Kimberley over the past decade or so (1996 to 2007) shows a statistical increase in rainfall compared with historical records (1930 to 1996) (CSIRO 2009). Rainfall has increased by 25 per cent, with a resulting 71 per cent increase in runoff, and this trend is predicted to continue over the near term. Despite this, there has been little change in storage capacity of water resources due to dry season temperatures and evaporation rates. At present the CSIRO (2009) considers the Kimberley as a water-limited environment due to high temperatures,

decreasing dry season rainfall and high evaporation rates. Increased stress on the water supply is possible in the future due to predictions of greater demand, higher evaporation rates and declining annual rainfall.

2.3 Impacts of climate change

In 2010 global temperatures were the warmest on record (CSIRO 2012). The impacts of climate change in the Kimberley are poorly understood due to a lack of baseline data and the remoteness of the region. Climate models generally suggest that the Kimberley is expected to become warmer with more hot days, fewer cold nights and a predicted temperature increase of 2 °C to 2.5 °C over the next 60 years. Heat waves and the number of days over 35 °C will also increase with inter-regional variation. According to the Department of Agriculture and Food (DAF 2010) in WA, the yearly average number of days above 35 °C in Broome could grow to 64–119 days from the current 54 days, and in Halls Creek to 166–205 days from 156 days. Exceptionally hot years are likely to affect about two-thirds of the region every 1.5 years on average (DAF 2010). As a result the spread of both insect-borne diseases, such as dengue fever, and waterborne diseases is likely to increase.

The Kimberley is most at risk from tropical cyclones, flooding and wild fires. The region's coastline is one of the most prone in the world to the impacts of tropical cyclones. Under an enhanced greenhouse climate, extreme events are predicted to increase in intensity (CSIRO 2012). Projections for tropical cyclones are highly uncertain. The increased high pressure at the mid-latitudes in WA means they may not travel as far inland or south. While there could be more intense cyclones, no evidence exists of a significant change in the number of tropical cyclones affecting the coast (DAF 2010).

Increases in extreme storm events are likely to cause more flash flooding, affecting remote Aboriginal communities and infrastructure, including water supplies, sewerage and stormwater systems, transport and communications (DAF 2010). This scenario will challenge the emergency services, with particular concern for the Fitzroy and Ord river catchments, where in recent years, extreme events have tested response capabilities to provide support to remote communities. During tropical cyclone events the coastal and tidal areas are expected to be increasingly vulnerable to sea-level rise and storm-surge inundation (DAF 2010).

Aboriginal communities in the Kimberley have been living with climate variability for thousands of years. In the 1950s extended drought and water shortages in the northern Great Sandy Desert resulted in Aboriginal people walking out of the desert to the Fitzroy River valley, where they still live to this day. In the East Kimberley Aboriginal people tell stories of wet season camps beyond the floodplains of the Ord River.

2.4 Geography

The Kimberley is one of the most ecologically intact and geographically diverse regions in Australia. This ancient landscape of sandstone ridges and limestone gorges was formed over 250 million years. The average elevation of the region is 200 m to 500 m above sea level. Water is the defining feature of the region, with more than 100 rivers forming what is known as the Timor Sea Drainage Division. From the Mitchell River Plateau in the northern Kimberley to the Ord and Fitzroy rivers (which originate in the central highlands) and the extensive aquifers of the Canning and La Grange basins in the central and western Kimberley, water brings life to an otherwise arid environment.

The extensive wetlands of the coastal regions are recognised as internationally significant habitats that support rich freshwater diversity, and the rugged coastline displays rich marine diversity (CSIRO 2009).

The region's water resources are of cultural significance to Aboriginal people and are critical not only for the sustainability of livelihoods but also for recreational activities, town water supplies and irrigated agriculture. The fractured rock aquifers provide good quality groundwater but are limited in yields. The CSIRO (2009) predicts that under a future extreme drying climate there could be limited aquifer recharge, resulting in supply shortages. The residents of Halls Creek already experience water shortages and future growth of the town could be curtailed under current climate change predictions (Government of Western Australia, Department of Water 2011). As a result, any future limitations in water availability that may be experienced under changed climatic conditions will have a substantial impact on the region's sustainability.

The region's vegetation reflects rainfall distributions and underlying geology and soil types. The northern Kimberley is characterised by rainforest thickets, eucalypt woodlands and mangrove forests, while the central and western Kimberley is characterised by savannah woodlands, acacia scrublands and spinifex savannah (CSIRO 2009). The biodiversity of the region is considered unique and highly varied. It supports a diverse and spectacular array of flora and fauna that includes many threatened and endangered species. Native bush tucker is an important food source for many Aboriginal people in the region and forms a major part of dietary nutritional needs. Aboriginal people in the Kimberley have an in-depth understanding of the phenology of flora and fauna and in recent years have noticed changes in the response of species to shifts in seasonal cycles (CSIRO 2009; Masini et al. 2009; Leonard et al. 2013).

The remote geographical nature of the Kimberley, combined with the increased risk of extreme events, places additional pressure on infrastructure in the region. The Great Northern Highway is the main transport artery of the region and is the only sealed road connecting Broome, Derby, Fitzroy Crossing, Halls Creek and Warmun. In the East Kimberley the Victoria Highway connects the Great Northern Highway with Wyndham and Kununurra. Every wet season, floodwaters close the highways and restrict movement around the region. This has a major impact on the region's remote Aboriginal communities as essential supplies run low, thereby limiting availability of fresh food and fuel. Many of these communities are not connected to mains electricity and rely on diesel generators and gas-fired power plants. In the extreme flood event of 2011, Halls Creek was isolated for more than three weeks. Food supplies had to be flown in from Broome, reserve gas supplies ran dangerously low and energy restrictions were enforced. Evacuating the town was seriously considered.

3. RESEARCH DESIGN, ACTIVITIES AND METHODS

In designing this project, originally entitled, 'Learning from the past, adapting in the future: Identifying pathways to successful adaptation in Indigenous communities', a participatory research framework was developed. In addition, a research plan and an end-user engagement and communication plan were developed, which determined the conduct of the research. The research framework included the design elements to address the research outcomes in terms of stakeholder and end-user expectations of the benefit of the research, and the methodological approaches and methods used. These expectations comprised identification of specific strategies to enhance adaptive capacity in Indigenous communities, and immediate relevance of such strategies to governments seeking to develop and implement adaptation policies to address existing and future climate risks in tropical and arid Australia.

3.1 Research aims

This project was designed to address three of the six research priorities identified by the National Climate Change Adaptation Research Facility (NCCARF) in *National Climate Change Adaptation Research Plan: Indigenous communities* (Langton et al. 2012). The following research priorities will enhance understanding of climate change adaptation for Australia's Indigenous communities.

First, the project addresses Research Topic 1 (Langton et al. 2012:5):

Understanding how interactions between social, cultural, institutional, economic and biophysical processes make Indigenous individuals, households, communities, businesses and institutions sensitive to climate risks, and identification and evaluation of strategies to reduce this sensitivity.

The project examines climate variability and change, including extreme weather events, and the ways in which Aboriginal people respond to variability and change in the selected case studies. It studies the impacts of climate variability on Aboriginal communities, the management of these impacts, and the lessons learned for adaptation to future climate variability and change. Project design covers analysis of the responses of individuals and households, institutions, government agencies and the private sector; analysis of the distribution of roles, responsibilities and capacities across different institutions and agencies; the interactions between climate risks and other risks; and explores psycho-social-cultural-factors that can improve resilience of Aboriginal people living in locations with extreme climate (such as monsoonal flooding).

Second, the project addresses Research Topic 5 (Langton et al. 2012:5):

Understanding the capacity of Indigenous individuals, households, businesses and institutions to adapt to climate change, and the identification of strategies to enhance this capacity.

The project examines, through place-based community-centred case studies, the existing strategies used in Aboriginal communities to respond to climate events, and whether such strategies are adaptive or coping mechanisms. Of key importance to this project is the question of how Aboriginal communities perceive and respond to climate risks (Veland, Howitt & Dominey-Howes 2010). An understanding of climate risks, the strategies to adapt to those risks and the awareness of the need to adapt are all significant determinants of adaptive capacity (Adger et al. 2006; Adger, Lorenzoni &

O'Brien 2009). Accordingly, this project considers the capacity of Aboriginal community members, as individuals and members of wider formal and informal institutions, to adapt to climate events and climate change, and the ways in which this capacity can be enhanced in each location (which in turn will offer important insights into the entry points for CBA).

The project also addresses Research Topic 8 (Langton et al. 2012:5):

Understanding the capacity of Indigenous individuals, households, communities and institutions to prepare for, respond to, and recover from extreme weather events, and the identification of strategies to enhance adaptive capacity.

The project examines the degree to which Aboriginal communities are vulnerable to climate variability, including extreme weather events, and identifies the factors that promote adaptive capacity and community resilience. These include the role of social networks; access of resources; institutional arrangements; traditional and scientific knowledge of Aboriginal people and groups about the environment; and historical experiences of climate extremes and change.

In particular, this project explores how Aboriginal people conceptualise climate variability and extreme events, and how these values and beliefs influence their decision-making about climate-related risks. This includes the different forms of knowledge (including traditional, local and scientific) that Aboriginal people have about climate variability and extreme weather events, the ability of communities and institutions to access information, resources and tools to plan and respond to climate events, and the degree to which Aboriginal individuals and communities place trust in both internal and external decision-makers. The project reviews responses to both seasonal climate variability (such as flood events) and extreme weather events (tropical cyclones) and considers the cultural and historical contexts to draw together lessons learned to better inform the development of equitable and effective adaptation policies and plans for Aboriginal communities.

3.2 Development of research design

The project built on an earlier two-year NCCARF research project conducted by The University of Melbourne (UoM) to identify significant gaps in current knowledge of Aboriginal engagement in climate change adaptation in Australia. This work identified the need for strong Indigenous community engagement in designing the research phase of projects (Langton et al. 2012:37):

It is essential that the needs of research end users in Aboriginal and Torres Strait Islander communities be taken into account early in the design of research projects to ensure that research outputs are useful and of value to a variety of stakeholders.

The design of the current project therefore adopted a community-based research approach, using the principles of partnership and collaboration, in which local Aboriginal institutions and community members were employed to undertake key research and engagement roles. Community members were involved as translators, research assistants and workshop facilitators. In consultation with Kimberley Land Council (KLC), Mirima Dawang Woorlab-gerring Language and Culture Centre (MDWg), Warmun Art Centre (WAC) and UoM, an ethnographic and participatory research design was developed. Participant observations, semi-structured interviews and focus group workshops were combined in an action research approach that focused on local community researchers initiating activities on country (that is, on the traditional land of the participant groups).

Ethics approval for the research was granted by the Health Sciences Human Ethics Sub-committee of the UoM School of Population Health. As part of the ethics process all participants in the project were asked to sign a permission-and-release form. In discussions about this process, Aboriginal participants requested not to be individually identified in the research results. As a result this report does not identify the names of informants; instead, where possible, it cites the workshop or focus group activity in which they participated.

Research was directed by our partner organisations based in the Kimberley, including KLC, MDWg and WAC, allowing for the strong capacity development of local Aboriginal researchers to actively engage, and subsequently drive, research activities. Field sites were chosen in response to gaps identified by traditional owners in consultation with KLC and MDWg. The research design used a mixed-method approach that focused on community-driven participatory action research through the use of 'Back to Country' field trips. This involved taking extended family networks of up to 60 people to outstations on traditional lands to visit important places and sites; undertaking traditional economic activities, such as fishing and hunting, as well as cultural practices; documenting traditional knowledge of environmental processes, weather and climate phenomena at workshops; and conducting interviews. Fieldwork visits with traditional owners were conducted at different times of the year to document seasonal changes. Participants were self-selecting on the basis of their traditional land relationships, and conducted themselves according to their cultural protocols. The Elders and other knowledgeable people were keen to convey their traditional knowledge and to teach younger traditional owners. They regard intergenerational transfer of knowledge as a traditional duty.

We used traditional knowledge as a focus for the discussions and as an aid to explain how Western scientific understanding of climate and weather relates to climate change.

A multimedia approach was used to document project activities and to record traditional knowledge. It was recognised that Aboriginal people have strong preferences for visual images and media for transmitting knowledge, so visual aides were used in workshopping concepts and understanding Western climate change predictions. Young people were encouraged to use video cameras to interview senior traditional owners and to document cultural activities relevant to this study of climate change adaptation. New topics were introduced through group workshops to translate English weather concepts into local languages, allowing discussions to be generated on how climate change affects their own livelihoods. After these discussions it was important to place a visual reference to traditional knowledge concepts through field visits to culturally significant sites where video would be used to document stories and place. Knowledge maps of these stories would then be painted and later expressed through song and dance. The visual and audio references were then workshopped, collated and translated by local Aboriginal research staff.

These techniques allowed Aboriginal people to evaluate their own understandings of climate change risks, establish links between Western scientific concepts of climate change and, most importantly, consider its bearing to contemporary Aboriginal life. These methodologies helped to build the social capital of Kimberley Aboriginal people to develop skills that enabled their community-driven research agendas. As the project progressed, these individuals increasingly helped facilitate meetings, lead discussions and develop focus group topics. Individual capacity was further developed through a number of MDWg local staff presenting research findings at national workshops and conferences.

Increased understanding by Kimberley Aboriginal people of the vulnerability of their country to climate change is a key driver of collaborative research activities to potentially create greater capacity among local Aboriginal communities to adapt to future impacts of climate change.

3.3 Selection of case-study communities

The Kimberley region of north-western Australia was identified as being underrepresented in the climate change literature despite the risk posed to the region from extreme events and its large Aboriginal population. Its geographic remoteness and socioeconomic profile, along with the cultural diversity and richness of its Aboriginal groups, are distinctive characteristics of the region. These, along with the prospect of studying the perceptions of Aboriginal people to climate change and in this context understanding the challenges of adaptation planning, provided a unique opportunity to research climate change adaptation capacity among vulnerable Indigenous communities at greater-than-usual risk of being affected by climate change. Communities were shortlisted for inclusion in the project based on geographic location, risk of extreme events, impacts of climate change and size of the community. The project aimed to represent the diversity of Aboriginal communities across the region. The case studies chosen to participate in the project were selected both through invitation and self-selection in consultation with KLC and the MDWg.

Three communities were approached and invited to participate in the project's research activities. The aim was to provide case studies of specific Australian Aboriginal perceptions of climate change and capacity to adapt. The communities that participated were:

- the Karajarri people of the Bidyadanga community in the southern section of the Great Sandy Desert
- the Gija people of the Warmun community in the East Kimberley
- the Miriwoong people of the Kununurra community, who maintain homeland centres in the Keep River district on the WA/NT border.

After initial community meetings and scoping activities, the willingness of community leaders and residents to engage in the project and the need for adaptation planning were the critical factors in choosing these three communities for the case studies. This has allowed us to test and evaluate the effectiveness of research methodologies and approaches in adaptation planning in different geographical settings with diverse socioeconomic circumstances and governance structures.

3.4 Participatory research framework

This research project drew on a range of participatory research methodologies intended to facilitate collaboration and produce a rich and detailed body of data. The project was designed to ensure that knowledge exchange (between community members, decision-makers and researchers) was ongoing throughout the design, data collection and reporting phases. Key features included:

- planning workshops with each Aboriginal language group
- presentation of climate change scenarios and brainstorming sessions for communities
- Aboriginal-only workshops for each language group
- workshops for decision-makers and other stakeholders
- community camping trips to the traditional lands of the Miriwoong people, the Gija people and the Karajarri people

- employment of local Aboriginal community members as workshop facilitators, translators and experts
- reporting back to communities in the form of videos, trip reports and a community report
- conference presentations, including inviting Aboriginal community representatives to attend and present at conferences in order to build research capacity and improve non-Indigenous understanding about Aboriginal climate change issues.

In relation to the collaborative nature of the research design, stakeholder categories in the research process and plan were identified at the design stage. These included:

- Aboriginal institutions
- community service providers
- emergency managers
- local governments
- WA state and federal policymakers.

The key stakeholders in the project were:

- Kimberley Land Council (KLC)
- Mirima Dawang Woorlab-gerring Language and Culture Centre (MDWg)
- Warmun Art Centre (WAC)
- Karajarri Traditional Lands Association (KTLA)
- regional shires
- WA's fire and emergency services authority
- various WA and NT government departments.

Despite initial interest, not all of these stakeholders participated throughout the project.

People from several of these organisations and agencies were directly involved in this project through stakeholder workshops. A bottom-up approach to research was taken to allow each community to develop the research design. The use of participatory techniques enabled the workshop participants to express ideas and opinions about the research process, issues and outcomes, based on their own experiences and with reference to their cultural beliefs. This allowed the identification and development of research strategies in climate change adaptation, resilience and vulnerability reduction.

3.5 Identification of issues

This project was first proposed by Aboriginal community representatives at the 2010 Northern Australia Indigenous Climate Change Adaptation workshop and again at the Climate Futures: International Climate Change Adaptation Conference (Hunter & Leonard 2010; Sinnamon & Mango 2010). At these workshops, participants identified the need to understand the cultural dimensions of climate change. The key issues were:

- understanding Aboriginal worldviews and cultural values and how these are reflected in perceptions of climate risk
- use of TEK in monitoring the impacts and mitigation of climate change
- impact of extreme events on remote Aboriginal communities
- development of adaptation planning frameworks that reflect cultural values and the individual needs of each community.

3.5.1 Climate change adaptation workshops

Informal discussions were held with KLC, MDWg, WAC and KTLA in December 2011 and January 2012. Presentations were then given to the board of directors for each

organisation, and additional presentations were given at native title meetings for the Karajarri and Gija groups. At these meetings, approvals were gained from each organisation to undertake the research and appropriate workshop participants and locations were identified.

Introductory workshops were held with each community in February and April 2012. The purpose of these workshops was to introduce researchers to community members and to develop a fieldwork schedule that identified the expectations of the project stakeholders and research participants. Introductory workshops allowed research and administrative issues to be identified, and field research was rescheduled to accommodate community needs.

At these workshops information flyers were distributed. Entitled 'What is Climate Change Adaptation', the flyer provided a plain English summary of climate change science and adaptation. Also at these workshops, presentations were given to explain projected climate scenarios for each community and the region more generally. Workshop participants worked with researchers to identify information gaps and difficult-to-understand areas, which then led to the design of further workshops. Small group discussions identified the types of information that would help build capacity to understand climate change risks. Extensive discussion also surrounded the use of traditional languages and an appropriate format for presentations. As a result, interpreters and linguists were engaged to translate and present the key concepts of climate change science and to produce information in plain English and in accessible language for the subsequent workshops.

The capacity of communities to engage in workshops and the existing demands on community members to attend many meetings was of particular concern for Bidyadanga (Karajarri people) and Warmun (Gija people) communities. As a result, options to work within the limitations of the communities' calendars of events were explored, and to collaborate, if possible and feasible, with other organisations undertaking similar research. At the Bidyadanga community, researchers explored options to work with the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) and KTLA. The Warmun community requested that workshop activities be conducted at WAC, where the highly knowledgeable Elders worked each day. Their artistic activities at that time were concerned with the flooding of the community in 2011 and the subsequent flood recovery program and rebuilding of community infrastructure. This disastrous weather-related event was discussed in terms of climate change. No one had ever seen or heard of a flood that reached the levels of the 2011 event.

To follow on from the introductory workshops, larger community workshops were organised so that the researchers in each community could undertake more in-depth analysis of perceptions of climate risk and identify community vulnerabilities, resilience and capacity to adapt. Workshops were held between May and October 2012 in each of the three communities. In these workshops people explained the difficulty of talking about the risks of climate change without first visiting country or traditional land estates to look at potentially affected sites. This traditional rule is important to senior traditional owners and reflects their belief in sentient landscapes that must be accorded respect. The research design allowed for such field visits.

In total, we undertook six comprehensive workshops with Aboriginal communities in the Kimberley. More than 120 Aboriginal people were interviewed either individually or in focus group sessions across the three communities. Additional interviews were conducted in Fitzroy Crossing and Halls Creek with Aboriginal community members

who showed interest in participating in the project to ascertain perspectives from a wider regional scope.

3.5.2 'Back to Country' field workshops

Fieldwork methods included 'Back to Country' trips as a way of engaging Aboriginal community members, stakeholders and decision-makers to discuss emerging issues at field locations and to identify options for adaptation. The intention of these field trips was to empower Aboriginal participants with a sense of ownership in the process and to allow participation according to traditional laws and customs. Camping on traditional lands (commonly referred to as 'Back to Country' trips) is an important social and religious practice (Pursche 2004). For many Aboriginal people, 'returning to country' is a necessary expression of cultural traditions. The presence of the traditional owner on his or her estate is a prerequisite for discussing important matters, because walking on the estate maintains familial, economic and spiritual ties to country (Toussaint 2008). The practice of taking Aboriginal groups back to their traditional lands is increasingly recognised as a key success factor in community-based research on Aboriginal issues in Australia (Palmer et al. 2006). Community camping trips were undertaken during 2012 to the traditional lands of the Miriwoong people of the Kununurra community, the Gija people (at Warmun) and the Karajarri people (at Bidyadanga) to investigate in situ cultural values and adaptation responses of traditional language groups. Each trip was designed to meet the needs and capacity of the community to engage with the research.

In July 2012 about 60 Miriwoong Traditional Owners participated in a five-day 'Back to Country' at the Thamberalm (Bubble Bubble community) on Newry Station on the boundary of the Keep River National Park in the NT. Researchers from UoM, staff from MDWg and Keep River National Park rangers coordinated this field visit. The trip facilitated visiting cultural sites identified as at risk from the impacts of climate change. In-depth discussions considered the significance of these sites to the Miriwoong identity, and TEK about changing seasons was documented.

Because of other pressing commitments, and deaths in the community, the Karajarri people could not undertake the extended 'Back to Country' trip and instead opted to undertake a shorter field visit with AIATSIS, UoM and the Karajarri rangers in October 2012. The focus of this trip was to look at the impact of extreme climate events on Karajarri lands at the edge of the Great Sandy Desert and to explore the capacity of the community to respond to the short-term impacts of climate change.

In November 2012 a 'Back to Country' trip was undertaken to Gija sites of the Warmun community with UoM and WAC. As Gija people live on their traditional lands, this trip did not take the same format as the Keep River trip; the camp was based at WAC on the edge of the community and day trips were undertaken to look at sites of importance. The key focus of this trip was to look at the impacts of the 2011 extreme flood event at Turkey Creek, which runs through the middle of the Warmun community.

The varied nature of the format of 'Back to Country' trips reflected the diversity among Aboriginal groups. The research design of this project needed to reflect the priorities of local people, the strength of cultural knowledge and the capacity of community members to engage in research activities.

3.5.3 Stakeholder engagement

One priority identified by traditional owners in the introductory workshops was the need to discuss climate change adaptation with their stakeholders. Identified stakeholders for each community differed depending on community priorities, geographic location and governance structure. A Keep River stakeholder meeting was held in the Keep River National Park with Miriwoong people and their identified stakeholders in late October 2012. These discussions involved NT National Park management, the Yawoorroong Miriuwung Gajerrong Yirrgeb Noong Dawang Aboriginal Corporation (MG Corporation)¹, the Northern Land Council and local pastoralists. The Territory Natural Resource Management, a not-for-profit community sector body, and several government departments were invited but were unable to attend, so interviews were also conducted over the telephone or in person in Kununurra. A one-day stakeholder field visit was held with Karajarri people. AIATSIS and the Australian Department of Sustainability, Environment, Water, Population and Communities. A larger stakeholder meeting had been planned, but for several reasons this was not possible. Relevant stakeholders were interviewed in Broome, and discussions were held informally between Karajarri people and stakeholders. Discussions were held with KLC, KTLA and Indigenous Protected Area program management about the inclusion of a climate change adaptation response in the draft planning document for the southern section of the Great Sandy Desert.

Informal stakeholder interviews were conducted with the Warmun Community Council, KLC staff and WAC about the impact of the 2011 flooding and subsequent responses in the Warmun community. Individual interviews were conducted with personnel of agencies responsible for emergency management in Warmun about the potential threat of future natural hazards as a result of climate change. These consultations and interviews confirmed the view of the project researchers that the future success of adaptation planning depends on successful engagement between Aboriginal communities and stakeholders to co-develop responses to climate change. Questions were posed in a variety of ways to ascertain local perceptions of environmental seasonal and weather changes observed over long periods of time and the perceived reasons for these changes. Questions about flood events in the past, the water levels in rivers and other waterways during past events, the local language terms for weather phenomena and weather events, floods and flood impacts were asked of senior people. As explained in Chapter 6, ways of understanding the weather system and the environment are shaped by Aboriginal cultural and linguistic belief systems that differ markedly from Western understandings. Nevertheless, the observations of the participants contributed to a picture of climate change risks as perceived by Aboriginal people in the Kimberley region, many of whom have extraordinary levels of knowledge of their environments that derive from inherited traditions and lifetimes of observation.

3.6 Summary of community-based research activities

Below is a tabulated program of key participatory research that was conducted over about a year-and-a-half in north-western Australia.

^{1.} In the literature this Aboriginal corporation also is referred to as Miriwoong Gajirrabeng Corporation or Miriwoong Gadjerrong Corporation.

Program of participatory research, north-western Australia, 2011–12

| Date | Location | Entities/people | Type of participatory research | Number of participants |
|---|---|---|---|-------------------------------------|
| December 2011 and January 2012 | N.R. | KLC, MDWg, WAC and KTLA | Informal discussions about project | N.R. |
| February and April 2012 | N.R. | N.R. | Introductory workshops | See May and October workshops |
| April 2012 | MDWg (Kununurra) | Senior Miriwoong people | Climate change workshop | N.R. |
| May and October 2012 | Bidyadanga, Warmun, and Kununurra | Karajarri, Gija and Miriwoong peoples | Three workshops on collaborative planning, identification of significant plant, weather words, and climate change | 120 participants |
| Around July 2012 | Three field trips: southern section of the Great Sandy Desert, East Kimberley, Keep River district Thamberalm (Bubble Bubble) | Karajarri, Gija and Miriwoong peoples | Three 'Back to Country' trips, including a one-day stakeholder field visit with Karajarri people, AIATSIS and Australian Department of SEWPaC; also Climate change adaptation field trip/interviews with senior Miriwoong people | 60 participants per trip |
| Late October 2012 | Keep River National Park | Miriwoong people | Stakeholder meeting | N.R. |

AIATSIS – Australian Institute of Aboriginal and Torres Strait Islander Studies. KLC – Kimberley Land Council. KTLA – Karajarri Traditional Lands Association. MDWg – Mirima Dawang Woorlab-gerring Language and Culture Centre. SEWPaC – Sustainability, Environment, Water, Population and Communities (Australian Department of). WAC – Warmun Art Centre. N.R. – Not recorded.

4. KEY RESULTS AND FINDINGS OF PARTICIPATORY RESEARCH

This report utilised participatory research with Aboriginal communities to better understand the influence of cultural and linguistic attributes of Aboriginal peoples in the Kimberley on their perceptions of climate risk, and the influences of Aboriginal tradition, colonisation histories, land rights issues, institutional arrangements and socioeconomic burdens on Aboriginal participation in and engagement with climate change adaptation planning and emergency management in the region.

Of fundamental importance has been our key participatory research finding that existing and future impacts of climate change on Aboriginal communities in the Kimberley are compounded by community stresses caused by a lack of resources and socioeconomic dysfunction in the region. The participatory research in this study identified the need to prioritise adaptation actions based on the immediate needs of the community and internal capacity of communities to engage in practical socioeconomic programs of benefit to Aboriginal people in the region. Indigenous involvement in climate change adaptation planning, including emergency management, depends on Aboriginal perceptions of a practical outcome for Aboriginal people in the region. If actions are not prioritised to the requirements and needs of Aboriginal people in the region, and if participatory 'bottom-up' approaches are not taken, adaptation actions risk becoming examples of maladaptation and a failure in public policy and practice.

During workshops for adaptation priorities, communities offered the following priorities that reflect current community needs and requirements. It is important to note that these priorities will likely change as communities develop and gain further independence, self-reliance and resilience. Any adaptation planning will need regular evaluation of priority needs.

4.1 Priorities of Gija people of the Warmun community

The Warmun community participants in the research project requested that further research be undertaken to identify how potential pathways to climate change adaptation could be developed to strengthen the community's sustainability for future generations. The main priorities identified were:

- the need for greater community involvement in the development of emergency management planning
- the training and funding of Aboriginal emergency management officers to work with the community council and assist the community in disaster preparedness and response
- recognition of cultural beliefs and practices in climate change planning
- further educational programs to help the community understand climate change in terms of their own worldview
- development of climate change monitoring and evaluation programs based on TEK.

4.2 Priorities of the Keep River Miriwoong Traditional Owners

Miriwoong people of the Kununurra community from the Keep River district said that it was essential to work together with their stakeholders to address climate change concerns and develop opportunities for adaptation. The Miriwoong people put forward five key priorities that would need to be addressed if successful adaptation strategies are to be identified:

• a need for joint management of the Keep River National Park

- establishment of an Aboriginal ranger program
- development of a climate monitoring program based on traditional knowledge of the Miriwoong seasonal calendar to work with Western science
- improved infrastructure of community outstations within the Keep River National Park
- development of a community-planning framework that takes into account the complex governance structures of Miriwoong lands.

4.3 Priorities of the Karajarri Traditional Lands Association

The KTLA identified a number of priorities for the successful implementation of climate change adaptation actions in Bidyadanga and on Karajarri lands. These include but are not limited to:

- include and consider the impacts of climate change in all aspects of future development planning on Karajarri lands
- work collaboratively with the Bidyadanga Community Council to develop a climate change adaptation strategy for the community
- develop a greater understanding of the roles and responsibilities of native title prescribed bodies corporate (PBCs) in climate change planning
- develop greater community awareness of the risk of tropical cyclones to the Bidyadanga community and surrounding outstations
- prioritise climate change as the most important threat in conservation planning on Karajarri country.

The following chapter (Chapter 5) discusses the importance of developing an Indigenous participatory planning framework for successful climate change planning adaptation, and the form such a framework might take in its attributes and desired outcomes. Such a community-based framework needs to take into account Indigenous worldviews and TEK (Chapter 6) and proper institutional arrangements (Chapter 7) for effective adaptation planning, including emergency management, for the remote Indigenous communities in the region.

5. PRINCIPLES AND PRACTICE OF ADAPTATION PLANNING IN INDIGENOUS COMMUNITIES

During the participatory research workshops and other meetings, Aboriginal groups in the Kimberley proposed many practical solutions to achieve successful climate change adaptation. Aboriginal traditional owners in north-western Australia variously canvassed collaborative management of conservation areas, establishment of ranger programs, development of TEK in partnership with Western science monitoring programs, improved infrastructure for key selected community facilities; and development and implementation of community-planning frameworks to take account of complex governance structures of Aboriginal lands. The purpose of Indigenous adaptation planning in climate change – like so many other Aboriginal programs whether in health, education, employment, housing or conservation – seeks to achieve practical benefit to and positive outcomes for Aboriginal people through the principles and practice of cultural traditions, ownership, empowerment, participation, and capacity building.

In this chapter we explore, document and validate with reference to the relevant literature the need for and form of a practical Indigenous community-based framework in adaptation planning for disadvantaged Indigenous communities facing climate variability and climate change. Three Western approaches to adaptation planning – risk management (RM), integrated development (ID) and community-based adaptation (CBA) – which are well documented in the literature, are examined. The three approaches are reviewed to derive an Indigenous framework to adaptation planning attentive to the context and needs of remote Aboriginal communities in northern Australia as identified through our participatory research findings. The approach put forward in this chapter has implications for the achievement of equitable, efficient and appropriate climate change adaptation plans and policies for other Australian Indigenous communities. The proposed framework is presented in terms of its objectives and desirable outcomes, its underlying assumptions, and the considerations for planners and communities at each of the identified planning stages.

Given the relatively limited attention to Indigenous adaptation planning as a field of applied practice, the approach articulated here draws directly on the lessons from successful natural resource management and health programs that have demonstrated high levels of Indigenous participation and delivered long-term benefits, while addressing priority areas of community-identified need and vulnerability. Underlying this approach is the assumption that in order for adaptation programs to be effective, planning activities need to identify tangible actions that improve community adaptive capacity and resilience generally, which in turn will improve the ability of individuals, households and communities to cope with, and benefit from, climatic change impacts and their flow-on socioeconomic effects.

5.1 Defining adaptation planning

The frameworks for disaster management form one component of the more encompassing field of adaptation planning. A key element of adaptation planning involves modifying existing disaster management measures, such as risk reduction, emergency services planning, and recovery management, to incorporate emerging information on the projected impacts of climate change (Department of Climate Change 2007). As a form of adaptation, disaster management plans focus on reducing emergent risk exposures based on the expectation of increased frequency and severity of extreme climatic events. New approaches to disaster management emphasise rapid
response and recovery from extreme events, and in some instances include measures for improving preparedness and increasing public awareness of climatic events. This approach to adaptation draws heavily on foundations in the principles and planning frameworks from RM (Webb & Beh 2013; Willows et al. 2003; Fussell 2007; Jones & Preston 2010). Many of the practical lessons identified throughout our report for improving disaster management in Indigenous communities have direct application for adaptation planning generally.

Adaptation planning both departs from and builds upon disaster management, and has assumed a more expansive remit commensurate with the range of projected flow-on climate impacts. While continuing to foreground disaster response and recovery measures, best-practice adaptation planning incorporates primary and secondary impacts of climate changes across the full spectrum of human activity. Adaptation planning encompasses changes to, for example, primary production, water management, coastal protection, public health, settlement patterns, built environments and economic development. The central distinction between disaster management and adaptation planning stems from the variable time horizons associated with climate impacts. This does not only include anticipating episodic impacts like extreme climatic events, but also changes to climate variability, short- to medium-term climatic changes (which include changes in climate averages and protracted or permanent climate alterations) and the need for anticipatory planning in response to model-based scenarios of long-term climate change. These aspects of climate change impacts engender different forms of vulnerability and risk for social and ecological systems, especially in the types of resource-dependent communities that characterise the Indigenous communities of Australia's tropical north (Adger et al. 2007). The variability of time horizons for climate impacts, and the prevailing condition of uncertainty in climate change prediction make traditional modes of risk and impact assessment tools less amenable to adaptation planning.

For example, permanent impacts on biodiversity distribution and spatial range as a consequence of climate change cannot be adequately addressed through the eventbased approach of disaster management. Flow-on environmental impacts on biodiversity can include changes to patterns of species migratory and seasonal behaviour patterns, with potential and explicit social and economic consequences for human populations. This is especially salient for remote Indigenous communities, and can lead to temporary or permanent disruption of Indigenous customary practices and connections, an inability to maintain custodial obligations to and management of country, and livelihood impacts on food security and income generating activities (Green, Jackson & Morrison 2009). Depending on the magnitude and duration of these impacts, climate change invokes transformative socio-ecological consequences; managing these forms of change exceeds the 'preparedness-crisis-response-recovery' framework of traditional disaster management. This has led to the need for adaptation planning to expand beyond risk assessment models, to incorporate planning concepts drawn from development, natural resource and strategic planning.

5.1.1 Four aspects of adaptation planning

Adaptation planning can be defined as the deliberative process involving potentially impacted stakeholder groups to select and implement anticipatory and targeted actions to reduce exposure to risk and harm, to increase the adaptive capacity to manage change, and to maximise the benefits from experienced or projected changes. Adaptation actions can include adjustments to or transformations of technical, institutional, legal, educational practices, service provision and infrastructure. Four key aspects derive from this definition. First, adaptation planning is conceptually and practically discrete from 'autonomous adaptation', which can be defined as the 'natural or spontaneous adjustments in the face of a changing climate' (Carter et al. 1994; Fankhauser, Smith & Tol 1999). There is an assumption that individuals, households and communities will adapt to climatic changes in more or less organised ways, subject to their access to information and resources to do so. These types of adaptations range in description from 'coping strategies' to incremental behavioural adjustments, and exclude more transformative actions and interventions (Nelson, Adger & Brown 2007). The limited attention to adaptation planning as a practice is linked, at least according to some commentators, to the observation that those in positions to direct policy initiatives in this area have 'generally assumed that they [affected people] have the financial and technical resources to adapt as and when necessary' (Burton et al. 2002). The need for planned adaptation is more crucial for regions and sectors such as remote Aboriginal communities in northern Australia, which have diminished access to the resources that can facilitate spontaneous adjustment.

Second, adaptation planning is anticipatory as opposed to reactive. Reactive adaptation refers to those adjustments that are made as a consequence of observed or experienced climatic changes after such impacts have occurred (Fankhauser, Smith & Tol 1999), such as the emergency response and recovery phases for the Warmun community after the devastating March 2011 flood (see Chapter 7). As a form of anticipatory decision-making, adaptation planning requires a series of future projections about how climatic conditions are expected to change, and to make decisions about how current or planned practices, policies and infrastructure will need to be amended to address these changes, and with what resources (Fussell 2007). Decisions about adaptation require the resolution of trade-offs associated with uncertainty, imperfect knowledge and resource availability, such as the selection of priority options based on an assumption of limited resources and the determination of acceptable or tolerable levels of risk exposure and harm.

Third, the broad scope of adaptation planning is not a separate sphere of activity isolated from the wider socioeconomic and institutional context. The effectiveness of an adaptation planning process is dependent upon the extent to which its outcomes are embedded within extant and ongoing planning and policy instruments, such as economic development, health, water resource and infrastructure planning. Impacts of climate change are likely to exacerbate risks and vulnerabilities that are currently within the responsibilities of existing institutions or programs. The Australian Government's policy position demonstrates a preference for the establishment of adaptation-specific arrangements, only when the existing frameworks have demonstrated an incapability to manage emergent impacts (Department of Climate Change and Energy Efficiency 2010). This approach means efficient use of resources and also enables the outcomes of adaptation planning to better match the prevailing context.

Adaptation programs rely on the social acceptability of the adaptation actions and on the institutional and resource constraints affecting the adoption of those actions, including the operation of governance frameworks and access and limits to the full suite of capital resources (financial, social, institutional, cultural and intellectual) in managing change. These non-climatic conditions are as determinate as climatic conditions in the effectiveness of adaptation planning outcomes. The research conducted with traditional owner groups for this study has demonstrated the pivotal role played by worldview and language in the socio-cultural acceptability of adaptation actions. Similarly, the need for high levels of coordination across diverse sectors and agencies is a significant barrier to a coordinated approach for planning, but is a prerequisite to its efficacy. It has been observed that this requirement has led to a preferential bias towards low-risk capacity building activities in adaptation planning to

date, rather than specific actions to reduce vulnerability and increase resilience (Preston, Westaway & Yuen 2011). A nested approach to adaptation planning is considered more desirable than the establishment of a new, usually resource-intensive, area of management.

The fourth and related point is that the outcome from adaptation planning need not be codified as a specific plan or document, and should be conceptualised in the ongoing social processes that seek to increase the capacity of a system (social, ecological, economic, cultural and so forth) to function effectively across a range of more or less foreseeable climate futures. These social processes extend existing adaptive practices to increase the flexibility, adaptability and robustness of service and infrastructure provision. Increasingly, adaptation planning centres less upon analysis of vulnerability and risk, and more on determinations of resilience and adaptive capacity (Burton et al. 2002). Resilience and adaptive capacity are jointly conceptualised dynamically within the context of continual change. These concepts refer to both the ability of a system to maintain condition and trend in the presence of significant change, or to 'bounce back' after the experience of impacts. More precisely, they are independent variables that limit and enable forms of adaptation. Resilience refers to the amount of change a system can undergo and still retain the same function and structure while maintaining options to develop (Nelson, Adger & Brown 2007). As a component of resilience, adaptive capacity is defined as the preconditions necessary to enable adaptation, including social and physical elements, and the ability to mobilise these elements (Nelson, Adger & Brown 2007).

Assessments of the variables that underscore adaptation planning, such as resilience, vulnerability and adaptive capacity, vary widely across individual, household, community and regional scales. These are neither static nor passive qualities of a given community or region, but are capable of radical redefinition through structured intervention. Adaptation planning is, in this sense, the implementation of actions to enhance these qualities within a system through deliberated action.

5.2 The need for Indigenous-specific adaptation planning

The needs and interests of traditional owners are currently under-represented in climate adaptation priorities in Australia. For example, the Australian Government's climate adaptation program has adopted a sectoral approach, based on the recognition that climate impacts will be experienced differently across sectors and require different levels of priority and urgency. In considering the best available science, governance arrangements and the relative costs of early intervention, the program identifies six national priority areas for action: water, coasts, infrastructure, natural ecosystems, natural disaster management, and agriculture (Department of Climate Change and Energy Efficiency 2010). Although investment and reforms in these sectors will coincidently support the adaptation needs of Indigenous communities in northern Australia, it is unlikely to address the specific climate vulnerabilities and values of the Indigenous population.

Developing an Indigenous-specific adaptation planning framework aims to recognise a distinct category of climate adaptation stakeholders in the traditional owners and Indigenous communities, and forms part of acknowledging and protecting the special category of values of these Indigenous stakeholders (Mackenzie 2012).

Establishing Indigenous specific adaptation planning processes is a pragmatic reform. This is because of the substantial areas of the landscape – particularly high-priority conservation lands and waters and climatically vulnerable regions – that are currently managed or held under the Indigenous estate. Research conducted by Altman et al. (2009) found that as much of 20 per cent of Australia's total landmass, and possibly as much as 60 per cent in the country's tropical north, is under Indigenous tenure. Some of the areas most at risk from climate change impacts are actively managed by Indigenous communities through cultural practice and, more recently, formal resource management programs. The combination of TEK and practical cultural management activities places traditional owners and rangers in a unique position to provide insight into current climatic and seasonal variability, observed changes and the flow-on impacts of projected changes. This information is invaluable for climate adaptation across the north generally (Mackenzie 2012).

5.2.1 Vulnerability and adaptive capacity in Indigenous communities

As discussed throughout this report, climate change induced impacts on the Indigenous communities in northern Australia are generally projected to be disproportionate to other communities and sectors of the Australian population, due to a series of interrelated factors. It is a well-established principle within the adaptation literature that climate change-induced impacts are spatially and socially differentiated, and that resource-dependent communities are more likely to experience significant impacts due to higher levels of climatic exposure and limited adaptive capacity (see Adger 2003; Thomas & Twyman 2005). Similarly, the experience of multiple forms of disadvantage has been shown to reduce adaptive capacity at community and regional scales (Hennessy et al. 2007; Braaf 1999). Many of the impacts anticipated to affect Indigenous communities are unique to those communities, such as alienation of land or reduced access to country.

The comprehensive review of projected climate impacts for Indigenous communities in northern Australia by Green, Jackson & Morrison (2009) demonstrates that the degree of exposure to climate risk is higher in those communities due to geographic vulnerability and the experience of disadvantage (see also Braaf 1999; Hennessy et al. 2007; Ellemor 2005). Indigenous communities in the north generally experience greater remoteness, reduced population health, inadequacy of service provision and infrastructure, limited employment and educational opportunities, and less economic and economic-sector diversity (Green, Jackson & Morrison 2009; Burgess et al. 2009). Each of these characteristics has been shown to negatively impact on a population's adaptive capacity. Indigenous communities are exposed to greater degree of risk from climate change because the integral elements of adaptive capacity at a community scale are less likely to be present in those communities. In general, disruptive change compounds the experience of disadvantage. As Adger (2003:396) argues:

Social hierarchies and inequalities in resources and entitlements are rarely overturned in the course of adaptation, and external changes, such as extremes in climate and other natural hazards, tend to reinforce these inequalities. (Adger, Kelly and Ninh 2001).

This in turn means that the types of adaptation required for Indigenous communities will be substantially different from the types of sector adjustments envisaged in the current adaptation priorities.

For Indigenous areas, adaptation is likely to instead focus on activities that enhance local capacity to address current social and economic issues. The achievement of development goals and the reduction of stresses other than climate change through building the general stocks of adaptive capacity will improve the capacity of communities to respond to climate change impacts. This point is clearly borne out in the critical analysis of the Torres Strait Islands Adaptation Plan by Langton et al. (2012:22). The research found that successful climate adaptation in Indigenous communities:

... must address the present-day situation in those communities. Long-term adaptation planning therefore needs to be accompanied by a parallel process of short-term adaptation outcomes, including, but not limited to, tangible remedial works, which are currently designed to reduce social vulnerability to natural hazards. Such short-term strategies will in turn enhance the capacity of those communities to adapt to future climate conditions. (Langton et al. 2012:22)

Against this, caution is warranted in applying simple assumptions about the vulnerability of the Indigenous population to climate change. Overemphasising the vulnerability of Indigenous communities to climate impacts discounts the demonstrated adaptive capacity of Indigenous societies in the continuous engagement with changing environments for generations (UNESCO 2007; Green, Jackson & Morrison 2009). Australia's Indigenous groups have adapted to millennial-scale climate variability and the systemic changes to their lived experience after colonisation. Greater investigation into the adaptive capacity of Indigenous communities is essential before generalisations about vulnerability can be definitively justified.

Differences in exposure to climate risks are one component of the diversity that inheres across the Indigenous population in the north. Adaptive planning needs to be sufficiently flexible to apply not only to differences in climate risks, but to recognise, respect and accommodate the cultural diversity of Indigenous people generally. Cultural diversity across the north of Australia is evidenced in the case studies conducted for this report, particularly in the conceptualisation of weather and climate relationships and worldviews. Beyond this, differences in traditions, laws, sites, stories and cultural practices or traditional practices between language groups and across communities limit the extent to which a prescriptive framework for adaptation will be viable. Other complications constraining a prescriptive framework include the variety of jurisdictional divides, governmental and governance structures, and the institutional arrangements associated with native title.

Knowledge about climate changes and the use of adaptive strategies across generations is embedded in Indigenous language and law, and continuously practiced through contemporary cultural management. For this reason, effective adaptation practice should ensure that Indigenous knowledge about the environment is afforded parity with scientific knowledge in decision-making processes. As climate impacts are experienced more acutely, this knowledge is likely to become increasingly valuable. As such, active measures must be made to ensure legal protection of intellectual property rights with regards to this knowledge.

5.2.2 Community participation

Adaptation planning may lead to significant interventions in Indigenous communities, from the installation of new infrastructure or alterations to existing infrastructure, through to relocation. Adaptation is not a value-free process, for the types of considered activities may be disruptive and potentially divisive. Similarly, adaptation planning and implementation is a resource-intensive process. An inappropriately designed planning process is more likely to divert attention away from other programs or developments in the community. As a fundamental precondition, a framework for adaptation must enable sufficient and culturally appropriate participation in decision-

making, and ideally should be driven by and respond to the priorities and aspirations of traditional owners. It should 'serve' traditional owners, rather than 'be done on them' (Ross 1990:186).

At a minimum this is an explicit obligation under the United Nations Declaration on the Rights of Indigenous peoples (UN General Assembly 2007), which requires under Articles 18 and 19:

- governments to consult and cooperate with Indigenous groups through their own representative institutions
- free, prior and informed consent (FPIC), before adopting and implementing legislative or administrative measures that may affect them
- a right to participate in decision-making in matters which would affect their rights, through representatives chosen by themselves in accordance with their own procedures
- a right to maintain and develop their own Indigenous decision-making institutions.

Green (2007) has identified the priority requirement to establish comprehensive community engagement strategies for adaptation planning, informed by Indigenous philosophies, and social and cultural values. Appropriate community participation is essential to adaptation planning to build confidence, transparency, trust, and ultimately support, in the adaptation process. In general, it is a foundational principle of democratic governance that people should have a say in decisions about actions which affect their lives (IAPP 2003), and this cannot be achieved without meaningful collaboration with those communities on their terms. As such, Indigenous adaptation planning processes must engender direct participation by Indigenous people to define and articulate their interests and needs in climate change matters. Effective participation is also likely to include a complementary and structured program of capacity building, such that traditional owners and Indigenous communities develop their understanding, skills, knowledge and confidence to actively participate in planning decisions. The establishment of agreed protocols on engagement is necessary to provide assurance and equitable conditions regarding consultation and negotiation, so as to guarantee input into decision-making, protect Indigenous knowledge and build long-term understanding of cross-cultural issues.

Culturally appropriate adaptation planning should not merely seek to involve the community in decision-making, but should also be structured to enable recognition and reinforcement of Indigenous identity and status of traditional ownership and custodianship. This should include the recognition and respect of customary governance arrangements for negotiation, authority and decision-making. As reflected in the Miriwoong case study, alignment of the adaptation planning process with the complex governance structures of Aboriginal institutions ensures that roles and responsibilities are embedded within local institutions and meet individual and community needs.

Adaptation involves the identification of potential social and economic benefits of climate change, and the planning process should be conducted, so that the communities can obtain maximum beneficial outcomes. For example, some traditional owners are in a privileged position to develop economic opportunities through participation in the carbon farming, sequestration and abatement activities. A range of benefits exist that are available to communities through their active involvement in adaptation planning and consequent adaptation actions, including fulfilling cultural obligations, practising and passing on traditional knowledge, providing employment, education and enterprise opportunities, improved management and health of country, and greater involvement in decisions that are important to and impact on Indigenous

development futures. As a result, opportunities are created by the early implementation of actions, which can also reduce potential future costs that can arise from the failure to minimise exposure. An appropriate adaptation planning framework must not merely limit exposure to risks, but be able to demonstrate and deliver community benefit, for three reasons:

- to ensure the viability of adaptation beyond initial planning investments
- to provide sufficient incentive for community participation.
- to enable any social or economic benefits flowing from adaptation to be made available to Indigenous communities (as a principle of distributive justice for the ongoing sovereignty and traditional custodianship of land and resources impacted by climate change).

5.2.3 Barriers to participation

A significant body of research has identified a number of barriers to effective engagement, which are commonly experienced by Indigenous participants in government planning processes. Ward et al. (2003) studied Indigenous involvement in natural resource management in Australia, and identified the common and pervasive impediments as:

- limited understanding and appreciation within government of Indigenous perspectives, responsibilities to country, the relationship with the land; and the implications of this perspective and cultural practices for natural resource management
- economic and social situation of many Indigenous people, which makes participation in government consultations difficult
- absence of respect for Indigenous people, their authority, views and knowledge relating to natural resource management and Indigenous cultural associations
- inflexibility of government culture, operations and systems to respond to the needs and expectations of Indigenous people, including inappropriate timeframes, styles of communication, bureaucratic systems, staff turnover and changing political agendas
- inadequate government resources and priority for Indigenous participation
- failure of the past efforts to produce tangible and beneficial outcomes.

Additionally, there are unique difficulties in working with Indigenous communities in northern Australia, such as the volume of existing processes that call on the involvement of traditional owners; the challenges of communicating with groups where English is a second or third language, particularly for complex, technical matters such as climate change; and extended wet seasons and remote locations of communities, which make communication and travel difficult and expensive. Planning processes historically have not accounted for the cultural practices and custodial responsibilities of Indigenous people, which can impact on timeframes and requires flexibility in procedure.

Howitt and Suchet (2004) argue that these barriers may not only be circumstantial, but also relate to the deeper inconsistencies in the ways that planning is conceptualised by Indigenous and non-Indigenous people. According to these authors, 'planning' relies on a very particular way of thinking about the passage of time and the control that people can hold over the organisation of space. In planning, 'a future is envisioned, one which is open to deliberate human intervention prioritising becoming, moving towards, achieving and goal setting'. This is a very linear way of thinking that Indigenous people may not share. Instead, a more culturally appropriate way of approaching planning is to open up a 'recognition space' that there are other ways of thinking about time and space, and work through defining the categories and meanings of processes that rely upon this linear mode of understanding the way our actions influence the world.

This is especially pertinent to climate adaptation planning, which relies fundamentally on the ability to measure and project future change (Fussell 2007; Hay & Mimura 2006). The current degree of access to global climate observations and simulated climate models is a new and unprecedented capability. As Fussell (2007) argues, most past 'societies that experienced changes in climate had few means of understanding its extent, identifying its causes, and predicting its future path'. Adaptation planning that relies on this very particular and very recent form of knowledge may not accord with traditional understanding of weather and climate, and may also serve as a conceptual barrier to engagement.

Moser and Ekstrom (2010) provide a useful distinction between barriers and limits. While 'limits' are defined as permanent, immutable and absolute boundaries, they define barriers as 'obstacles that can be overcome with concerted effort, creative management, change of thinking, prioritisation and related shifts in resources'. The failure of past engagement programs and the historical exclusion of traditional owners from planning processes are not immutable, and more recent experience attests to the ability of such impediments to be overcome. Reviews of Indigenous engagement (for example, Smyth, Szabo & George 2004) that have identified means of overcoming these barriers include:

- dedicated resources and personnel available to be directed towards the needs identified and prioritised by Indigenous people
- strategic approach to engagement that addresses material concerns and demonstrated tangible community benefits
- deliberate and adaptive engagement process that is responsive to Indigenous cultural protocols and recognises the diversity among Indigenous people
- capacity building of both Indigenous and non-Indigenous participants in the process
- dedicated and neutral facilitators who are committed to Indigenous empowerment, priority setting and decision-making.

5.3 Climate adaptation planning frameworks

In developing a planning and decision-making framework suitable for adaptation planning for Indigenous communities, the recognition of cultural diversity limits the extent to which a prescriptive approach is feasible (Taylor 2003). Rather than attempting to provide a definitive model, the following sections will explore three related questions:

- What are the objectives and desired outcomes from an Indigenous adaptation planning process?
- What existing frameworks are available that can assist in the achievement of these objectives?
- What additions or changes are necessary at each of the stages of planning to increase the suitability of these frameworks for an Indigenous context?

5.3.1 Objectives and outcomes of Indigenous adaptation planning

The central objective of implementing an Indigenous adaptation planning process for northern Australia is to establish a set of priority actions to reduce vulnerability to, and increase benefits from, the impacts of climate change that are owned and endorsed by the traditional owners and wider Indigenous community. Adaptation action can be defined broadly to include a wide range of initiatives, such as adapting existing or the creation of new policies and programs, the initiation of community development projects, or the implementation of technical, administrative, infrastructural or economic adjustments. An adaptation planning process should develop a strong negotiation position for traditional owners in engaging with government agencies and others on issues of climate change. Ultimately, adaptation planning process can be seen to be successful when Indigenous communities have the skills and confidence to discuss and negotiate on climate issues and to respond to climate change in a comprehensive and coordinated manner.

Although the objective of an Indigenous planning program is intended to serve the interests of Indigenous communities primarily, it is anticipated that the process will contribute directly to the improvement of adaptation activity in northern Australia through a more culturally comprehensive approach that incorporates Indigenous knowledge and values. Capacity building, engagement and project activities undertaken to achieve this objective are likely to entail a series of co-benefits for the community. The extent of community ownership of adaptation activity will be a direct consequence of the extent to which these co-benefits are realised through planning and implementation.

Outcomes from a successful adaptation planning process may also include:

- increased engagement and participation by Indigenous people in adaptation planning and management, and an improved community capacity to participate equitably in adaptation decisions
- increased community understanding of the nature and extent of climate risks
- identification of opportunities to enhance social benefits and reduce adverse impacts
- increased employment opportunities for Indigenous people in the range of activities involved in climate mitigation and adaptation, including participation in the emerging low carbon economy
- identification of community opportunities to access funds for adaptation projects
- improved understanding of how Indigenous interests, values and knowledge can be incorporated into adaptation planning undertaken by non-Indigenous, mainstream agencies
- increased recognition of the specific risks faced by Indigenous communities through climate exposure, and of the options for the protection of values, use and customary management regimes for natural resources
- increased role for cultural and TEK in the assessment of risks and the monitoring of climate impacts and adaptation measures by Indigenous and non-Indigenous stakeholders
- enhanced community capacity to develop and implement climate adaptation actions on Indigenous land, and how this can be incorporated with other land management activities such as fire management and weed management, cultural heritage and 'caring for country'.

Three adaptation planning approaches that could assist in the achievement of these objectives are RM, ID and CBA, which are discussed immediately below.²

^{2.} Although the latter two approaches of ID and CBA are variations on a more general RM approach, they offer significant amendments to the RM approach and are highly relevant for Indigenous adaptation planning; hence, they are considered in this chapter as distinct planning approaches.

5.3.2 Risk management

RM has a well-established history of application in the full range of government, business and community planning processes. Its adoption as a climate adaptation planning framework has become increasingly predominant (Jones 2001; Willows et al. 2003; Lim & Spanger-Siegfried 2004). At least part of its appeal derives from the generally high level of familiarity that decision-makers have with RM as a decisionframework, but also due to the alignment between its objectives and those of adaptation planning. This has been supported by the production of generic guidance and guideline products that have established a consensus framework through a widely endorsed international standard (Standards Australia & Standards New Zealand 2009). Jones and Preston (2010) argue that RM is the most appropriate overarching framework for assessing climate change adaptation, and most alternative approaches to adaptation are compatible with a broad risk assessment framework. This is confirmed by Webb and Beh (2013), who suggest that there is a high degree of reliance on a RM framework in the available range of tools and products to support adaptation processes. RM proceeds from the definition of risk as the effect of uncertainty on the achievement of outcomes, and comprises a sequential, but not necessarily chronological, iterative procedure.

The application of the generic principles of the RM framework to climate adaptation generally entails the following five recurring stages (Jones & Preston 2010; Webb & Beh 2013).

- Scoping and initiation: a baseline of existing conditions and trend is established through an analysis of the context in which adaptation is to occur. Areas of uncertainty are identified as gaps, and further investigation is initiated as required. Objectives and expected outcomes from RM are framed, and the mandate of affected stakeholders to proceed with the framework is secured.
- 2. Risk identification and evaluation: risk assessments are conducted to assess both the exposure to hazards and vulnerability. The consequences of the risks and the likelihood of their occurrence are analysed through techniques of scenario development and impact analysis. The degree of exposure to those risks is established and agreed upon, and are then prioritised on the basis of community values, probability and magnitude, potential costs and benefits, and the consideration of existing capacity to meet those risks.
- 3. Adaptation options assessment: options for dealing with those risks are considered and prioritised according to their feasibility, barriers to their implementation and cumulative impacts.
- 4. Implementation: chosen adaptation options are developed into actionable measures, with attention to timeframes, budgets and responsibilities. Delegation of roles, partnerships or the establishment of new institutions are negotiated as necessary.
- 5. Adaptive management: monitoring and evaluation techniques are used to subject the implementation of adaptation measures to regular and frequent assessment. Decisions are made whether to reinforce, re-evaluate or repeat the risk assessment process. The framework is continually improved through the application of learning from evaluation.

Some of these steps differ marginally from the generic RM framework established through the international standard (Figure 2).



Figure 2: Generic risk management framework (Reproduced with permission from SAI Global Ltd under Licence 1306-c107 http://www.saiglobal.com)

RM approaches assess the exposure of a specific region, community or system against two contextual variables: hazards and vulnerability. In hazard assessment, model- or expert-based climate projections are used to determine the probability and possible magnitude of biophysical changes or specific events that have the potential for harm. Drivers of climate change are projected through a cause-and-effect process to determine the likelihood of occurrence of hazards, such as sea-level rise, storm surge, drought or extreme rainfall events. In isolation, hazard-based assessments identify the risk potentialities, but the extent to which such hazards constitute a risk is a function of the vulnerability of a given system to those hazards. Hazard assessment is typically combined with vulnerability assessments that assess the ability of a region, community or system to respond to and cope with climatic hazards. Vulnerability assessments tend to emphasise the non-climatic factors that influence the capacity of a system to anticipate, manage, respond and adapt to future climate change. In adaptation planning, vulnerability assessment emphasises socioeconomic and institutional determinants, adaptive capacity and resilience, and the experience of managing past climatic risks and variability. Where hazard assessment places a strong reliance on model-based climate and climate impact projections, vulnerability assessments place an expanded role on stakeholder engagement and qualitative information. Determinations of priority climate change risks are a function of the magnitude of hazards and degree of vulnerability of a community or system to that hazard.

Current best practice in RM accounts for adaptability and flexibility in the framework, which is achieved through monitoring and review. Monitoring and review is regarded as especially critical for climate adaptation given the high degree of uncertainty in projecting specific and localised climate impacts. Systematic and frequent review of

adaptation decisions and actions is necessary for these to remain applicable given unanticipated changes or maladaptive consequences. Monitoring and evaluation are seen to support learning processes that facilitate continually improving practice, and generally enhance adaptive capacity.

Although communication and consultation is presented as continual throughout the process, the form and extent of engagement is subject to the informational requirements at each stage and the scale of the management activity. The framework eschews any prescriptive requirements about when, how and with whom communication and consultation should occur, other than adherence to the broad principles of transparency and inclusivity. Such questions are intended to be resolved through planning design, subject to the preferences of the community and assessor. Analytical approaches that limit the extent of active community involvement and instead rely exclusively on climate science are not uncommon in RM, however. This requires that the negotiation of terms of reference between stakeholders (including expert knowledge providers) and agencies clearly specific roles and responsibilities in the initiation phase of the RM framework. Adaptation planning does have some inherent characteristics that inhibit effective stakeholder engagement, such as the presence of misinformation and scepticism about climate change, which are common reactions to uncertainty, and variations in the capacity for long-term planning (Gardner et al. 2009). Understanding the role of stakeholders and the types of engagement activity for adaptation is an area of evolving research and practice.

Despite its ubiguity in adaptation discourse, the RM framework is not without limitations. By treating climate change as an emergent risk to be managed, the approach tends to overemphasise a deficit approach to planning. That is, risk exposure is conceived as a deficiency to be overcome through the allocation of resources (knowledge, time, finances and so forth) or the correct application of technical intervention or technological transfer. The approach simplifies the causal relationship between climate change, impacts and actions, with two consequences. First, it fails to account for the complexity of non-technical factors that affect the ability of a community or region to adapt. Although incorporating vulnerability assessments into RM assists in improving the consideration of non-technical information, it does not tend to account for the role of social values and multiple epistemologies in conceptualising, framing, understanding and responding to risk. Second, it limits the extent to which potential social benefits of change can be utilised or enhanced. There is generally a reduced emphasis on the potential to identify potential social or economic advantage through adaptive activity, or to necessarily align with community development goals. These are not insurmountable issues for RM, and indeed both the ID and CBA frameworks represent attempts to improve RM in framing planned adaptation.

5.3.3 Integrated development

Frameworks for adaptation planning that adopt a more complex approach for determining adaptation needs can be characterised as ID frameworks. Among these, the most fully articulated approach is the United Nations Development Program Adaptation Policy Framework (Lim & Spanger-Siegfried 2004; Burton et al. 2002). Adaptation is approached from within an existing policy and development context, and adaptation planning integrates exposure current and future climate risks with other developmental goals, policy objectives and institutional arrangements. ID adaptation shifts the focus away from individual adaptation projects as a response to climate change and toward a fundamental integration of adaptation into existing policy, management and planning processes.

This approach varies from RM in terms of the scoping and objective-setting phases. Greater attention is paid to the social and economic determinants of vulnerability in the context of unfolding social development pathways. Existing programs and policies within the community are assumed to affect adaptive capacity. These are identified and evaluated during the scoping phase to assist in the alignment of adaptation processes within existing measures or institutions. Programs examined in this stage include successful strategies in place that reduce impacts of climatic variation, or the management of past climate hazards. A focus on the wider policy context of adaptation assists the design of more robust planning outcomes that are able to be embedded within existing mechanisms of policy implementation and service delivery. Additionally, it can highlight potential agency partnerships and opportunities to build on strengths of existing program delivery in areas such as enterprise development and resource management.

Considering how adaptation accords with the goals and objectives of these programs allows for greater consideration of the risks currently managed by regions and communities in dealing with not only with climate change but also with natural climate variability and non-climatic stresses that limit or enhance their ability to adapt. The scoping phase also pays greater attention to local definitions of risk and vulnerability, and seeks a shared consensus about the risks to be managed through planning. Stakeholder analysis processes are used to gain a better understanding of the adaptation context, and roles and responsibilities of stakeholders – including policymakers, technical experts and affected communities – are defined prior to planning activity.

In the objective-setting phase, the objectives of adaptation planning are not limited to the management of risk, but are presented in terms of desired outcomes arising from the adaptation and are expressed across a range of achievable outcomes. Adaptation objectives are determined for the elimination of risk (also referred to as climateproofing), minimising or rectifying climate impacts, and for reducing the negative impacts of unavoidable risks. A broad range of adaptation objectives is preferred for the management of multiple timeframes and sequencing of climate impacts, for the accounting of local and regional variations, and in the selection of implementation options that better match with institutional capacity and preferred policy responses. In line with the stated goals of ID, these objectives are then assessed to identify potentially conflicting agendas and opportunities for collaboration and partnership.

Objective-setting also includes determining targets, or defined and measurable goals, that are used to assess progress against the identified objectives. Targets are defined through the selection of measurable indicators that are assumed to reflect the influence of actions on objectives. The selection of appropriate targets and indicators are informed by access to and the availability of data, including consistency with current data-gathering activity used in other policy measures. Re-purposing existing data enhances the cost-effectiveness of adaptation monitoring, and also allows for the integration of useful adaptation information within wider program and policy implementation.

The ID model advances adaptation by redefining adaptation planning as a negotiated social process. The ID framework recognises that risk assessment is not objectively determinable. Rather appraisals of risk involve the interplay between social perceptions and beliefs about and attitudes towards change, trust and credibility. What constitutes an acceptable risk will vary based on an explicit or implied evaluation of the trade-offs between expected costs and benefits, and this will vary across cultures, regions and communities. The social acceptability of adaptation is a consequence of a dynamic and negotiated change process, which cannot be achieved by technical means, or through

the implementation of a set of adjustments. This process is deeply structured in and by the existing socio-cultural and policy setting.

5.3.4 Community-based adaptation

CBA has developed from the applied work of international development practitioners, based on the experience of implementing adaptation projects in the context of multiple stressors on community wellbeing and socioeconomic condition. CBA is based on the assumption that adaptation projects in such circumstances are required to achieve multiple co-benefits simultaneously for affected communities, such as poverty alleviation, gender equity, environmental restoration and improved health outcomes. CBA does not provide a distinct planning framework as much as it brings the learnings from community development practice to bear on the principles and planning concepts of risk and integrated management. As a result it does forward an alternative series of assumptions and emphases that counterpoint the technical and managerial methodologies inherent in the previously described frameworks. Primarily CBA begins with an assumption that adaptation initiatives that combine community-ownership of programs with local knowledge and experience are essential to translate information about climate impacts into locally relevant action.

As opposed to expert or government-initiated processes, CBA is a community-led planning process that uses facilitated engagement and capacity building programs to harness community priorities, needs, knowledge and capacity to empower affected communities to plan for and adapt to climate impacts (Hug & Reid 2007; Reid et al. 2009). CBA begins with an assessment of expressed community needs and priorities. An assessment of community goals can help to ensure that the subsequent adaptation planning is tailored to the needs and interests of the community. Participatory techniques are used to identify the broad development and aspiration goals of those communities who prefer developing their own strategies to determine goals and facilitate engagement. Such techniques are based on the practice of Rapid Rural Appraisal (Chambers 1997), where the interests of groups are paramount to the design of policies and programs. Community development goals identified in this process are not intended to be limited to climate risk or exposure, nor could they be. As Reid et al. (2009) note, in regions experiencing multiple issues, planning activity that limited its attention only to climate-related considerations is unlikely to reflect community priorities, or ultimately garner sufficient community salience to generate local support and commitment. This is an important inversion of the purpose of adaptation planning in CBA – it is not conceived as a crisis-management intervention in response to emergent risk, but as a mechanism for accomplishing beneficial social and economic change for communities (Hug & Reid 2007). Rather than planning responses to climate impacts, CBA practitioners work with communities to consider and integrate the potential for climate change policies and programs to impact positively on the achievement of community-expressed goals, and to adapt climate change actions to achieve these goals as necessary.

Once community aspirations have been identified, climate science and model-derived information is made available and accessible to the community to improve their understanding of their exposure to specific risks. The provision of scientific information is conducted through carefully tailored communication methods, and is intended to improve the ability of the community to interpret, incorporate and integrate technical information and climate science. Climate projections are provided at a scale conducive to decision-making and action, and include information about the reliability of those projections. The technical information is coupled with local and traditional knowledge, particularly local knowledge about experienced changes and past strategies for coping

with climate variability and gradual and extreme climatic changes. This assumes that communities have well-developed resources for adapting to changes – resources and changes that may not be readily apparent to those outside of that community – and that local, experiential and traditional knowledge can prove a rich source of additional information, review, or a source of innovation for alternative and unconsidered solutions (Tan et al. 2008). In instances where climate data is unreliable or insufficient, local information may provide the most credible source of information for determining potential impacts (Reid et al. 2009). CBA is characterised by its insistence that equal weight be afforded to local and traditional knowledge. The emphasis on the sharing of past experience of climate events shifts the focus of planning to the enhancement of existing capacity that the community has for reducing vulnerability and adapting to change.

CBA invites the inversion not only for adaptation planning, but also for capacity building as a corollary to planning. Capacity building then shifts, so that local and Indigenous groups are also seen as sources of capacities, and the so-called 'capacity builders' become accountable to the community in terms of recognising their own needs for improved capacity in areas such as cross-cultural literacy and negotiation (Howitt & Suchet 2004). Community members are reconceived as valorised sources of initiative and innovation, rather than as the passive recipients of information or the subjects of an adaptive process. Examples in the literature on CBA bear out the relevance of this inversion. For example, Jennings and McGrath (2009) report that in one instance, the community rejected the initial focus on structural adjustments to the agricultural sector, and instead developed actions to improve childcare, family planning, access to loans and credit, education and health care. While these areas were not typically considered as adaptation activities, the community felt that focusing on these investments would then improve their ability to respond to climate change. This is also evident in the Miriwoong case study, where the five recommended strategies for adaptation address more fundamental goals relating to governance and landscape management, rather than technical or infrastructure investments. Examples such as these demonstrate the way that CBA counters inconsistencies between community ambitions and the goals of institutions, funding program designs or expert appraisals of priority or vulnerability.

Another key advantage of the CBA framework is that commitment to the implementation of planning outcomes can be maintained in the presence of uncertainty and scepticism. For example, if climate vulnerability is considered normal or impacts are perceived as too remote to warrant concerted action, more pressing community concerns and issues are likely to take precedence. Emphasis on responding to community-identified priorities and the pursuit of short-term benefits to address these priorities in the context of adaptation permits sufficient incentive for continued community participation. Community-based planning is also more likely to reveal no- or low-cost measures that deliver community benefit quite independent of future change. The CBA approach is more likely to produce positive outcomes, in the absence of reliable impact projections, by emphasising tangible actions that will build community adaptive capacity generally and that can be delivered through existing institutions or programs. Because the focus of CBA is on the elaboration of adaptive capacity, the outcomes from the process will be robust against a wide range of plausible climate futures.

As Huq and Reid (2007) suggest, an adaptation project initiated through a CBA planning initiative may be indistinguishable from a standard development project, and not obviously a response to climate change threats. CBA practitioners explain this as a consequence of the shared motivations behind both adaptation and community development generally – namely to ensure and protect the security and quality of lives, livelihoods, identities and assets (see Reid et al. 2009). Both adaptation and

community development initiate actions to respond to threats to these values. While adaptation responds to unprecedented threats, such threats are not so unique as to necessitate an entirely novel planning approach.

CBA practitioners warn that the few existing CBA projects are so recently implemented that they have not been subjected to rigorous assessment for resilience to climate variability, or to climate change generally (Huq & Reid 2007). This same argument could be equally mounted against the other planning frameworks. CBA is also limited by its preference for locally motivated action, which inhibits comparability and transferability across regions and groups, and resists a clear and stepwise methodology.

5.4 Variations to an adaptation planning framework

All three planning frameworks reviewed in this chapter offer relevant approaches for a planning framework for Indigenous communities. RM, ID and CBA offer convergent frameworks. The tensions between these frameworks should be considered less as incompatibilities, and more as choices to be determined by the needs and scope of the planning process to be implemented. For example, a planning process with the priority objective to minimise climate threats, and a significant amount of reliable predictive data about those threats, would suggest a RM approach. Alternatively, in a planning process that sought greater alignment of agency effort in the achievement of development goals, the integrated management framework would be more suitable. If however the overall goal of adaptation is community empowerment, and there is a high degree of community support for adaptation, the CBA framework would be appropriate. In general terms, these frameworks differ in terms of their informational requirements, the extent of community and technical participation, and their assumptions about the purpose of adaptation. They also differ in the types of planning outcomes likely to be delivered – RM is more likely to deliver technical solutions and resource transfers; ID adjustments to policy and partnerships; and CBA is more likely to produce projectbased initiatives.

Given the limited experience with Indigenous adaptation conducted in Australia to date, it is not possible to assert which of these frameworks is more suitable or desirable. A better understanding of the effectiveness of these approaches could be obtained through action-learning research initiatives that systematically evaluate the utility and appropriateness of each of these approaches. However, a balanced approach that combines elements from each of these frameworks in a fit-for-purpose configuration based on the specific context of adaptation is preferable.

Nonetheless, a number of amendments and adaptations are relevant to each of these frameworks and would assist in their salience for Indigenous adaptation planning. These are considered in the following sections, and linked to the stages of planning common to all three planning frameworks – scoping/initiation, plan development, implementation and monitoring and evaluation.

5.4.1 Scoping and initiation

All three approaches stress the need for an establishment phase, consisting of scoping and planning initiation. This phase is essential to establish the context of adaptation planning, identify and resource the planning governance, clarify the terms of reference and secure community and political support for planning. These considerations are common across all adaptation planning. However, Indigenous adaptation planning may need to consider the following in this phase – the drivers of adaptation process; scale of adaptation; approach to community engagement; need for FPIC; and establishment of engagement protocols.

5.4.2 Drivers of adaptation planning

The most determining characteristics for the success of adaptation among Aboriginal communities in northern Australia will be who initiates and resources Indigenous adaptation planning, and governance arrangements for managing the planning process. There are several potential drivers of adaptation planning, and given the intractable nature of climate change, initiation is more likely to be a joint undertaking by:

- governments at local, state and Commonwealth levels
- non-government actors, including regional service providers
- regional Indigenous institutions, such as Land Councils and PBCs
- Indigenous land and sea management organisations
- local communities.

One of the observations from CBA practice is that the presence of local drivers and process leadership is integral to the achievement of outcomes. Local drivers are essential to influence community decision-making, including the decision to initiate planning, and to enable the dissemination of information and adaptation learnings (Sekine et al. 2009). Even if the economic incentives for adaptation in different communities are the same, the resultant degree of adaptation activities of the residents at each community will vary depending on how deeply, and to what extent, leadership can influence the residents of individual communities (Chishakwe et al. 2012). For these reasons, an organisation with a clearly defined and transparent mandate to facilitate the adaptation planning process is preferred.

Selection of an organisation to lead and manage the process should have due regard to existing governance arrangements in the area and to the history of the organisation and its relationships with the community. The managing organisation will need to navigate the dynamics of political, social, cultural environments at all levels of governance, including community, prescribed body corporate (PBC), regional bodies, local organisations including local government, national agencies, government departments and the research community. Navigating these dynamics can have severe impacts on the ability of the organisation to lead the development of adaptation strategies. Groups with recognised native title or existing natural resource management, or NRM, organisations could incorporate adaptation planning within their existing responsibilities. However in remote areas with little or no organisational foundations for engagement, establishing the governance framework for adaptation will be complex and time-consuming.

Preference could be made for those organisations that can demonstrate impartiality and transparency. The impartiality of the managing organisation is relevant in its ability to promote inclusivity, ensure confidence and credibility in the process and provide incentives for participation. Ideally, that organisation would understand the external pressures and pre-existing commitments of the community, and have some previous experience in engaging the community in planning and management activities involving government or private sector partnerships.

Putnis, Josif and Woodward (2007) provide further criteria for the success of managing organisations. Their review of land and sea management arrangements in delivering natural resource management outcomes shows that adequate financial, administrative and reporting systems in the managing organisation are essential to allow the effective

allocation of resources with certainty to the community, and to provide acquittal and reporting information back to the funding agencies. This includes the need for adequate staff and board arrangements within the managing organisation to follow through consistently on delivering support and building capacity. This governance would need to be reinforced through mechanisms to ensure that the managing organisation is accountable to the community in fulfilling its roles and responsibilities.

5.4.3 Scale of adaptation

The second key consideration in the pre-planning phase is the required scale of adaptation planning. Adaptation occurs at multiple spatial and time-scales, across multiple climate sensitive domains, and in response to multiple scales of risk and hazard. Not all of these scales are suitable for climate change adaptation planning; for example, household responses to current changes in climate averages is more likely to be addressed through spontaneous adaptation, and less likely to require planning intervention. Given the amount of resources required for an effective planning process, it should be reserved for community-scale and larger adaptations requiring the involvement of multiple players and agencies. The CBA framework and the need for actionable and tangible outcomes suggest that the time horizon for planned adaptation should extend over several years, but be sufficiently scoped to be capable of delivering short-term or immediate outcomes to maintain community support. The scale of adaptation may be less of a consideration, subject to the motivation of the planning process. For instance, funding programs or agency priorities may pre-determine the scale of adaptive planning, or planning may be required to respond to specific threats or needs in the case of community-initiated planning. Scalar questions will similarly be circumscribed by the timeframes, resources and access to information.

Geographic scale is a pertinent consideration for Indigenous planning if it is to observe customary governance protocols, and to facilitate traditional modes of decision-making of Indigenous people. Externally initiated planning activities are seldom attentive to the nature of Indigenous interests in what Hunt and Smith (2006) refer to as the 'cultural geographies of governance' in a catchment. If the scale of adaptation planning does not align with the scale of Indigenous social organisation and customary governance, detailed anthropological and consultative investigations will be required. It cannot be assumed that the Indigenous populations in a given region or community are culturally, linguistically or politically identical, and a given area may have numerous language groups with rights, responsibilities and interests in particular sites, locales or connections to country. Indigenous land and sea tenure does not align easily to typical adaptation planning scales, and historically these territories have shifting and 'fuzzy' boundaries that allowed for sharing of resources and land in times of need or scarcity (Sutton 1995).

The complex of land tenure systems comprise what is commonly referred to by Aboriginal people through the English word as 'country': a socialised place created by ancestral beings who established the social, legal and economic institutions governing Indigenous societies. Use of the term 'country' is seen to encapsulate interconnections between land and water, but also history, identity, traditional law, people and social relations (Rose 1996). As such, a process for determining the social and economic aspirations of the communities, or for planning adaptation that aligns with those aspirations, will require an approach that corresponds to Indigenous ways of knowing and conceptions of country (Douglas 2004). This is clearly demonstrated in Chapter 6's discussion on how the Miriwoong and Gija worldviews shape the ways in which they perceive weather and understand concepts of climate change. The ability to speak for country is governed by strict community protocols for authorisation, nomination and representation. This is illustrated in the Warmun and Bidyadanga case studies in Chapters 6 and 7. Native title holders who have the right to speak for a particular spot sometimes do not communicate or take into account the other community members who live in the community for historic reasons; for example, the non-Karajarri people at Bidyadanga, and the Gija people originating from estates outside the immediate Warmun area. Those 'others' are disenfranchised, while the traditional owner with the right to speak may not even live in a particular community under discussion. These cultural requirements cannot be observed in the type of representative decision-making forum established through stakeholder platforms without a significant investment of time and support to the Indigenous representatives. Relationships between the different language groups that make up the population of a given area will require consideration when decisions are made that affect the future development of that area. Negotiation and agreement between these groups, some of who have never worked together before, is essential to ensure all interests are represented. The resources required, including time, for the establishment of a multistakeholder platform to negotiate and obtain the appropriate legitimacy will substantially increase the timeframe and budget required for an adaptation plan. Ideally, and to minimise issues related to cultural authority, adaptation planning should be undertaken at a language group scale. However, given the sheer number of language groups in northern Australia, many of whom face exposure to similar risks and vulnerabilities, this scale of planning is likely to be inefficient use of the limited resources available.

5.4.4 Engagement pathways

The three planning frameworks considered here differ markedly in terms of when engagement with the community should commence, with whom and for what purposes. Risk assessment, for example, tends towards community participation only after the nature of the risks, including their potential consequences, is thoroughly understood. In contrast, CBA would promote community involvement before any assessment of risk and would include the community as partners in issue identification, goal setting, planning design, implementation and monitoring. For Indigenous adaptation planning, early involvement is necessary to obtain consent to a planning program before the finalisation of a planning project design. Some preparatory work in terms of understanding the region and its population is essential, but the initiation of planning activity should not commence without community endorsement.

When to engage is perhaps less of a contested question than whom to engage with. Correctly identifying the relevant groups for an engagement process is a common issue for people who work with Indigenous communities. Part of the difficulty comes from the definition of the word 'community'. As Moore (2001) suggests, the term community can have many different meanings depending on the context. In engagement programs the 'community' tends to refer to people who live in a particular area or region. However, when discussing issues to do with climate change, and in particular the management of natural and cultural resources, the priority is to work with the traditional owner groups that have an historical and accepted responsibility for caring for a particular country.

Working with the traditional owners is not the same as working with the community (Moore 2001). This is not to suggest that the wider Indigenous community – the Indigenous people who live in the area – should not be engaged. The wider Indigenous community is likely to have their own interests and concerns in adapting to climate change, and will unequivocally be impacted both by climate changes and adaptation decisions. However, the highest priority for preparing to work with the community is to

identify and work with the traditional owners that speak for the different parts of the area subject to an adaptation plan. Traditional owners are the recognised authority for decision-making with respect to country, and will provide guidance on who should be involved in planning activities. Working with traditional owners can be more challenging than working with Land Councils, PBCs or other organisations. They are less likely to have an office or have a formal organisational structure with elected representatives, staff or regular meetings. A further complication is that traditional owners may no longer live in the area that they have custodial responsibilities for, and special arrangements may be necessary to ensure that non-resident traditional owners are also identified and engaged.

Appropriate engagement pathways for adaptation planning are best served by working within existing networks and institutions to incorporate adaptation into existing programs and service provision. This holds true for Indigenous communities also. A preliminary stakeholder analysis process can be conducted at this stage to ascertain those agencies and service providers that are operating in an area and that have an established history of successful engagement. Similar consultations may have occurred recently in the area, and any relevant outcomes should form part of preliminary data gathering before an additional request to consult with the communities is made.

5.4.5 Free, prior and informed consent

Engaging with Indigenous communities on any project that has the potential to impact on the traditional ownership and cultural values of country should not commence without obtaining the FPIC of the traditional owners. FPIC is best described as a process by which a community is informed of the risks and benefits of a proposed project, so that they can make an informed choice about whether they believe the project should go ahead, and how they would like to participate. Adaptation must observe the requirements for FPIC before planning activity commences. Similarly, actions that are undertaken based on the outcomes of the planning process by other agencies need to uphold these requirements, especially if the actions have the potential to impact on other communities who were not involved in the planning.

FPIC requires allowance for community input into the design of the planning process, and a commitment to modification of proposed planning activities based on community feedback. A detailed proposal of the adaptation planning process should be prepared, and the community must be allowed sufficient time to review this proposal to make a decision. Planning proposals may require several amendments before the obtaining permission to proceed. The proposal to commence adaptation planning should address the following questions.

- What are the aims of the adaptation planning? What is its intended outcome?
- What is the timeframe available for planning?
- Who is funding the planning? To what extent? What are their aims and objectives?
- Who else will be involved in developing the plan?
- Who has been involved in developing the planning proposal so far?
- What are the potential benefits for the local community? Will these be temporary or permanent?
- What are the risks to the community in conducting adaptation planning? What are the risks of not conducting adaptation planning?
- How will the appropriate cultural protocols been included in the design of the planning activity?

- What activities will be conducted, and how will the community be involved in these activities?
- What are the expectations for community participation? What are the benefits for the community in participating in this project?
- Have similar projects been undertaken elsewhere? What have these projects achieved?
- How will progress on the plan be assessed? On adaptation generally? How will this be documented?
- What mechanisms will be used to communicate with the community about progress?
- How will community concerns with the planning be addressed?
- Who will have ownership of any outcomes, such as an adaptation plan or documented traditional knowledge?
- How will Indigenous knowledge and practices be protected, and intellectual and cultural property rights in that knowledge preserved and secured by the traditional owners?

There are four clear requirements for FPIC – it must be free, informed, prior and consensual. First, traditional owners must voluntarily agree to adaptation planning taking place. This means that traditional owners have the right to say no to the project if they do not believe it is in their best interest to allow it to proceed. The traditional owners can also negotiate changes to the design of the project if they consider that this is in their best interest.

Second, traditional owners must have access to enough information about the project, including their rights and obligations, and the risks and benefits of the project, in order to make a decision whether the project can proceed. The planning proposal should provide as much information as possible up-front about intended outcomes and objectives, as well as providing reliable information about potential climate change impacts, vulnerabilities, adaptation options and tools, good practice examples and advantages of adaptation. Additional information should be provided at the request of the community. Any information should be provided in the language and format, so that that all members of the community fully understand the project and its consequences. Translators or experts in cross-cultural communication may need to be engaged to assist in this task. The community may also wish to seek independent advice about the impact of the process, and may need assistance in getting access to that advice.

Third, the requirement for prior consent means that permission to undertake planning by the traditional owners is required before the commencement of any work that is likely to impact on the community. Baseline research in the preparation of a proposal may not require FPIC, but this will depend on the extent and any consequences of that research activity. If the community does not agree to the terms of the project, it may be necessary to redesign the proposal to better meet their interests, and seek permission at a later date.

Finally, there must be consent. The traditional owners must make an agreement together to allow the project to proceed. This agreement should be recorded either in writing or as part of the official minutes of a community meeting. Unanimous support is not usually required, and objections to the proposal can lead to changes or amendments that benefit the planning process. Incorporating these changes may lead to a planning process that addresses the wider needs and aspirations of the community as a whole, while avoiding creating tension in the community, which can later impact on the success of adaptation initiatives.

It is important to recognise that community has the right to not participate in adaptation planning and management if they have other priorities. In this case, adaptation planning may be better incorporated into existing programs and networks, such as measures for disaster management, natural resource management, public health and education programs. Proceeding without consent significantly reduces the likelihood of willing community participants, and compromises the ability of the planning process to deliver its intended outcomes. Conversely, the flexible and patient pursuit of FPIC will:

- improve the knowledge and understanding of climate change and the need for planned adaptation
- ensure that the planning process is aligned with community and cultural protocols
- identify unanticipated gaps, issues or challenges that may limit the effectiveness of adaptation planning and implementation
- ensure transparency and accountability in the project
- build community ownership of the project through a shared understanding of objectives and outcomes
- establish a reciprocal relationship based on information exchange, feedback and respect
- ensure that the planning process is relevant and targeted to community needs and aspirations
- address issues arising from past grievances where similar engagement activities have not adhered to culturally appropriate protocols.

5.4.6 Establishing engagement protocols

Adaptation planning should be based on a negotiated agreement with traditional owner groups or delegated representatives around an engagement protocol. Engagement protocols are an increasingly recognised way of ensuring that there is clarity between project partners and Indigenous communities, and are a key mechanism in furthering recognition of Indigenous rights. Agreed engagement protocols specify and formalise the planning framework, and seek to establish a more level platform for negotiation, where ownership and control of the decision-making process is consistent with the traditional governance arrangements in the region.

Typically Indigenous communities have been subjected to many so-called 'consultations' where their only role has been to respond to the interests and objectives of government agencies. In such cases the community is unable to set the terms of the engagement and consequently is at a disadvantage in negotiation. The response of the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) to the Australian Government's Living Murray Initiative establishes the importance of engagement protocols in creating more equitable conditions for consultation and negotiation.

The initial building block for involvement by Traditional Owners should be protocols with Indigenous Nations about how they wish to do business with government and the general community on management of natural resources. (MLDRIN 2003:6)

Engagement protocols are not transferable, and need to be negotiated *in situ*. Some land areas may already have protocols in place as a result of other consultations Indigenous communities have done with government or industry, and these protocols may be adapted for planning purposes in collaboration with traditional owner groups or representatives. The advantage of providing a structured method for developing an engagement protocol is that this community document can later be used as the basis for other consultations and negotiations involving the same community.

There is no best standard practice for engagement protocols, and formats have varied from a verbal agreement to the more formalised memorandums of understanding, or MOUs. They can contain as much or as little information as is required by the consulting and negotiating parties. However, engagement protocols have assumed greater importance as a mechanism for the protection of Indigenous cultural and intellectual property rights. These rights refer to the wide array of traditional knowledges, practices, beliefs and expressions of cultural values through ritual. community laws, performance and artistic works held by Indigenous people. It would also include any documentation of this heritage. Protection of these rights is of critical importance to Indigenous people, particularly to prevent the transmission of knowledge and practices that breach customary legal obligations. An adaptation plan is likely to involve the use of such knowledge and practices, such as those relating to TEK. There is no specific legislation in Australia that recognises and protects Indigenous cultural property rights. According to the National Copyright Unit (NCU), the most effective way to protect Indigenous cultural property rights is through the development of engagement protocols (NCU 2012).

Mechanisms to protect intellectual and cultural property can be implemented in an engagement protocol through agreements relating to confidentiality and benefit sharing. The engagement protocols should specify that all information, knowledge or intellectual property will remain strictly confidential at the request of the traditional owners. This relates not only to public access to this information, but may include requirements for how information and knowledge is stored, retrieved and identified. Additionally, the engagement protocols should specify that any benefits from the use of that knowledge or property should be negotiated to ensure that an equitable distribution of those benefits is achieved. Publication or commercialisation of those materials should not proceed without the written approval of the knowledge holders or owners.

5.5 Planning

In all three of the frameworks, the stages of planning are relatively consistent and easily synthesised into a broad approach, as follows:

- identification of broad community goals and aspirations (CBA/ID)
- establishing targets to reflect those goals (ID)
- assessment of climate-induced risks to the achievement of those goals (RM/CBA/ID)
- identification and investigation of probable/potential impacts (RM/CBA)
- identification and prioritisation of available options in adaptation measures (RM/ID/CBA)
- assessment/testing of viability of adaptation options (RM/ID/CBA)
- selection of actions for implementation (RM/ID/CBA).

There is no evidence to suggest that these stages would not be applicable for Indigenous adaptation planning. Instead, there is a long history of undertaking planning activities in Indigenous communities. Several well-developed resources mean that work in these stages are practically relevant, accessible and culturally appropriate. For example, Walsh and Mitchell (2002) provide an indispensable resource for the selection and facilitation of planning and capacity building tools for working with Indigenous communities and traditional owners. Their book contains 15 planning techniques that have been developed internationally and applied successfully in Central Australia. Similarly, the approach to country-based planning developed by Smyth (2011) could be usefully adjusted to incorporate adaptation planning.

5.5.1 Language and concept definition

Community ownership of adaptation is vital to its successful implementation; however, adaptation is likely to compete for community attention with other more immediate issues. As a general principle across all frameworks, community ownership is more likely to be achieved if the planning process can be structured to involve participants throughout. In most instances the achievement of community ownership will only be marginally controllable by the efforts of adaptation planners. It largely depends on the presence of a trigger event that brings the adaptation work into wider recognition. This can happen in a range of ways – for example, the involvement or commitment of key community leaders; bringing the community together in a regional forum; or an external pressure that creates a risk requiring a whole-of-community response. While these types of triggers may be unanticipated, they are likely to expand community interest in adaptation, and highlight the need for a systematic approach to engagement. Ideally, the community takes on organising the terms of engagement themselves – setting up reference groups, seeking information, engaging research and developing plans.

One of the frequently cited impediments to community ownership arises from the usefulness of information provided to community decision-makers in availability, relevance and accessibility, as well as credibility and legitimacy of the information and information providers (Moser & Ekstrom 2010). Likewise, informational boundaries are a function of the community receptivity to that information (Moser & Ekstrom 2010). This highlights the importance of capacity building as an initial step in the planning stage; namely, in building the framework for meaningful discussions by improving the local capacity to articulate values and interests in relation to climate change risk. A key part of this stage is about language and definition and that there is mutually explored understanding about key terms used in adaptation. Risk and vulnerability will likely be conceived of differently in different regions. Concept development that allows for the community to be fully informed before decisions are made can take a long time.

Adaptation remains dominated by a technical approach that relies on the use of non-Indigenous science and technical information. Like all areas of management, the approach has developed its own technical lexicon and uses terms that are unfamiliar to professions and people outside of its narrow disciplinary purview. Working through the issues of language in adaptation must be approached as a process of mutual learning and exchange, involving reciprocal processes of translation. To be empowered in the decision-making process, people will need to have access to enough information to make an informed decision. This information will need to be relevant, up-to-date and meet their needs. The discussion and results presented in the following chapter (Chapter 6) clearly demonstrate the limitations and barriers that complex and technical language can present. The very fact that Miriwoong and Gija peoples do not have words in their languages for 'climate' or 'weather' highlights the difficulties faced by adaptation planners in delivering climate services to Aboriginal communities in Australia.

In some instances, translation will be a literal process. As Howitt and Suchet argue, 'In talking about their country, people should be able to use their language without hesitation or apology' (in Walsh & Mitchell 2002:26). Part of the planning process will be the literal translation and interpretation of science and policy into Indigenous language. But translation also involves making existing information and previous research on climate change or the region available and useful to the community. Communication of technical information needs to be matched to the capacity of the community. The complexity of information must be presented cogently to enable people to understand and engage with the content. This may require the development of plain-English communication materials and the involvement of specialist interpreters.

Importantly, not all interpreters have experience in science communication; they need to work closely with information providers, so that the information being provided is accurate. The translation and communication of climate change to Aboriginal people in the Kimberley will need to be a multi-layered process of extension at the local level. Boundary organisations (Cash et al. 2003; Guston 2001; Vogel et al. 2007) will need to become long-term enablers of communication between research and local communities. The success of this research project, through its partnership with KLC, MDWg and WAC, has demonstrated the importance of boundary organisations in adaptation research. These organisations have been identified as regional champions that have the potential to be leaders in adaptation planning in the Kimberley.

The translation process should also work the other way, in assisting non-Indigenous decision-makers to interpret and translate community values and aspirations that can help decision-makers take account of these in adaptation planning. Good facilitation ensures two-way communication between knowledge providers and decision-makers. This is a different approach from information giving, in that facilitation requires dialogue and negotiation. Infrequent contact, exclusion from knowledge generation processes, and a lack of understanding of needs and capacities between knowledge providers and decision-makers lessens the effectiveness of this knowledge exchange. In many Indigenous communities there is limited experience with formal climate adaptation, planning and technical aspects of climate science. There is, however, extensive and detailed knowledge of weather and climate derived from TEK systems. As discussed in Chapters 6 and 7, basing climate change discussions on traditional knowledge systems is essential if Aboriginal communities are to successfully understand what climate change means to them. The major challenge is how to allow for a two-way exchange of knowledge and information in a culturally sensitive and respectful manner.

Mutually agreed concept development allows the community in turn to take on more of an active role in adaptation, by seeking out additional information and requesting to be kept up to date with planning activity. Concept development is an essential adjunct to the planning process to build engagement readiness. Joint projects that allow for wide participation and that demonstrate tangible results in this stage help to build credibility and show the relevance of the program.

5.5.2 Objective-setting

Identifying community aspirations, needs and priorities is essential for designing and implementing adaptation that makes best use of the available resources, and is most likely to generate community ownership. Community aspirations cannot be assumed or derived without the explicit engagement of traditional owners. As Altman et al. (2009) argue, the diversity of Indigenous circumstances and aspirations requires detailed, targeted studies of local needs and interests. Green, Jackson & Morrison (2009) recommend the use of community assessments that employ ethnographic methods. The workshops and engagement strategies employed in their report provide relevant examples of the types of engagement strategies appropriate to objective-setting in adaptation planning. Among their insights, it was important to gather information in a way that respects and reflects the internal diversity of Indigenous communities. Qualifying information should be recorded to best understand relevant differences in the community, for example, how aspirations differ in different language groups, genders, age or area. It might not be appropriate to present this information back to the community in this format, but recording this information should help the community to represent all of its interests, so that the process does not strengthen the voice of some groups of participants at the expense of others.

The objective-setting process should adopt the principle from CBA that inquiry into aspirations be framed broadly and not merely in terms of climate-related issues. Community aspirations may be expressed across a broad range of community interests, including native title rights and recognition; economic development goals; continuing cultural practice, such as ceremonies and intergenerational knowledge transfer; protection of and access to significant sites and landscape values; improved health outcomes; language preservation; and access to employment opportunities. Past programs are likely to have documented regional and group needs and interests, although this may not have been done in a format or at a scale conducive to adaptation planning. Targeted consultation is necessary to identify specific interests of the community, and the extent to which the achievement of these aspirations can be enhanced or facilitated through climate adaptation.

Moving too quickly to identify needs and priorities of adaptation can simplify or distort issues, leading to outcomes that are marginal to the community. Some further awareness-raising activities may be needed before issues, values and concerns can be accurately identified. Initiating conversations about aspirations may initially appear to be beyond the scope of an adaptation program, but such conversations shift the emphasis of adaptation away from a specific pre-occupation with climate-related risks, and looks to focus community motivation on the underlying issues to be addressed. An aspiration-based approach is more consistent with addressing climate-risk in the context of community-based management of a cultural landscape.

Conversations about aspirations are likely to also generate a list of concerns that the community hold. In areas of high disadvantage, the emphasis will be on problems that are immediate and pressing to the community, and although they may not be explicitly relevant to adaptation, it is important that these are recorded and considered as part of planning. Sometimes dwelling on these concerns might be counterproductive, but identifying opportunities that explicitly target these concerns clearly has co-benefits. Such opportunities can also become the basis of future activities in capacity building, because of the additional information, joint fact-findings, and localised community-based solutions to identified problems. Such non-climate change concerns can be used to begin a conversation about other types of actions for inclusion in adaptation planning.

There may however be some critical reasons to avoid a problem- or concern-driven planning process. Some of the concerns of the community relate to their capacity or influence to effect solutions in the context of global climate change. The approach of CBA pays special attention to the role of framing adaptation. A focus on expanding existing capacity can avoid an overemphasis on climate impacts that are outside of the community's sphere of influence or ability to control. Experience with CBA practice has observed that an exclusive focus on climate impacts is disempowering for communities (Reid et al. 2009). Focusing on problems tends to be regressive. Franks and Blomley (2004) point out that planning based on addressing shortcomings or deficiencies can limit the attention that people give towards developing new ways of thinking and being. The two researchers suggest that that a problem-based approach is particularly useful where the issue is relatively technical and where there is a high degree of consensus among the stakeholders about its cause. For example, a problem analysis approach is probably more useful for confronting issues with an identifiable and actionable cause. Given that the cause of climate change is increased greenhouse gas emissions globally, which Indigenous communities have little capacity to influence, a problemsolution framework for adaptation is untenable.

5.5.3 Climate risk assessments

Following the approach of CBA, the risk assessment component of adaptation planning entails assessing the potential of climate change to impact on the achievement of community-expressed goals, and to adapt the climate change actions to achieve these goals as necessary. Both hazard and vulnerability assessments are useful. The approach should seek to involve external knowledge providers and local, traditional and customary knowledge in the evaluation of risk. This may involve additional information gathering and research if the available knowledge is limited or not conducive to an improved understanding of the specific climate risks to be addressed.

Some previous reviews have shown that working in collaboration with research and science support has led to successful capacity building. Putnis, Josif and Woodward (2007) have shown that when researchers work alongside Indigenous land and sea managers with their local ecological knowledge and skills, the 'two tool-box' improves both the capacity of researchers and the community at the same time. If this work is based on identified knowledge needs that the community have expressed, the community can also better direct the way that research is done on country, and be in control of how information and knowledge is protected.

The informational needs relevant to the hazard and vulnerability assessments include:

- community awareness and understanding of climate change, potential impacts and vulnerability
- relationships with potentially impacted biophysical resources and environments, including spiritual, cultural, economic, aesthetic and recreational values associated with those resources and their contribution to livelihoods and quality of life
- perceptions of risk and vulnerability to climate
- effective adaptation measures used to address current climate risks and variability
- capacity of local institutions
- availability of resources for implementing adaptation measures, including incentives for community participation in implementation.

In determining the impact of climate change on aspirations, structured focus questions could be used to guide a facilitated investigation, such as the following.

- What are some of the concerns you have about climate change?
- What do you know for certain, and what are you unsure about?
- What sites, places or practices are important to you? Can they be mapped?
- In what ways are these things important to you?
- What condition are they in? How are they changing for better or for worse?
- In what ways do the things that you value depend on the weather or season?
- What are the pressures or threats on those things?
- What condition would you like them to be in for the future? How would you like to leave them to your grandchildren?
- What do we need to do to get them in that condition?
- What can we do now?
- What forms of support would be useful to undertaking these actions?

Based on the review of aspirations, concerns and knowledge needs, there may be any number of projects that are an appropriate means for building adaptive capacity. Ideally the planning process generates a range of options for implementation activity, including short-term knowledge sharing and capacity building projects. Not all options will be feasible, and facilitated negotiation is necessary to prioritise adaptation options. Projects that are achievable in the short term can be delivered with existing resources, or presenting low-cost options that deliver multiple co-benefits should be emphasised. Focus questions to be considered in prioritising adaptation options include the following.

- How will this project contribute to the aspirations of the community?
- How will it address an identified concern or meet a knowledge need?
- What are the co-benefits of this activity for the community?
- What are some of the side effects of this project?
- How will this improve the capacity of the community to manage a range of different climate scenarios?
- How urgent is this project?
- If this project is shown to be ineffective, how difficult will it be to reverse its outcomes?
- What are the costs of the project, and what is the capacity of the community to implement it?

The project-based approach to planning avoids the trap of planning versus implementation. In many cases, Indigenous programs place too much emphasis on planning. Detailed research projects are commissioned, and detailed plans compiled by consultants. Past experiences have demonstrated that these outcomes are rarely used, can be culturally irrelevant and become obsolete (see Sayer & Wells 2004). It is more difficult to maintain enthusiasm for plans that do not lead to action. Using project-based work as a way of achieving planning outcomes has the advantage of momentum.

5.6 Implementation

Implementation of the outcomes from the adaptation planning process is dependent on the priorities set through the planning phase. The selection of adaptation priorities outlined here displays a bias towards a project-based approach to adaptation. It is recommended that the initial projects are not too ambitious, are contained within a short timeframe, ensure high levels of participation and demonstrate concrete results. The underlying objective of using a project-model is to establish short-term and achievable outcomes that allow the community to demonstrate to itself that it can successfully manage its own development (Caldecott 1996). Project implementation should involve the community at each stage from design through to implementation and evaluation. Skills and experience developed through the implementation of projects increase the ability of the community to analyse problems and seek solutions without reliance on external service providers. Over time the role of the managing agency should move from coordinator to observer of community adaptive action. Small, celebrated achievements step the community along in this process.

Although all communities are different, experience demonstrates that this process of capacity building can take as little as two to three years (for example, Franks & Blomley 2004). Some of the factors that impact on time include the number of people who need to be involved, scale of the activity, cooperation of other stakeholders and competing demands on the community (Walsh & Mitchell 2002). Monitoring is included as a key component of this stage, so that a culture of learning by doing is reiterated throughout the implementation cycle.

Implementation involves progressing the adaptation options into a formal strategy by determining responsibility for implementation, resource requirements, task allocation and appropriate support and governance structures. Where the required resources are not available in the community, partnership approaches with agencies and service providers may be necessary. Determining the necessary resources should include the

staff, facilities and funds to ensure that the program has a reliable foundation for longer-term follow-up and support. New management or oversight arrangements should be created only as necessary, and delivery through existing institutions with an established regional history preferred.

One of the key limits of the CBA approach is the limited ability of local action to affect structural barriers to adjustment. These structural barriers include national or state policy directives and the allocation of resources to adaptation. There is a strong case for the establishment of cross-regional arrangements for advisory groups, adaptation policy groups and access to planning support expertise. Many of the issues to be addressed by Indigenous communities in northern Australia will be similar, and some will require adaptation actions that are beyond the policy reach of individuals, communities and groups. Adaptation policy structures can ensure that local adaptation plans are better coordinated with and contribute to national adaptation strategies. Similarly, regionally coordinated training and research can deliver efficient outcomes across multiple communities. Cross-regional arrangements may also be preferable for ensuring integration of Indigenous values and interests in the sectoral strategies favoured in current adaptation policy.

5.7 Monitoring and evaluation

Adaptation is an ongoing process for which systematic monitoring and periodic evaluation is vitally important given the degree of uncertainty associated with climate change. Uncertainty is present on two fronts – the uncertainty associated with the projection of specific climate impacts, and the uncertainty around the measures taken to reduce vulnerability to those impacts. A structured monitoring and evaluating framework initiated from the commencement of the planning process itself contributes to adaptive capacity, by ensuring that the community has access to information to improve the effectiveness of its adaptation measures.

A monitoring framework should be developed during the objective-setting phase, and may include the use of indicators as recommended in the ID approach. ID also stresses the importance of identifying data sources from other agencies or programs that can be used to assess progress against objectives. Monitoring should not only assess progress against broad objectives, but also should assess the ongoing feasibility of adaptation projects, including community commitment and participation. Ideally, monitoring information is cross-referenced against regular and frequent climate observations, to ensure that adaptation actions based on projected impacts align with the real experiences of climate change and variability. CBA emphasises a key role for the community in monitoring and in evaluating the design of monitoring activities, and in the generation and control of data used to inform community planning. This can include primary data gathering and interpretation, such as the installation of climate monitoring equipment. Monitoring activities dependent on external parties will be more difficult to maintain and less relevant for the community. Monitoring is ineffective without evaluation, and triggers for plan evaluation and review should be in place for unanticipated changes, emergence of improved scientific knowledge or observation of maladaptive practice.

Monitoring is useful not only to determine progress, but also to ensure that the initial plan is responsive to changing community needs and priorities. Effective adaptation is intended to increase the capacity to respond to a range of risks, and increased adaptive capacity may alter the status of risks that were seen as priorities at the commencement of the process. In this sense the greater the success of the adaptation process, the more likely that the community priorities will shift. Adaptation activities are

also likely to facilitate changes for the wider community that are supplementary to the process itself. These changes are often indirect or unintended outcomes, and may include changes in knowledge, language, organisation, practices, motivation or intent. Effective adaptation may also produce changes to the power dynamics within a community, and these changes may include the reallocation of authority and agency, responsibility and resources (Mackenzie 2008). These may serve to support or inhibit adaptation efforts. As an ongoing process, there must be sufficient flexibility and responsiveness factored into adaptation planning to accommodate these non-climatic changes.

5.8 Summary

The processes of planning, implementation and monitoring within the Aboriginal context of ownership, capacity building, participation and engagement have an important bearing on whether adaptation to climate change becomes a reality for Indigenous communities in Australia. This chapter has shown that it is possible to design a community-based framework by which policies and programs to potentially improve resiliency and adaptation are formulated. Such a framework especially needs to relate to the development of adaptation priorities and plans in the context of broader Indigenous objectives.

In the next two chapters we apply the community-based framework approach to two foundational aspects of Indigenous adaptation planning, namely Aboriginal worldviews and TEK (Chapter 6) and the institutional settings for climate change adaptation (Chapter 7). The community-based framework is especially relevant to Aboriginal worldviews and TEK in adaptation planning. Better understanding of Aboriginal perceptions of climate change will assist in developing and designing practical resource material to assist communities prepare, cope with and ultimately benefit from the impacts of climate variability and climate change.

6. UNDERSTANDING INDIGENOUS ADAPTATION, WORLDVIEWS AND INTEGRATION OF TRADITIONAL ECOLOGICAL KNOWLEDGE

This chapter explores the critical role that traditional Aboriginal knowledge of environments, weather and climate has in mediating Indigenous understanding of climate and environmental change in the Kimberley region of north-western Australia, and how this traditional knowledge may contribute to future decision-making on climate change adaptation, and to adaptation strategies and the capacity of Aboriginal people in this region to adapt to these changes. The results of the case studies with the Miriwoong people of the Kununurra community in the Keep River district and Gija people from Warmun are discussed with reference to how these communities with Aboriginal traditional knowledge, belief systems and worldviews frame their perceptions of vulnerability to climate risks and their capacity to respond. Further, we discuss how these groups use their linguistic resources and traditional knowledge to understand the abstract concepts and language of climate change and assess the effectiveness of current awareness material. Aspirations of participants to use TEK to monitor future climate impacts and develop adaptation strategies are identified, including integrating TEK and Western science and pathways to adaptation.

The detailed results of the case study conducted with Karajarri people of the Bidyadanga community is not included here because planned lengthy field visits were cancelled due to other pressing commitments and deaths in the community. Following shorter field visits and a workshop, some of their contributions are presented in this chapter through individual comments about climate change perceptions.

6.1 Traditional ecological knowledge

This report uses the term traditional ecological knowledge, or TEK. An expert on traditional knowledge systems, Darrell A. Posey³ observed that 'The nature of traditional knowledge is such that more of it is transmitted orally than written down' (Posey & Dutfield 1996:81). For our purposes the definition provided by Berkes, Colding & Folke (2000:1252) is useful and concise:

Traditional Ecological Knowledge as a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment.

The future retention of traditional environmental knowledge is at risk as national education systems are extended to rural and remote populations and Aboriginal languages become endangered, and thus the documentation of this knowledge may be critical to the capacity of future generations of Aboriginal peoples and local communities to access that knowledge. Worldwide it is recognised that cultural absorption of Aboriginal peoples and local communities into dominant societies (as indicated through language loss, biodiversity loss and its impact on traditional biodiversity-related knowledge) are key factors that endanger these ancient human knowledge systems (Langton et al 2003)

Until his untimely death, Posey was Director of the Programme for Traditional Resource Rights at the Oxford Centre for the Environment, Ethics and Society, University of Oxford, as well as Visiting Researcher with the Brazilian National Council for Science, and Research Professor at the Federal University of Maranhão.

Traditional and Indigenous knowledge systems related to biodiversity conservation are fundamental to Aboriginal lifeways and subsistence throughout much of Australia, especially in rural and remote areas. This is because of the degree of dependence of some Aboriginal populations on traditional food harvesting and production and other activities to provide basic needs. As a result the value of traditional and Indigenous knowledge systems is incalculable. The capacity of Aboriginal people in the East Kimberley region to develop, initiate and participate in effective adaptations to climate change will depend on the degree to which national and regional government and nongovernment institutions acknowledge and respect their traditional knowledge and worldview of climate and weather phenomena and change.

Experts and researchers from a wide range of sciences, including environmental science, ethnobiology, ethnobotany and ethnoecology, the social sciences and other fields, have contributed to the recording of traditional biodiversity-related knowledge globally. As a result the literature includes several identifiable sub-categories – scientific and technical literature; a body of social science, philosophical and theoretical literature; legal literature; and community practitioner literature. This analysis of the ethnographic and linguistic data that was elicited during our field research is drawn from these disciplines.

Obtaining an understanding of the Miriwoong and Gija perspectives on climate change and adaptation meant working with traditional owners who spoke in their own language and with interpreters who explained the traditional climate and weather concepts to us. Posey & Dutfield (1996), writing about the 1988 Declaration of Belém that used the phrase 'the inextricable link between cultural and biological diversity', stated that this:

link has been increasingly investigated through studies of ethnobiology, ethnoecology, and linguistics. Clearly the taxonomic systems, emic perceptions, and codified knowledge of overt and covert ethnobiological categories depend on language as a major vehicle for cultural transmission. Together with the understanding that many previously assumed 'natural' ecosystems are in fact 'cultural landscapes', and that many 'wild' plants are indeed human-modified, the role of traditional ecological knowledge and natural resource management strategies have become central to effective conservation of biodiversity. This is formally and legally recognized in the Convention on Biological Diversity.

Maffi (1998; see also Harmon 2001) also argued that linguistic diversity is inextricably linked to biodiversity, based on a study by the International Union for Conservation of Nature of 12 megadiversity countries:

At the local level, linguistic and cultural distinctiveness has often developed even among human groups belonging to the same broadly defined cultural area or whose languages are considered to be historically related, and within the same bioregion. As local groups have adapted to life in specific ecological niches, they have developed specialized knowledge of them, and specialized ways of talking about them, to convey this vital knowledge and ways of acting upon it for individual and group survival.

This is well understood by Australian anthropologists, and has been recorded since at least the 1930s. In reference to Australian Aboriginal tribes, the anthropologist Norman Tindale (1974:133) stated:

Coincidences of tribal boundaries to local ecology are not uncommon and imply that a given group of people may achieve stability by becoming the most efficient users of a given area and understanding its potentialities.

The Australian Government has supported the retention of traditional Aboriginal knowledge systems in several ways, including capacity building measures that encourage and support the development and use of collaborative agreements in biodiversity conservation programs to enable the involvement of Aboriginal peoples and local communities and to safeguard the traditional biodiversity-related knowledge and practices of Aboriginal peoples and local communities. Such measures include the Indigenous Protected Area scheme and the funding of Aboriginal ranger programs and conservation organisations. The Australian, WA and NT governments have variously provided capacity building resources to establish cooperative recovery plans for endangered and vulnerable species of particular significance to Aboriginal peoples and local communities, and resources for the application of their traditional biodiversity-related knowledge in species conservation.

If Aboriginal and Torres Strait Islander people are to develop, initiate and collaborate on climate change adaptation measures, the coordinated development of capacity building policies and programs by governments and others is required so that traditional knowledge of climate and weather can be integrated into local and regional planning.

TEK incorporates knowledge of bio-temporal indicators, water and weather; it is an allencompassing term that provides important information about seasonal diversity within the ecological system. Bio-temporal indicators can be defined as the timing of particular behaviour of flora and/or fauna to indicate that a season is changing or that a certain weather event may be about to happen, or that it could be the appropriate season to undertake 'caring for country' activities. The nature of TEK can help understand both positive and negative feedbacks of the changing nature of the socio-ecological interface. Combining scientific and traditional monitoring methods can allow Aboriginal people to critically evaluate scientific predictions and to articulate values and knowledge systems.

The difference between TEK and Western science approaches to understanding the connections between climate and environments in TEK systems is well established in the literature. Despite this, in the technical and scientific literature on climate change adaptation, worldviews are rarely considered as elements of adaptation. They are fundamental in shaping how people understand the causes of phenomenon linked to climate change, which in turn influences the acceptability of adaptation responses (see, for instance, O'Brien 2009; Adger, Lorenzoni & O'Brien 2009). Adaptation options and decisions about governance and institutional arrangements are underpinned by values of particular worldviews that shape whether particular responses are worthwhile (Jacob, McDaniels & Hinch 2010; Wolf & Moser 2011; Spence et al. 2011).

A worldview can be defined as a 'coherent and self contained system of both material and spiritual activities and values that provide a social group meanings for their behaviours, beliefs and responses' (Stavenhagen 1998:8). Worldviews can influence which adaptation strategies are acceptable and can identify the barriers or limits to adaptation (Adger, Lorenzoni & O'Brien 2009). Only recently have researchers begun to explore how worldviews and associated value systems shape adaptation in any great detail (Coulthard 2009; O'Brien 2009; Wolf 2011). Culture plays an important role in enabling adaptation, and CBA can promote change from within (Ensor & Berger 2009). Competing worldviews can result in different stakeholder groups pursuing dissimilar adaptation options and perceptions of what constitutes successful adaptation (O'Brien, Hayward & Berkes 2009; O'Brien 2009; Ensor & Berger 2009; Heyd & Brooks 2009). Adaptive management of coastal settings is increasingly a crucial part of planning for future sea-level rise and reconciling conflicting goals (Tompkins, Few & Brown 2008). However, the idea that Aboriginal value systems can shape both the process and outcomes of climate change adaptation is poorly researched and little understood in the literature. Worldviews incorporate belief systems, cultural values and traditional knowledge systems, and are framed by language, tradition and historical adaptations to environments.

Traditional Aboriginal knowledge systems have high levels of complexity, weaving together relationships between cultural values, belief systems (such as religion), social structures, and traditions and practices of Aboriginal people. These knowledge systems are applied in various ways – in ritual, economic and social practices – in their use and management of land, resources and environments.

An understanding of their knowledge systems is important in defining social capital and the ability of communities to adapt to changing climatic conditions.

Social resilience to changing climatic conditions and ecological processes depends on the effectiveness of responses, which will be determined by the capacity to use local knowledge of conditions and to adapt traditions to changing circumstances. The Aboriginal groups who participated in this study have inherited bodies of knowledge of their environments that include bio-temporal indicators that are used to read landscapes and environmental events in a variety of traditional practices, including hunting, burning dangerously flammable vegetation to reduce wildfire risk, fishing, harvesting native bush foods and travelling across landscapes. Deciding when to undertake certain cultural practices is not determined by a static indicator (such as the use of calendar months or seasons by English speakers) but by the observation of biotemporal indicators within the environment. Ford and Martinez (2000) have discussed the benefits of using TEK in helping Aboriginal communities respond to and monitor environmental fluctuations.

More importantly, the use of TEK assists Aboriginal people to evaluate both positive and negative feedback within the environment and strengthens their social and cultural knowledge and practices by applying them in modern land and environmental management regimes. With the impacts of European agricultural and grazing expansion, mining activities and climate change, there have been changes in the indicators that Aboriginal people relied on in the past and cultural adaptation to these new circumstances.

Effective adaptation strategies must address institutional needs while preserving cultural values. The incorporation of traditional knowledge in adaptive management tools strengthens the capacity of Aboriginal people in northern Australia to participate in measuring and monitoring climate variability, change and impacts, and their responses to impacts, including quantitative exercises for assessing vulnerability and adaptive capacity to climate change.

A body of inherited traditional knowledge and informed observations shapes Miriwoong and Gija perspectives of weather and climate phenomena and is described in the literature by a number of terms, such as traditional environmental knowledge, traditional climate and weather, and traditional biodiversity-related knowledge.

The following section presents the findings of the research conducted on the TEK systems and worldviews of Miriwoong and Gija peoples and how they shape their understanding of climate risks.

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6.2 Keep River case study

The small Keep River catchment borders the Ord River catchment to the east of Kununurra on the WA/NT border. The head waters of the Keep River flow from the east of Mistake Creek through the rocky outcrops of the Keep River National Park to Spirit Hill, where the extensive floodplain and tidal marsh system straddle the NT and WA border. When in flood, the waters of the Keep River floodplain expand across the Weaber Plains to join those of the Ivanhoe Plains of the Ord floodplain. The Keep River is of great cultural and environmental significance to Miriwoong people, whose ancestors have been living and adapting to climate variability and weather changes for thousands of years in this region. In 2010 Miriwoong people expressed concern about very recent changes they were witnessing on their country and started documenting these changes based on their traditional knowledge systems. In the first half of 2012 we conducted two workshops and one 'Back to Country' trip with Miriwoong people to document their traditional knowledge and aspects of their worldview, and to discuss their understanding of climate risks in the Keep River district. In this section the results of this research are presented and the implications are discussed for adaptation planning.

6.2.1 Miriwoong and Gajirrabeng (MG) peoples

The traditional lands of the Miriwoong people extend from an area north of the Carlton Hill Homestead, south to an area near Lissadell Station, the site of the Argyle Diamond Mine. Their lands encompass the Carr Boyd Ranges, most of Lake Argyle, and country east from Kununurra in WA to Argument Gap in NT. Miriwoong country takes in the middle reaches of the Ord River, the lower part of the Dunham River and the middle reaches of the Keep River, including most of the Keep River National Park. The adjacent Gajirrabeng people (called Gajirrawoong by the Miriwoong and spelled various ways in the literature – for example, Gajerrong in the native title claim) lived to the north of the Miriwoong, almost to the coast north of Kununurra on Carlton Hill and in the lower reaches of the Keep River in areas now taken over by Legune and Bullo River stations, as well as the northern part of the Keep River National Park. The Wardanybeng, closely related to the Gajirrabeng, lived to the north-west; the Doolboong lived on the sea coast, north of the Gajirrabeng.

These lands straddle the state border of WA and NT, adding another level of administrative and policy complexity, for in each state the lands are subject to state government legislation and land tenures, covering freehold and native title-determined lands, pastoral leases, conservation areas jointly managed by government and communities, and a National Park in NT. Traditional laws and culture are followed throughout this cultural bloc and determine rights and responsibilities, including rights of access and control of resources. These traditional laws and culture were the subject of Aboriginal evidence in the peoples' native title claims and contributed to the success of these claims.

The European settlement of the Miriwoong and Gajirrabeng (MG) peoples' land took place between 1885 and 1894, with the establishment of cattle stations on areas now known as Newry, Argyle Downs, Lissadell, Ivanhoe and Carlton Hill (Shaw 1986:291). The port of Wyndham was established in 1886, and a gold rush around Halls Creek near the borders of Gija and Jaru country brought many fortune seekers to the East Kimberley in the 1880s. After the initial invasion most MG survivors remained on the cattle stations as workers in their own country, until they moved to town following the construction of Kununurra and the Ord River dam and the introduction of equal wages and citizens' rights between 1961 and 1971 (Shaw 1986:291).

The Mirima Reserve, now Mirima Village, was gazetted in 1963 (Shaw 1986:294) and most of the people who had been working on stations in Miriwoong land initially moved there. During the 1980s the outstation movement saw many MG people set up small communities on their own family *dawang* (Miriwoong term for traditional estate) areas. Many of these on the WA side of the border are still occupied by the *dawawang* (people who belong to the country or who are members of the landowning group). However, because the NT/WA border cuts through Miriwoong country, most of those on the NT side of the border have encountered many problems accessing services to maintain community outstations. For example, when we visited Thamberalm (Bubble Bubble) on a bush camp with Miriwoong people to discuss climate change issues, community members pointed out that they could no longer live there on an ongoing basis, because the Ngaliwurru resource agency in Timber Creek (which helped to manage infrastructure needs) had lost funding, which resulted in the removal of pumps, solar panels for energy needs and other infrastructure.

The MG peoples, along with their southern neighbour Gija people, are the surviving members of the Jarrakan language family (McGregor 2004:40). These languages are distinguished from other neighbouring languages by their phonology (the sound system), by a nominal gender system marking masculine and feminine agreement, and similar pronominal and complex verb systems. The languages include extensive vocabulary linking them intimately with the particular flora, fauna and topography of their traditional lands. While working on the cattle stations, Miriwoong people had retained and passed on the knowledge of their language and culture to descendants, and evidence of this knowledge was a major factor in the success of their native title claim. Although Miriwoong people are closely related to Gija people, 'the Miriwoong and Gajirrabeng people traditionally have much closer links with language groups to the north and east, particularly Ngarinyman, Jaminjoong, Ngaliwoorroo and Murrinh-patha' (Newry & Palmer 2003:101).

Despite the small speaking community, great emphasis is placed on being able to speak the Miriwoong language to express traditional cultural concepts such as land ownership and relationships with people and places, and traditional environmental knowledge. Newry and Palmer (2003:104) stated that the 'link between land and language is also reflected in terms of ownership' and that 'In the Miriuwung Gadgerong native title cases heard in the Federal Court claimants used knowledge and use of language as evidence of an unbroken link to land'.

Many Miriwoong people say that 'unless you know language you cannot know country'. Until recently numerous significant flora and fauna species known and described by Miriwoong people were not named and classified by European scientists. This is particularly true of insect species such as the three species of 'sugar-bag bee' found in the East Kimberley, the 'sugar leaf' (lerp) species and root vegetable species. 'Sugar bag', the Kriol term for the hives, which included the wax, pollen and honey of three species of the small stingless bee *Tetragonula* – formerly *Trigona*, or Aussie Bee (n.d.) – and the sweet nectar of the 'sugar leaf' species, were important food sources in earlier times. People still collect 'sugar bag' on any possible occasion. 'Sugar leaf' is an edible sweet white flaky substance that appears on the leaves of some eucalypt species during the late dry season. 'Sugar leaf' is made by insects that are relatives of scale insects, the bane of citrus growers in the southern part of Australia.

Knowledge of Miriwoong language is also important in spiritual matters. One of the main ways people care for and relate to country is by speaking correctly according to their traditions. Previously people spoke the language 'belonging to the country' (as witnessed by cultural consultant Frances Kofod when travelling in 1988 to parts of
Gajirrabeng country with a group of MG women). Miriwoong members of the group changed from speaking Miriwoong to speak Gajirrabeng on arrival, out of courtesy to the land and the traditional owners.

In 2013 very few people know Gajirrabeng language, and Miriwoong is the common language spoken. The Mirima Council set up MDWg in 1989 to assist in the preservation of the Miriwoong language. Classes for young Miriwoongs and also for the public are held regularly. MDWg also assists a master's apprentice program to facilitate the transfer of Miriwoong language skills from Elders to younger people. Like most of the East Kimberley, the lingua franca of Aboriginal residents is Kimberley Kriol, a creole language that has developed from English in combination with the traditional languages.

6.2.2 The Miriwoong traditional ecological knowledge

Miriwoong people who maintain cultural traditions that derive from their pre-contact past define themselves by their relationships to each other and the landscape. These relationships are said to originate in a sacred past called the Ngarranggarni, a term that encompasses the ancestral beings that created human society and the natural world, including the principles of the social world that Miriwoong people regard as their laws and customs. They believe that the ancestral beings created the social institutions that govern kinship, descent, the traditional land tenure system and the features of the natural and supernatural world. These institutions and forms of social organisation include, for instance, the descent-based landowning corporations referred to as dawang. The dawang, or traditional estates, as well as the owners of the estates, the dawawang, are related to each other in a number of ways according to these traditions. Within the MG lands there are 16 *dawang* or traditional estate areas, and the senior members of each of these landowning groups have the exclusive authority and right to 'speak for' or represent these estates, to speak of or transmit the traditional knowledge about them, and to exclude others from entering these places under traditional laws and customs.

Anthropologists use the term 'estate' to refer to named areas of land and water in which descent groups have rights of ownership, while speakers of the local Aboriginal Kriol in the East Kimberley use the term 'country'. The word 'estate' can be translated as the Miriwoong word *dawang*. However, the Miriwoong word *dawang* ('country', also 'home') can be used in different contexts to refer variously to the whole earth on which all humans live; a particular defined area such as a large area sharing a common language, whether Miriwoong, Gajirrabeng or Gija; an area owned by an estate group; or an individual's own particular house, home or camping area.

Estates are named and identified in a range of ways, including by labels that also apply to the languages that Gija, Malgnin and Miriwoong peoples identify with; for example, 'Miriwoong country', 'Gija country' and 'Malgnin country' (Doohan 2007:118).

There are traditions of affiliation to estates by individuals descended from ancestral owners. Writing about Gija, who have land affiliation traditions similar to those of their Miriwoong neighbours, (Doohan 2007) explains, 'Because each individual has a special and particular relationship with areas of country, including the Dreamings of that country, such associations provide one of the bases for an individual's identity (for example, Barramundi)'.

As well, an individual may take:

... aspects of ones identity from one's parents and grandparents. For example an Aboriginal man or woman who identifies as, say, Gija, is Gija because he or she is connected to areas of land and/or water that are Gija and/or with parents and/or grandparents who are/were connected to land and/or water that are Gija. Moreover, in some situations there are 'mixed' identities for country and therefore for individuals so that a person will say that he or she is 'Miriwoong/Gija mixed' or 'Malgnin/Miriwoong mixed.' These may be areas of country where they were 'found, or 'mixed' areas to which their parents and grandparents - and other close relatives, have connections. As well, a person's mother might be Gija (through connections to country identified as Gija) and their father Miriwoong and therefore the children of this couple could identify as 'Gija/Miriwoong mixed' although contingent factors may lead them to chose only one identity label. That is to say, individuals take on these multiple, including mixed identities, because of their connections to country including countries that their parents and grandparents or other close kin are connected to (see also Palmer & Williams 1990:17; Williams and Kirkby 1989:3-4; Doohan 2007:119-20).

Further, historical factors, such as residential history, language acquisition and ritual responsibilities for particular places or ceremonies, may be particularly important – influencing the choices that individuals make in choosing an identity determined by affiliation to places or estates (Doohan 2007:120). The *Ngarranggarni* identity of places is usually unambiguous and so too is the traditional ownership. For instance, Kununurra is located in country that is unambiguously identified as Miriwoong country (Doohan 2007:125).

Doohan also points out that traditional estates or country are also articulated in terms of ecological zones, geographical features and directional terms, and many of those identified and named countries, and groups of people, are also metonymic (Doohan 2007:120).

An important regional traditional social institution is the *wirnan*, conceived of as a system of reciprocal exchange among the landowning and ritual groups. Often referred to in the literature as the 'Wunan', it is a system of relationships based on the Aboriginal spiritual ceremonial cycle and exchange of spiritual objects, and on the conferring of status in the Kimberley and part of the NT, tying groups of people and their traditional estates together through sacred narratives and initiation ceremonies. The Aboriginal Elders also conceive it as an economic relationship, legitimised by its spiritual basis, and use its principles in everyday life as an economic logic. The *wirnan* ties people and countries together across vast landscapes in significant binding relationships.

The Miriwoong people maintain their system of kinship, the kinship terminology and the subsection system, which consists of eight named categories known as subsections by anthropologists and as 'skins' in the Kriol language of the local people. Each person in the social world of the Miriwoong falls into one of these categories by birth and is related to others through a system of putative kinship ties represented by the subsection system. This system is shared with eastern and southern neighbours Jaminjung, Ngarinyman and Gija, and well beyond into Central Australia.

Miriwoong subsection names (Table 1) are the same, except Miriwoong *Jalyirri* is called *Jabalyi* in Gajirrabeng, and Miriwoong *Jimij* is often called by the Gija version of this name, *Joongoorra*.

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| Nangari | Nambijin |
|----------|-------------------|
| Jangari | Jabija |
| Nawoola | Nanagoo or Nanany |
| Joolama | Janama |
| Nalyirri | Namirra |
| Jalyirri | Jabarda |
| Nangala | Namij |
| Jangala | Jimij |

Table 1: Miriwoong subsection (or 'skin') names

The subsection names have been arranged into female and male sibling sets. For example, *Nangari* and *Jangari* are the female and male subsection names of siblings. The names have also been arranged to indicate the first marriage choice (or 'straight' skin for marriage) as shown in the opposite boxes. The first choice of husband for *Nangala* would be *Jimij* and for *Namij* it would be *Jangala*. The children of *Nangala* and *Jimij* are *Nangari* and *Jangari*, and the children of *Namij* and *Jangala* are *Nambijin* and *Jabija*. In traditional times if the first choice of spouse was not available, the second choice was from a matrikin group.

A complete set of putative and often actual kinship relationships can be deduced from the subsection or 'skin' names of Aboriginal people. For example, people of *Nambijin* skin call all other *Nambijin* 'sister' and all *Jabija* 'brother'. They call everyone of *Namij* skin 'mother' and all people of *Jimij* skin 'uncle'. Newcomers such as long-term white employees of organisations such as MDWg are often given a 'skin', so that people have a relationship term or a skin name by which to address them.

The subsection system of putative kinship categories extend beyond the human world to incorporate named fauna and flora, placing them in direct relationships with the human world. The rainbow snake being that is believed to live in particular water bodies is referred to by the subsection name *Namij* and is addressed as such when people visit significant water places in the land. This act of speaking to the ancestral beings in the landscapes and waterscapes is part of the widespread Aboriginal tradition of 'caring for country', or stewardship of the natural environment, and human relationships with the places and their inhabitants. This tradition requires that senior people 'speak to the country' when travelling and on arrival at special places, and this practice was observed throughout the research field work conducted in various places in the East Kimberley with Miriwoong people.

At the MDWg meeting about climate change in April 2012, participants reminded each other that when they go hunting, people 'talk to the country' to ask for success. One person said, 'If you are stranger you can't get anything. If you have somebody, *dawawang,* 'country owner' with you, he'll say, "Ah come on give us a fish" (speaking to the country)'. Throughout the Miriwoong lands, there are special places where this practice must be observed. For example, the goanna 'dreaming' or ancestral place near Newry Station is visited by Miriwoong people during hunting trips, and here they hit the stones with leafy bushes while speaking to the place to 'bring out' or manifest fat goannas.

Rituals that express the rights of owners to exclude others, but also to be responsible for their wellbeing while on the owners' land, are as important to Miriwoong as to other Aboriginal groups. When Miriwoong people visit part of their country with newcomers, the 'strangers' must be welcomed to the country. This rule applies to other Miriwoong people and other Aboriginal people and also to non-Indigenous people. On arrival at Thamberalm (Bubble Bubble), a community outstation east of the Keep River National Park where a meeting was held in 2012, the senior Traditional Owner sat at the edge of the water and said:

Gala jarrawoonya gelengabinyja berra ngenayim biyanygoo. (Whoever has just come here for the first time let her come here.)

She then poured water from the place on the head, hands and feet of each newcomer.

Mantha nemenawoontha ngoowa woora ganginybentha berrayinga dawanga. Ngoondengiwinyja berrinda ngoondebtha. (I welcome them so that the country does not fail to recognise them. Then they will be safe and well here.)

This 'welcome' ceremony, called *Manthe* or *Mantha*, is conducted by Miriwoong, Gajirrabeng and Gija people throughout the East Kimberley, and is a ritual measure to ensure the safe passage of visitors in Miriwoong places with ancestral presences that may be harmful to strangers. This ritual is widespread across the Kimberley and varies in the details of the practice from group to group.

6.2.3 Weather and climate in the Miriwoong worldview

A number of meetings connected with water, weather and climate have been held at MDWg and community places in the Keep River National Park over several years leading to the release of the Miriwoong seasonal calendar in 2011. At a climate change workshop held at MDWg in April 2012, we worked with knowledgeable senior Miriwoong people who explained through interpreters the relevance of their traditional cultural beliefs and practices to phenomenon of changing weather and climate patterns that they have observed in their lifetimes. They also explained the traditional beliefs about weather, weather patterns and their relationship to the *Ngarranggarni*. This workshop aimed to build on the documentation of traditional knowledge for the Miriwoong Elders furthered their understanding of climate change and adaptation concepts, and simultaneously improved our understanding of Miriwoong climate and weather-related traditional knowledge, practices and beliefs.

When describing climate and weather patterns and phenomena, Miriwoong speakers called on a rich lexicon and body of traditional concepts that incorporate traditional knowledge (their form of science), observations of atmospheric and biophysical events, and their spiritual or *Ngarranggarni* beliefs. They talked about the characteristics of rain and influences on the rain and weather, including natural and human effects, and the role of 'clever men' who are believed to have supernatural powers.

The Miriwoong belief in the human-like characteristics of weather events and the correlation of weather events with human states is evident in their discussion of whirlwinds, lightning, the rainbow snake and the rainbow seen in the sky. The weather system, like their social system, is gendered, including weather phenomena, patterns and events.

Dangerous weather events, such as strong lightning and a big 'willy-willy', or whirlwind, are considered to be male, whereas the rainbow snake of Namij 'skin' that lives in the water is female. (Whirlwinds can be classified as minor whirlwinds, land devils, water

devils and fire devils.⁴) One senior women stated that they 'talk to the weather' and 'speak out strong in language' to influence it. A senior Miriwoong woman told how to make the willy-willy go away by holding up the finger of the left hand and calling:

Gardawoo, gardawoo, thamboorroonya ngelayijiyanyja-ninggi gardawoo, gardawoo! (Look out, look out, your mother-in-law is here, look out, look out!)

This tricks the willy-willy, an ancestral man in their belief system, into going another way to avoid his mother-in-law in accordance with their traditional law.

The same speaker, when asked to speak about lightning during a thunderstorm, used the word *jigeng* (bird) to talk about the lightning. She said that she could use the normal word *jimilwiring* (lightning) when the weather was fine, but if she pronounced the word while it was actually happening, it would make it 'more cheeky' (that is, more dangerous). If she used the word *jigeng*, the lightning would feel shame and calm down. The lightning is always classified as male.

The *lemoogeng* (blue-tongue lizard) was a woman in Dreamtime and is associated with the rainbow in the sky. The rainbow is *wajing* (married to someone of the wrong 'skin') and this stops the rain. If there is not much rain during a wet season in Kununurra, a common joke is that there is 'too many *waji*'; that is, because too many people are married to someone of the wrong 'skin', the rainbow has stopped the rain.

Special speech statements, together with sacred songs performed by appropriately authorised people, are highly regarded traditions of human interaction with, and influence over, weather events. Such authorised people, usually men with spiritual powers, or 'clever men', are said to 'sing the rain' when it is too dry; and both men and women are said to 'sing' or speak to rain events if there is too much rain. There was some discussion at the April workshop and again at the meeting at Thamberalm (Bubble Bubble) in July regarding these practices and associated terminology and speech. Clever men could use *ngooralng* (rain stones), put them in the mud and *nyiwood* (sing the rain); and one little cloud would come soon to be followed by big rain. The April meeting mentioned the existence of rain stones at a fishing spot on the Ord River frequently visited by Miriwoong residents in Kununurra. They stressed the importance of not allowing children to randomly pick up such stones, because only the appropriate senior people could safely use such things.

Miriwoong people have undergone much change in the past 130 years since the arrival of Europeans in their country. There have been radical changes in lifestyle. While the first settlers were establishing their cattle runs, the police force and vigilantes enforced a cruel frontier regime and removed hundreds of men from their lands in chains. The remainder were forced into strictly controlled, and often unpaid, labour on the cattle runs. By the 1960s many had drifted into the newly established town of Kununurra. Others remained on the cattle stations and yet others established small homeland communities or outstations with Commonwealth funding support after the establishment of a federal Department of Aboriginal Affairs in 1972. The drowning of a vast area of their country by the damming of the Ord River and the development of intensive agriculture left many people in a state of shock. With discussion of additional

^{4.} See the Tornado and Storm Research Organisation (n.d.), which classifies whirlwinds as 'major whirlwinds' (funnel clouds, tornadoes and waterspouts), 'minor whirlwinds' (land devils, water devils and fire devils), 'eddy whirlwinds' and 'other whirlwinds'.

changes in their world, such as global warming, it is difficult for people to understand the global scale of climate change.

6.3 Warmun case study

The Warmun Aboriginal community is situated in the east Kimberley in the central Ord River catchment and is the home of many Gija people. The community is built on the banks of Turkey Creek and is subjected to flooding most years. In 2011 an extreme flood event devastated the community, with most buildings destroyed. The Warmun community has since expressed concerns regarding the impacts, the natural hazards and their future vulnerability to climate change impacts. Gija people have strong cultural links to their ancestral lands and express the desire to be directly involved in its management. The Warmun community participants in the research project requested that further research be undertaken to identify how potential pathways to climate change adaptation could be developed to strengthen the community's sustainability for future generations.

6.3.1 Gija people

The Gija people's traditional lands extend from an area north of Warmun (Turkey Creek) in the upper catchments of the Ord and Dunham rivers and their tributaries, the Bow River catchment, south to Halls Creek and west to Lansdowne and Tableland stations. The Purnululu (Bungle-Bungle) National Park is mainly in Gija country. The Argyle Diamond Mine is located on both Miriwoong and Gija estates. The Gija language is closely related to MG languages, being part of the same language family. Two dialects of Gija are identified, the northern dialect spoken by people whose traditional country surrounded the present day Warmun community and a southern dialect whose speakers are now mostly based in Halls Creek.

A senior man of both Gija and Miriwoong descent, now passed away, often told the story of two mountains, Rawooliliny and Warnambany (Mount Glass and Mount Buchanan), to the east of Warmun. In Dreamtime these were two men, one whose language was Miriwoong and the other Gija.

The Miriwoong man said in Miriwoong language: Ngayoowa Miriwootha-ngany. Looloo ngendindayin ngenayimara wanewoogenga.
(I am Miriwoong. I will stay here for good.)

The Gija man standing to the south spoke in Gija language: Ngagenybega Gijam-nga. Roord nginbinkende ngenenggayana jimerrawoon. (Mine is Gija. I will stay right here forever.)

They became the two mountains and stayed forever. This event placed the language in the landscape and defined the borders of the language areas. It is a salient example of the perceived power of the spoken word in relation to the landscape and defines people's relationship with the environment in which they live.

Gija country, like the MG country to the north, is tropical but semi-arid. In the wet season from December to March the rivers and creeks become raging torrents and in the dry, when there is virtually no rain, they dry out to strings of waterholes. The landscape features many dramatic red cliffs and hills with little springs contrasting with

comparatively flat country with creek and riverbeds. This contrast is reflected in the directional system of the language which refers frequently to 'up hill', 'down hill', 'down to water', 'upstream' and 'downstream', in addition to the cardinal directions frequently encountered in Australian languages. As in Miriwoong, there are many specialist Gija terms to describe the natural world. For example, four different species of 'sugar leaf', or lerp, are named, together with the tree species on which they are found (Table 2).

| Lerp species Gija name | Tree species where found | Gija tree name | Scientific name |
|---------------------------|--------------------------|----------------|---------------------------|
| wanamarriny | bloodwood | mawoorroony | Eucalyptus dichromophloia |
| daliyany | snappy gum | thalngarrji | E. brevifolia |
| binkany | coolibah | warernji | E. microtheca |
| warrayiny | red river gum | bilirnji | E. camaldulensis |

Table 2: The four species of 'sugar leaf' and the tree species in which they are found

The first Europeans to arrive in the Ord River catchment area were Alexander Forrest and his exploration party in 1879 (Clement 1988:26). His report of well-watered 'unoccupied' land quickly attracted pastoralists, including Nat Buchanan, who first brought cattle to the Kimberley in 1884 (to Ord River Station). In 1885 'Long' Michael Durack arrived at Lissadell with a large herd from Queensland. Other Europeans with cattle arrived in the following decade and set up stations in Gija people's country, including Texas Downs, Bedford Downs, Mabel Downs and Springvale. Ecological devastation followed, with waterholes decimated by overgrazing and the original millet and yam species that formerly sustained the people virtually wiped out by cattle.

The first years after the arrival of Europeans saw violent conflict as Aboriginal people attempted to defend their land. People were starving after the ecological destruction of their land, and cattle spearing invoked bloody reprisals. Many Gija people have recorded stories and produced paintings describing massacres in their country. The exhibition *The Blood on the Spinifex*, held at The University of Melbourne in 2002–03 (Oliver, Langton & Kofod 2002), was a notable example of this storytelling. As in MG country, the survivors of the initial invasion stayed in their own country as station workers until the second dispossession, when the 1968 equal wages decision saw them thrown off their land. Most moved initially to Wyndham before a community was set up at the site of the old telegraph station, police station and public house at Turkey Creek.

Today the surviving Gija people live at Warmun (or Turkey Creek), Halls Creek, Imintji on the Gibb River Road, and on a small number of outstations spread throughout the area.

In March 2011 Turkey Creek flooded and wrecked most of the houses, school, clinic, art centre and community offices, destroying almost the entire Warmun community. The community members were airlifted to Kununurra and the area was declared a disaster. The people were accommodated in workers' camp in Kununurra for about three months before being allowed to return to Warmun.

6.3.2 Gija worldview

Gija people, like the Miriwoong, define themselves according to social traditions that establish relationships with land estates, ancestral narratives about these estates, and the land's flora and fauna. The traditional land tenure system of the Gija is similar to that of their neighbours the MG in most respects, including filiation to named estates by direct descent from parents and grandparents.

The same group of eight 'skins', or subsection classificatory relationship system, as found with the Miriwoong is used by the Gija but with different names in most instances. Gija people assign 'skin' names to many animals and to some significant tree species. When plucking a *birnkirrbal* (bush turkey) that belongs to the *Nyaajarri* subsection, a Gija person can be heard to address the turkey, 'Mooloonggoo-galen-ma-ngoo Nyaajarri?' ('Are you fat, animal belonging to Nyaajarri subsection?'). Many people are still aware of the animal 'skin' names and consider the animals of a particular 'skin' as kin. In addition to the fauna species that are *nharroogoo* (same name) because of their 'skin' group and treated as relations based on the appropriate kinship for the particular 'skin' name, Gija people also have personal *Ngarranggarni* (dreamings) inherited from their parents and their parents' country.

Even Gija young people observe deeply ingrained speech restrictions. As with the Miriwoong, women cannot say their brothers' names and men cannot say their sisters', mother-in-laws' and mother-in-law siblings' names. At meetings, people in avoidance relationships must sit separately from each other. A brother and sister cannot sit together in the same part of a vehicle. People do not speak the names of the dead for a long time after the person has passed away.

Because of the disruption to traditional life after the invasion by Europeans, and the fact that people could not always marry the correct person according to pre-colonial kinship rules, people have real relationship names or terms for close relations and for relationships determined by the group system of 'skins' for people more distantly related. Such type of names for relationships is also applied to the fauna species related to the particular individual.

Many Gija people are internationally acclaimed artists, but each artist is very careful to depict only the country or traditional estate and associated *Ngarranggarni*, or dreamings, to which they have particular inherited rights, usually by direct descent from parents and grandparents. Gija artists Lena Nyadbi and the late Paddy Bedford have artwork incorporated in the Musée du quai Branly in Paris. Lena Nyadbi's country includes a long mountain range to the west of the highway, north-west of Warmun, called *Jimbirlan* (the place of the stone spear head). Many of her paintings include references to *Jimbirlan* and also to *lirnkirre* (the scales) of *dayiwool* (the barramundi), which were left in the area of the Argyle Diamond Mine just to the east of *Jimbirlan* in Dreamtime. Her work in Paris depicts the *Jimbirlan* spearheads and a work (which will be included on the roof of the Musée du quai Branley during 2013) that shows the *lirnkirre* of the barramundi. Paddy Bedford always declared that each painting related either to his mother's or his father's country.

Within Gija country, people believe that strangers are at risk if they visit a place without being properly introduced because 'the country does not know them'. The word *ganginy* (fail to recognise someone) is used in this context. To ensure safety, visitors need to be welcomed to the country with either a smoke or water ceremony, described as *mantha* (to welcome and make it safe for someone to be in a strange country). Gija people who are traditional owners for the Argyle Diamond Mine area about 50 km from

Warmun regularly conduct *mantha* ceremonies. One owner described what she says to the new mine workers:

Ngarranggarnim ngaginybe ganginy nimbirrijtha-boorroo. Miya mantha nharajtha-ngungu.

(The dreamings from my country will not know you [you might be in danger]. I would just like to welcome you to my country [conducting the proper ceremony].)

The word *ganginy* expresses the sentient power of the country, and *mantha* expresses the relationship between the country owners, the country, and the power of water, smoke and the spoken word.

Gija people have very strong beliefs that only people who have rights to a particular area, either through birth, inheritance or knowledge of ceremonial law, can take significant action in that area. This includes not only traditional ceremony like *mantha*, but also who is authorised to paint 'country' or traditional estates, tell associated sacred narratives (or stories) and make decisions in practical modern governance issues. Only people with legitimate and recognised rights to country are authorised to make decisions, 'talk for', and give representation to planning and other matters proposed in a particular traditional estate.

6.3.3 Weather and climate in the Gija worldview

Gija people believe changes in the weather result from human activity and are not a matter of chance. One participant described a huge storm in October 2012:

Warlangooba waniyidji yangoorranyji deberr-anyji berrani, ganarram. Ngoorriny, Garloomboony ngoorriny. Deberranyji berrani ganarram. Wayinigana menan wananyji. Deberr-ngarri boorroorn ngoorroony, menannoongoo, ngerne.

(It came with big wind, somebody must have been breaking leafy twigs/bushes.

That thing right over there, the spiritually dangerous hill called Garloomboony, the place of the spear [a sharp hill that can be seen in the east from WAC]. They must have been breaking leaves/twigs. Because of that the lightning was travelling. When they break leafy twigs over there it flashes lightning.)

The Warmun flood that destroyed the community in March 2011 is seen as a result of a number of possible events. The day before the flood was the day of a funeral for a young man who had committed suicide. A possible reason given for the flood was retaliation by the relatives from further south who sang up the storms. Another explanation involved the tragic death of a young woman, which occurred about the same time; it was said that her relatives in Jaru country to the south-east could also have sung up the flood in revenge. Others said that children were playing in the creek and broke the eggs of *goorlabal* (the rainbow snake), who came out from the small water remaining after the previous rain and carried water with her everywhere. Several Gija artists produced paintings after the event to show the destructive course taken by the rainbow snake after she was aroused.

It could be said that the whole Turkey Creek – Warmun art movement began as the result of a previous large weather event. In the 1970s a woman was killed in a car accident just south of the community during a big storm. It is said by Giga people that 'the snake crossed the road and caused the accident'. The spirit of the woman came back to renowned East Kimberley artist Rover Thomas and gave him the song and dance cycle known as the Goorirr Goorirr (also Kurirr Kurirr/Gurirr Gurirr). When performing this dance drama, dancers carry painted boards on their shoulders illustrating the places the old woman has visited in her travels as a spirit after her death. It was about this time that Cyclone Tracy destroyed Darwin, so one of the verses tells of her seeing that storm. The rainbow snake itself is sometimes carried on the shoulders of the dancers in the Goorirr Goorirr (Figure 3).

The painted boards associated with the Goorirr Goorirr song cycle inspired many Gija people to paint, and a world-renowned art movement was born. The woman who died in the car accident and whose spirit gave the song to Rover Thomas was a Worla person from the Doon Doon area. During the first 25 years of performances, the Goorirr Goorirr could not be performed unless one of the woman's close descendants was present. In the late 2000s, after the death of one of her last surviving close relations, the rights to stage the song and dance cycle passed to Elders and relations, who paint at WAC. Although a public ceremony, care must be taken to observe traditional law when staging an event so closely associated with storms and the spiritual world.



Figure 3: The rainbow snake carried on the shoulders of the dancers during a performance of the Goorirr Goorirr at Warmun, 2009 (Photograph: Frances Kofod)

Gija people talk about three main seasons – *jadagen* (time of big rain) or *yiwirnji* (set in rain) when talking about the wet season, *malwalan* or *barnden* (hot time) and *warnkan* (cold time). They also recognise the transitions between seasons. The transition from the hot, wet season to the cold, dry season is recognised as a time when the environment begin to *lintharrg* (dry out), and during the transition from hot to wet is a time known as *werrgalen* (the green time), when many trees produce new green shoots and flowers before the rain comes.

Water, which the Gija regard as the source of all life according to their traditions, is the home of *goorlabal* and *garlooroony*, the female and male rainbow snakes. It is a strictly observed tradition that requires that people be very careful when approaching water so as not to arouse the snakes and cause a cyclone. Care must be taken when saying these names, and strangers must be welcomed by one of the *daawam*, or country owners, when visiting a place in Gija country for the first time.

Gija people are expected to observe correct behaviour according to traditional law so that they are not overtaken by disastrous weather events. Many Gija artists paint the story of two young men who ate 'ant bed tucker' (termite eggs) 'in Dreamtime'.⁵ This was a food that only women and old men were allowed to eat. Some women dug up a large quantity of the nutritious white eggs and left them in a coolamon, or wooden dish. The young men stole the food and ate it. This aroused the ire of the rainbow snake, who created a huge storm. The two young men and all their relations were drowned. The word for termite mounds and the larvae that comes from them is *jamerndel* in Gija. It has a close cognate in the Miriwoong word *jamerndeng*. In Miriwoong country jamerndeng is an ordinary noun of masculine gender. There does not seem to be any restriction on pronouncing the word. The Gija word jamerndel is feminine gender. Gija who live in the Warmun area use the word freely. In 1995 Frances Kofod was checking a list of 500 basic Gija words with two old men who spoke the southern dialect of Gija. Asked the Gija word for 'ant hill' or 'termite mound', they looked really shocked. Then one old man whispered that they could not say the word or a cyclone would come and take them away. This is an example of the perceived power of the spoken word to invoke changes in the environment.

The active partnership between traditional estates or 'country' and 'country' owners is seen as necessary for the health of the land. Many places in Gija country that once had permanent water are either now dried up or have minimal water. Loss of vegetation and erosion is more likely due to overgrazing than climate change, but Gija people often say that the environmental change is because the traditional owners no longer live in the country. A Gija woman explained why a place that always had water and waterlilies when she was young was dry when we visited in September 2009.

Daam, berra, mooloorroo berrani-berrewa. Nyamanani marra yirrayin-ngarri, marrarn berrayin-ngarri. Woolmoolmeyinbe loosembany-ngarri yirramanyji thamany-woorrarrem, gangga-woorrarrem damga. Well roog berrayin naw daam-boorroo, roog berrayin. 'Gawoo-ngirri?' berrani daam. Roog boorroodboo. mooloorroo boorroorn daam.

(The country is sorry because of them [the people who have left]. We and all the old women have gone, they all went away [from the country]. The old men, all those old grandparents, we have lost them now. The country has taken a sulk/is offended because they left. 'Where are my people?' said the country. It is sulking, the country is sad.)

Lack of rain and a dried-up waterhole as a result of the sadness of the country for its people is another example of the perception of the land as a sentient agent.

^{5.} Frances Kofod has been documenting paintings by Gija artists since 1990 when she worked for MDWg. As a MDWg employee, she provided documentation for paintings done for Waringarri Arts, the main outlet for East Kimberley artists' work before the establishment of other centres in the latter part of the 1990s.

6.4 Perceptions of climate risk

Of key importance to this project is the question of how Aboriginal communities perceive and respond to climate risks. From a Western science perspective, an understanding of climate risks, the strategies needed to adapt to those risks and the awareness to adapt to climate change are significant determinants of adaptive capacity (Adger et al. 2006; Adger, Lorenzoni & O'Brien 2009). The perceptions of climate risk among Miriwoong and Gija peoples are influenced by their worldview of the environment in which they live. With insights into their worldview and how such knowledge systems determine their relationship with the environment, we explore the capacity of Aboriginal community members, as individuals and members of wider formal and informal institutions, to adapt to climate events and climate change, along with the ways in which this capacity is enhanced at each location. This in turn offers important insights into the entry points for CBA. Ensor and Berger (2009) found that some cultures are narrowly defined by resistance to change, but our research found that Aboriginal people in the Kimberley are adaptive by nature and have developed flexibility in cultural traditions over thousands of years to allow for social change in response to changing environmental conditions. This socio-ecological relationship forms the basis of both the Miriwoong and Gija worldviews.

6.4.1 How does worldview influence perceptions of climate change?

There are no words for 'climate' or for 'weather' in Miriwoong. Aboriginal people see dramatic weather events, such as the flood that overtook the Warmun community in Gija country, as the result of inappropriate human behaviour or actions locally. People must behave correctly according to traditional law when living in a particular place. The same kind of story told by Gija people about the cause of the flood was repeated during our community meeting at Kununurra. It was said that the flood happened because children were playing with something in the creek that they were not supposed to touch. Aboriginal people mentioned similar things and places in Miriwoong country, which if touched could cause dangerous weather events. Miriwoong and Gija see the country, its constituent parts – including flora, fauna and weather events – as a sentient entity that can be spoken to, that are affected directly by song and that directly responds to its people. These strongly held beliefs make it difficult for Aboriginal people to understand that the natural world is changing because of other outside agencies.

The perception of incorrect behaviour (like that of the young men who ate the 'ant bed tucker' in Dreamtime) is still spoken of in Warmun. One interviewee was asked if he thought the weather was changing. He said that he had seen on television that 'we going to have lot a wind and cheeky lightning'. He said that this was because:

Young people have a wrong feed. Young people supposed to not eat this and that till they go through the law. They eating things any way. Well that law lookin' at, and that wind bin come any time and rain.

The same interviewee said that in earlier years he had seen another big flood at Warmun, and remembered people sitting on the roof of the hen house with the fowls out of the floodwater:

Long time when I bin kid. All my father bin young. They bin hangin' up la fowl house. Water bin underneath, all the fowl bin on top.

The only building to survive the 2011 flood at Warmun – the old post office, which is now used as WAC staff accommodation – was built on very high solid concrete stilts, which suggests there was a major flood event in the early-to-mid part of the 1900s.

The previous interviewee was not familiar with the term 'climate change', and did not see the 2011 flood as a result of climate change.

Another person who had travelled widely out of the community, when asked about the 2011 flood, said:

I reckon because of the climate change *gardiya* (white person) way. Climate change the *gardiya* side of it. We know the blackfella side of it, because the kids found the serpent's eggs and broke them. That's what they say. People say it. They found them, then they broke them, that's sort of why.

Another older interviewee said that a reason for the flood could be:

Lot a them stranger all day come here you know. They don't welcome them mob you know, smoke 'em and talk la the country. Sometime that's why this rain might be.

That is, the country is punishing the people with big rain because many strangers have come without being properly introduced by traditional owners.

Aboriginal people do not regard floods necessarily as a bad thing, but as a way of renewal. The same interviewee said:

Gelengen, yiligin therinyberrwany-ngarri benayidji, bedalg woomberrama goowoolem yiligin. Menkawoog bemberrama. Warna-warnarram berraniyinngarri goorriny-ngarri berraward, gelengendi daa bemberramangbe naw, menkawoom.

(Now, after the flood knocked everything down, all the little trees are growing back. It made it good. The old people who lived here who have all died now, today they make the country good again.)

A much younger interviewee said that he thought the climate was changing, and did not ascribe the changes to traditional law. He saw a goanna out walking at night, which was very unusual. He also said that plant flowering and fruiting times seemed to be changing:

They used to come up, you know he bloom, the bloom pops out and people know straight away, 'Ah' what season it is or maybe, you know, like fruit or weather season. They could tell by the flower. But those flowers sometimes don't show up now.

The same person also said:

The hot weather is starting earlier. From wet weather it's supposed to go to cold weather. We don't have cold weather. It's like we skip that and go straight on to summer.

Asked, 'What do you reckon we can do to understand the changes?', he said:

Understand all the traditional reading knowledge. You know, how we used to say that, oh well, this flower represent that season now and animal behaviour. Gija people have a different way of reading. Trees, animal behaviour, country. Put all that together [do you] understand? You see that flower there now? In cold season, but cold season doesn't happen, we go straight in to summer. Record all that now. And there might be cold season and sort of like a, monitor that, how long it go for. Might even get a cold weather season. Because of strongly held Gija beliefs of the power of the relationship between the country and the people, it is difficult to explain climatic change in terms of carbon emissions in faraway places. Especially among the older generations, the causes of local events are, at least in part, the result of local human activity, although usually involving some supernatural force.

6.5 Some practical measures in communication

Aboriginal people in remote communities in northern Australia appear to show preference for traditional knowledge and language when dealing with complex scientific concepts. Translating such material using their worldviews to Indigenous-friendly communication tools and material is highly desirable. This is in order that urgent messages about forecast extreme weather events are communicated efficiently and effectively to Indigenous communities under the threat of climate change.

6.5.1 Use of fact sheets and presentations

It is conventional in the practice of climate change adaptation to communicate complex scientific information through information brochures and presentations. In this project we developed numerous information sheets and gave PowerPoint presentations in which information was presented about climate science and abstract concepts were explained in plain English. This met with mixed results. We found that the Warmun and Keep River communities did not understand these communication products/tools, which did not assist with capacity building. An information pamphlet developed at the beginning of the project was then adapted into a Kriol version and images of the local region were inserted to localise issues and build ownership of concepts being discussed. In addition, a PowerPoint presentation was redeveloped to explain the concept of climate change and present local climate scenarios in accessible language and terms. The same materials were used for each case-study community. The effectiveness of these materials was evaluated by assessing the level of engagement in conversations about this material.

The results suggest that in communities with higher levels of literacy, these materials were informative and stimulated further conversations. In communities with lower literacy, such as Warmun and Keep River, these materials were commonly discarded and did not prompt further discussion, even when they were translated into Kriol. Generalised information sheets presented in English to Aboriginal communities are unlikely to be useful in awareness and planning activities. Localising the issues through examples in the local area is more effective; and, where possible, it is important to work with interpreters to translate concepts into local languages and visually present them in workshops. These presentations were more effective, but still presented many challenges for the direct translation of terms into local languages.

6.5.2 Direct translations of climate change concepts

Many words and concepts in the climate change literature are conflated, vaguely defined or imprecise, and lead to confusion and misunderstanding of climate change terms among the generally educated English-speaking public (O'Brien et al. 2009). Specifically, the semantics of abstract climate terms such as vulnerability, adaptation, mitigation and endurance have different interpretations within the English language and can cause difficulties for policymakers to understand issues and implement adaptive actions (O'Brien et al. 2009). These confusions are compounded when trying to translate terms into traditional or minority languages. Many Indigenous languages have

no direct translations for these words, and this is a key barrier to understanding and developing adaptation strategies.

The research project recognised this issue and attempted to develop methodologies to assist the Aboriginal communities in building capacity to understand complex concepts of climate change and climate scenarios. To assist workshop participants, a weather words activity was designed. Common climate words were written on large sheets of paper and discussed, with the intention of finding a direct translation into the local language. The workshop found that many Indigenous languages do not have direct translations for words such as climate, weather, adaptation or mitigation, which suggests that the actual language of climate change is a barrier to adaptation. Attempts were made to find alternative words that would help build community capacity to understand complex concepts of climate change. The result below offers an example of the difficulties in translating these terms and reveals how complex concepts can be easily misunderstood, which in turn creates misleading perceptions of climate risk.

6.5.3 Miriwoong weather words and perceptions of climate risk

A key activity undertaken during this research project was the 'Language of Climate Change Workshop' held at the MDWg in Kununurra in April 2013. Aboriginal interpreters and linguists attended to facilitate discussions and translations of complex local language issues and lexicon and abstract terms of climate change science (Figure 4).

How do Miriwoong interpret the words 'change', 'mitigation' and 'adaptation'? Do they have direct translations for these terms in Miriwoong and, if not, how can these terms be effectively explained to help people understand climate risks? Miriwoong language encompasses a rich lexicon of weather and climate terms as demonstrated in the Miriwoong seasonal calendar. In spite of this richness in language, it was initially difficult for workshop participants to talk about and identify terminology for climate change.



Figure 4: A Miriwoong weather words workshop at the MDWg Language and Culture Centre, Kununurra (Photograph: Sonia Leonard)

The first word discussed was 'weather'. A senior Miriwoong man and language scholar explained that 'names are given to events as they happen, words come onto things' and that there is no word for 'weather' in Miriwoong. There are only words that describe each type of weather. For example, many words describe different types of rain. Miriwoong people only have names for the things they see and have difficulties conceptualising 'weather' and 'climate', which are considered abstract 'white man' concepts.

After some discussion it was decided that it was best to start the discussion by describing 'change'. The term *yanybe* can refer to a change of decision but cannot be used to describe a change in climate. The meeting decided that the most appropriate Miriwoong translation for 'change' in terms of climate would be *Loowoorrgeb ginayin dawang gelengoo*. This sentence translates as, 'The country is turning around today', indicating that things are not the same. As mentioned previously, the word *dawang* can be translated in a several ways – it is specific about a person's home or own area, but can also include the whole world where we all live. This way, the Miriwoong sentence above could mean, 'The world is changing'.

As discussed, there is no generic term for 'climate', but there are words for 'seasons'. Miriwoong language workers helping to run the workshop decided that the three main seasons need to be named when interpreting the word 'climate'. The term 'climate change' was eventually translated as *Warnka-mageny, barndenyirriny, nyinggiyi-mageny, loowerrgeb beniyawoon*, which literally means, 'The cold, hot and wet times are changing'.

When asked why the seasons were changing, a Miriwoong Traditional Owner replied:

Thenanganygoo. Ngooj ginayin-yarri dawanga. Ngoowa woonyjoo-woonyjoo yirranken-ni. Wayini loowoorrgeb ginayin-yarri dawang. (For some reason, the country is angry with us. We are not looking after it. Because of that it is changing on us.)

Another suggestion at the workshop was that the country is *ganginybeng* (unrecognisable).

People were comfortable talking about specific seasonal indicators and whether the indicators had occurred. Both Miriwoong and Gija groups mentioned the very few boab nuts that were available in the year leading up to the research meetings. Miriwoong people at the April meeting mentioned that the 'knock em down' rains had not come at the end of the wet season that year.

Ngoowa dalyb gooward marlinga, ngoowaga-noong. Marling barrawoondaberri dalyb gimantha.

(The cane grass has not been knocked down yet. It was supposed to be knocked down by a big storm but that did not happen.)

The 'knock em down' rains flatten the annual native sorghum species, known commonly as cane grass or spear grass – *marling* in Miriwoong language. The *marling* grasses spring up in abundance at the end of the wet season and the final rain signals the end of that season. The dry grass becomes a large fuel load that is frequently burned (Petheram et al. 2010).

Miriwoong observation of weather patterns is essential for traditional burning practices and control of fire in this wet–dry monsoon region. The risk of 'hot' fires, and especially uncontrollable wildfires, can be avoided by commencing the annual burning in the early dry season when the landscape and vegetation still retain high levels of water content following the monsoon.

The distinct wet–dry monsoonal climatic influence in this region, as elsewhere in northern Australia, is the basic bio-geographic feature that explains the Aboriginal seasonal practice of burning particular landscapes in order to manage spaces as living areas and sources of food, medicine and other material necessities of life. The literature reports consistently that Aboriginal fire regimes create mosaic patterns in the landscape, resulting from the seasonal burning and the rotation of fires across places within the landscape over several years. Burning in different seasons is implemented with different types of vegetation, and for different purposes, such as hunting, clearing highly flammable undergrowth and protection of vulnerable plant communities.

Such detailed knowledge of seasonal patterns and events is typical of Aboriginal knowledge systems, and forms part of the system of fire use reported throughout much of the Australian continent (Bowman 1998; Bradley 1995; Davis et al. 2003; Hallam 1975; Haynes 1985; Head 1989; Jones 1969; Latz & Green 1995; Nicholson 1981). Wherever Aboriginal economic traditions have survived, researchers have discovered ordered, patterned and rule-governed Aboriginal burning practices (Lewis 1989; Pyne & Cronon 1991; Rose 1996; Russell-Smith et al. 1997, 2002, 2003; Stanton 1992; Thomson & Peterson 2005; Whitehead et al. 2003; Yibarbuk 1998). Such is also the case with the areas in this study - it is the possessory value of a customary title to land that affords its holder(s) the right of use, including the use of fire (Davis et al. 2003:6). Put another way, knowledge and associated practices in the use of fire constitute more than an economic system; the social implications of this use of fire are also an expression of land tenure relationships. The integration of the principles of this system into natural resource management and planning is now widespread throughout northern Australia. The implications for climate change adaptation should be clear such intimate knowledge of weather, fire and other climatic events should be integrated into climate change adaptation measures. How traditional owners in the three study areas choose to do this integration is becoming clearer as they engage in projects that provide them with opportunities to apply their traditional knowledge and practices. One such project is the Miriwoong seasonal calendar.

As well as discussing *marling* and the rains, participants at the workshop discussed the species *Sesbania formosa*, a tree with the Miriwoong names of *Garareng* or *Ngarangarang*. There was discussion of when 'the flowers come out' and what this event indicates in the environment for the behaviour of faunal species and weather patterns. Recitation of this knowledge is both a process of transmitting knowledge and reaffirming it among the group of knowledge holders.

There were intense discussions about climate change scientists and their goal of mitigating climate change. The term 'mitigation' was explained to workshop participants as an activity that stops climate change, but in Miriwoong society, mitigation would be achieved by talking to the weather:

When we go back to country we talk to country. When we want to go hunt we talk to country.

Woorlab-banjelng warany, ngenja goowinda-yarri. (If we talk good way [to country], it will give us things.)

Miriwoong people attribute responsibility for the changes to a human agency, because someone must have 'sung them' and 'they have not sung it back to the right way'.

Discussions about words describing the Miriwoong's interpretation of complex terms enables Miriwoong people to better understand how climate change impacts may affect them and their relationship with the environment. The workshop discussions on Miriwoong language and concepts directly related to their cultural understanding of climate change, and this allowed participants – both Aboriginal and non-Aboriginal – to build on these concepts over time and develop a more holistic approach to climate change adaptation planning.

6.5.4 Traditional knowledge of trees

Trees and their flowering times are key seasonal indicators. In Gija country the flowers of the boab tree *joomooloony* (*Adansonia gregorii*) appear at the beginning of the wet season. The red honey-laden flowers of the bauhinia tree *goonjiny* (*Lysiphyllum cunninghamii*) indicate the coming of the hot time, and the flowers of *mawoorroony*, the bloodwood tree (*Eucalyptus dichromophloia*), indicate the coming of the cold time. As well as their role as seasonal indicators, each of these trees are of economic significance because of the many edible parts of the boab and the importance of flowers in the production of honey, pollen and wax in 'sugar bag' (*Tetragonula species*) hives.

In workshops with Gija people, more than 60 plant species of significance were identified as bio-temporal indicators of changing seasonal events. A similar number were identified with Miriwoong people. The complex understanding that Aboriginal people have of the phenology of plant and animal species is significant in understanding the impacts of climate change. Many Aboriginal participants noted that they observed species behaving differently from how they were traditionally understood to behave. For example, one Miriwoong workshop participant noted changes in the fruiting of plants in the Keep River district:

When that first rain of the wet season comes we know it's time to go get the black and green bush plums; this year we went just after them rains and they were already gone, the weather is changing.

In Warmun many Gija people reported that there had been no boab tree nuts after the 2011 flood and that in 2012 even fewer nuts were found. Aboriginal knowledge of phenology, if recorded systematically, can be used to monitor and evaluate landscape changes. More importantly it helps Aboriginal people understand climate change in their own language and cultural terms and in context of their own worldviews. They can see how their TEK systems are changing and adapt to these changes accordingly. If the landscape in which people are intrinsically linked changes, this also changes their identify and the way in which they interact with their environment. One Aboriginal participant said:

Through understanding the changes in the knowledge of the trees, we can understand what that climate change is doing to our country.

6.6 The Miriwoong seasonal calendar: a case study in communication

Several Indigenous seasonal calendars have been produced to document traditional understandings of seasonal indicators and environmental change in northern Australia (O'Connor and Prober 2010; Green, Billy & Tapim 2010; Woodward 2010; Prober, O'Connor & Walsh 2011), and are used as educational and cultural tools. However, there has been little attempt to use these calendars to develop TEK management tools

for monitoring and evaluating on-ground impacts of climatic change. The Miriwoong seasonal calendar can assist in the development of community-driven models of climate change adaptation. The research project therefore engaged TEK to bridge the knowledge gap between Western and Aboriginal understanding of weather and the seasons, which in turn facilitated community discussions about the observed impacts of climate change on Miriwoong traditional lands.

In response to the need to understand observed changes in the landscape and the potential for future impacts of climate change, Miriwoong TEK was developed into an interactive seasonal calendar that documents the links between cyclic changes and the responses of flora and fauna in the environment. The Miriwoong describe three distinct seasons – *nyinggiyi-mageny* (wet season), *warnka-mageny* (cold season) and *barndenyirriny* (hot season). In each of these seasons, distinct sub-seasons are defined based on weather phenomenon and are distinctly linked to bio-temporal indicators. The seasonal calendar is a device for understanding environmental systems and allows Miriwoong values to be conceptualised in an interactive visual model. The model was designed by senior Elders in Miriwoong language to document their TEK as a baseline system, and a digital form was then created to engage younger generations in the contemporary medium. Among a range of other tools, it is used by rangers and traditional owners to assist in further documentation of observed changes in their environment.

Figure 5 shows the front-page interface of the Miriwoong seasonal calendar, an internet-based tool that is hosted on the MDWg website. The calendar is available to wide sectors of contemporary Miriwoong society and helps to strengthen cultural capital and the management of country by Aboriginal rangers and land manager groups. Importantly the design allows for a template in monitoring and evaluating impacts on TEK from climatic change. Each section of the calendar can be clicked to lead to more complex layers of TEK. The multi-layered seasonal calendar allows the user to understand the links between seasons, weather, animal behaviour, and the flowering and fruiting of plants. For example, if the user clicks on the season icon containing information related to the early phase of the wet season (when the first monsoonal rains occur), the user is directed to further information relating to the fauna and flora events in that season, namely, that the *daloong* (green plum, *Buchanania obovata*) fruit is ripe, heavy rain is on its way and *goording* (goanna) are fat and ready to eat.



Figure 5: Front interface of the Miriwoong seasonal calendar as seen on the MDWg website (Source: Mirima Council 2012)

Categorisation of the natural world in different languages and cultures depends partly on the physical reality of the world and partly on cultural perceptions of that world. Generic terms covering a number of entities do not necessarily correspond from one language to another. For example, Miriwoong does not have a word for 'food' like the English word that covers all edible things. It has two generic terms, ngarin 'meat' and maying 'vegetable or non-meat food'; 'food' terms in Aboriginal Kriol are 'beef' and 'tucker'. The word ngarin is sometimes used in a similar way to the English word 'animal', but usually means 'edible animal'. There are generic Miriwoong words for 'bird' (jigeng), 'fish' (goondarring) and 'kangaroo' (jiyirreng). Jiyirreng covers all the kangaroo and wallaby species, with each also having its own name. There is no word that means 'lizard'. The generic term goording covers all the goanna species. Other lizards, such as blue-tongue and frill-necked lizards, have their own names. There is no generic term for 'insect' in Miriwoong. The three species of native bee, together with their hives and the honey and pollen products from the hives, are covered by the generic term ngareng (in Kriol, 'sugar bag'). There are also specific names for the three species of native bee and for the honey, pollen and wax. The word ngareng is also used today to mean 'sugar'.

Many of the significant animal species that were men or women in *ngarranggarni* (Dreamtime) are assigned to particular 'skin' groups, which operate to determine relationships among a network of people involved in the kinship system.

A non-Indigenous person might say that the wet season is late or early, but this is judged according to the static Gregorian calendar. The key features of the Aboriginal seasonal calendar are the indicators that link named seasons, such as *warnka-mageny*, *barndenyirriny* and *nyinggiyi-mageny*, with changes in the floral and faunal populations, weather patterns, temperature and other changes in the environment. A Miriwoong person might say, 'You see the red flowers of *wanyarring* the bauhinia, you know the hot is there' or 'You hear the thunder speaking to the ground and you know it will be time for the goannas to come out from hibernation' or 'You see *marling* the cane grass growing long and know the knock em down rains will be along and the wet will be over'.

6.7 Integrating TEK and Western science: pathways to adaptation

In the previous sections we discussed the complexities of Miriwoong and Gija traditional knowledge systems, and their worldviews, and how these influence the way in which individuals and communities perceive risks. TEK systems have high levels of complexities that explain the relationship between weather patterns and the phenology of flora and fauna. The development of assessment frameworks that integrate TEK systems with Western science offers the potential for the participation of Aboriginal people in climate monitoring and the development of pathways to adaptation.

The results of this study indicate that when people are given time to understand climate change scenarios through their own knowledge systems and worldviews they are better able to evaluate climate risks and articulate potential pathways to adaptation. Further research is required to evaluate the effectiveness of integrating TEK with Western scientific concepts of land management to produce adaptive bottom-up responses to climate change. There is great potential for the Aboriginal personnel in Indigenous Protected Area programs and Indigenous 'Working On Country' ranger programs to work with Western scientists to document impacts of climate change. Seasonal calendars based on TEK are potential management tools for monitoring and evaluating the impacts of climate change at both the macro and micro levels. The Miriwoong model uses TEK in the baseline of data for the development of biodiversity monitoring and evaluation programs. Aboriginal ranger groups have the potential to monitor and map traditional bio-temporal indicators and timing of annual weather events to develop long-term records and to identify and record small-scale shifts in environmental conditions and climate fluctuations. The mapping of vegetation species distribution would also allow for large-scale landscape evaluation to assist in identifying potential carbon abatement opportunities.

The development of management tools based on TEK has the potential to strengthen the capacity of Aboriginal people to critically evaluate scientific models of climate change in remote areas of northern Australia, to assist them in identifying key vulnerabilities including cultural vulnerabilities, and to test future adaptive capacities. Most importantly, the tools would allow Aboriginal people to develop equitable roles in the development of climate change adaptation methodologies. Practical action initiated by Aboriginal communities is important in developing adaptation technologies, such as the Miriwoong seasonal calendar, to promote resilience and sustain future livelihoods.

7. ADAPTATION PLANNING AND EMERGENCY MANAGEMENT IN REMOTE INDIGENOUS COMMUNITIES: TWO CASE STUDIES

Critical to effective adaptation planning and emergency management is a thorough understanding by planners and emergency response personnel of the institutional environments that are peculiar to Aboriginal and Torres Strait Islander communities. In this chapter we examine the degree to which communities are vulnerable to climate change by investigating resilience and community capacity to respond to extreme weather events in the context of the local and broader Aboriginal institutional environment.

Particular attention is given in this chapter to the role of federal, state and local government in the provision of community services for climate change adaptation. The complexities of institutional and governance arrangements, both Indigenous and mainstream, in climate change adaptation are described. The history of several land title determinations in northern Australia is provided to illustrate the importance of native title corporations to the long-term capacity building of Aboriginal communities in the region. Aboriginal capacity building is critical to address the economic, social and environmental issues of disadvantage, including climate change and its impacts, facing remote communities.

In this chapter we present two case studies – a tentative assessment of the risk from severe tropical cyclones to the Aboriginal community at Bidyadanga on the edge of the Great Sandy Desert and the impact of an extreme flood event on the Warmun Aboriginal community in the East Kimberley. The factors that promote adaptive capacity and community resilience in two examples, including the role of social networks, access to resources, institutional arrangements, Aboriginal knowledge of the environment, and historical experiences of climate extremes and change, are identified. A summary of the legal and organisational issues necessary for better engagement with Aboriginal people in the East Kimberley is provided for each case study area. In terms of the wider institutional environment relevant to these challenges, we explore how Aboriginal people gain access to weather warnings, understand resources and availability of tools to plan and respond to extreme events. Finally we examine the existing strategies used in Aboriginal communities to respond to extreme events and suggest response priorities.

7.1 Understanding vulnerability in an Indigenous context

One of the most immediate challenges of climate change adaptation in remote Aboriginal communities across northern Australia is the impact of extreme events.

Aboriginal communities in the Kimberley are vulnerable to climate variability, in particular extreme weather events. Community resilience is determined in terms of ability to prepare, respond and recover from an extreme event. There is considerable Australian and international literature that discusses concepts of vulnerability in relation to extreme events, but there is limited discussion as to how Indigenous worldviews and belief systems affect vulnerabilities (Lewis 1999; Howell 2003; Wisner et al. 2004; Ellemor 2005; Baumwoll 2008; Mercer et al. 2009; Hewitt 2007; Howitt et al. 2012). There is a distinct lack of capacity of many emergency management agencies to understand and meet the challenges of cultural diversity in the response to natural disasters in Australia. Howitt et al. (2012) discuss this failure and suggest that this in turn makes Aboriginal communities more vulnerable to disasters. The social and

cultural resilience of many Aboriginal communities has been adversely affected by historical and contemporary policies and practices of government and non-government agencies in Australia (Howitt et al. 2012). The impact of natural disasters can be further compounded by a mix of social disadvantages, cultural beliefs and lack of resources. In building resilience and reducing community vulnerability, it will be important to understand how the worldviews and knowledge systems can be integrated into response and recovery programs. In northern Australia there has been a history of treating Aboriginal communities as victims in responding to the impact of natural hazards. This has been a disempowering experience for the residents of these communities and an obstacle to their active involvement in recovery processes. This tendency to exclude Aboriginal people from emergency management planning and responses reduces their capacity to develop and use their own specific coping strategies and increases their vulnerability.

Whether greater exposure to climate events such as monsoonal flooding, by itself, will increase remote community preparedness is debatable. Although emergency management procedures for recovery and reconstruction after the impact of extreme natural disasters are considered to be well developed within Australia, responding to the immediate needs of a remote Aboriginal communities presents a number of complexities that pose challenges for local emergency managers. Over thousands of years Aboriginal people have lived with tropical cyclones, floods, heatwaves and fires. With the development of sedentarised Aboriginal communities with housing stock and related infrastructure, and the impact of extreme events on these communities, a new set of challenges has arisen. The extension of disaster and emergency planning and management to remote areas such as the Kimberley region has involved Aboriginal people in considering their involvement in planning for and management of emergencies and disasters. Accessibility issues in remote locations, delivery of services and available resources all pose logistical challenges. Additionally though, emergency managers also need to consider appropriate cultural engagement, heritage protection and recognition of native title rights and obligations. In recent years a number of extreme flood events have affected remote Aboriginal communities in WA and present a unique opportunity to learn from these experiences to develop adaptive emergency management plans for remote Aboriginal communities. Climate change predictions indicate that extreme events may become more severe in the future understanding vulnerability and the adaptive capacity of Aboriginal communities to respond will be fundamental to community resilience.

7.2 Emergency management response in Aboriginal communities in the Kimberley region

In the following, we consider how emergency management and disaster response responsibilities are distributed across Australia's federal system of government, and the governmental and institutional environment in which the Aboriginal communities are located. How responsive are the responsible agencies to Aboriginal needs in the Kimberley? While there is little specific information, the small body of literature points to a range of issues that should be addressed to improve these services. Some of the relevant Commonwealth government departments and agencies, the responsible agencies in the Government of WA and local institutions are surveyed and their services briefly described. While this is not a thorough analysis of the institutional environment of emergency management and climate change adaptation planning, the available data and information points to identified needs, both immediate and long term, of Aboriginal communities and populations in the Kimberley region.

7.2.1 Federal government emergency management initiatives

A National Emergency Management Strategy for Remote Indigenous Communities, *Keeping Our Mob Safe*, was developed by the Remote Indigenous Communities Advisory Committee (2007), a subcommittee of the Australian Emergency Management Committee (Emergency Management Australia 2007). The strategy aimed to develop a more coordinated approach to emergency management in Aboriginal communities across Australia. It recognises the need to develop preparedness and prevention tools that promote the capacity of Aboriginal communities to engage with the relevant government and non-government agencies in community partnerships. The report identified four major priorities that needed to be addressed – training, education, communication of warning systems and increased engagement.

The objectives of the national strategy are to:

- develop knowledge and skills in Indigenous people and organisations to enhance emergency management in remote communities
- improve the level and appropriateness of emergency management-related services in the area of prevention, preparedness, response and recovery provided by relevant agencies in remote Indigenous communities
- build the capacity of remote Indigenous communities to improve community safety through sustainable emergency management
- increase government commitment and accountability to address issues impacting on effective emergency management in remote Indigenous communities
- promote effective partnerships between emergency management agencies, Indigenous organisations, government and other agencies to improve community safety outcomes for remote Indigenous communities. (FESA & KLRC 2008:13)

The establishment of the Remote Indigenous Communities Advisory Committee (2007) has significantly helped to address the need for greater Aboriginal involvement in emergency response to natural disasters in Australia.

Despite this report and the work of this committee, many Aboriginal communities in northern Australia still do not have emergency management plans, and engagement with emergency management personnel is limited until an event occurs. Reactionary approaches of only engaging during a disaster response leaves Aboriginal communities vulnerable to the impacts of both short- and long-term effects of climate change. The Australian Government Attorney-General's Department has specific responsibilities for emergency management. Its funds administer 'nationally significant emergency management initiatives that support measures to minimise adverse effects of disasters in Australia' (Attorney-General's Department n.d.a), which are listed in the following.

National Emergency Management Projects (NEMP): NEMP is a grants program funded and administered through the department for nationally significant emergency management initiatives. The department website states that, 'These projects help strengthen the nation's disaster resilience by supporting measures to strengthen communities, individuals, businesses and institutions to minimise adverse effects of disasters in Australia' (Attorney-General's Department n.d.b). Furthermore, 'Funded projects align with the policies and priorities of the Council of Australian Governments, Standing Council of Police and Emergency Management and the Australia-New Zealand National Emergency Management Committee (ANZEMC). New proposals for

projects are assessed by ANZEMC annually and recommended to the Attorney-General for funding' (Attorney-General's Department n.d.b).

Crisis Coordination Centre: the website of the Attorney-General's Department (n.d.c) states that the Crisis Coordination Centre is a dedicated all-hazards monitoring facility that operates 24 hours a day, seven days a week (24/7) and provides whole-of-government situational awareness to inform national decision-making during a crisis; for example, the coordination of physical assistance, as well as briefing and support to the Australian Government, state and territory governments, and non-government agencies. It also:

- · centralises and coordinates information during a crisis in Australia
- supports the Department of Foreign Affairs and Trade and AusAID during major emergencies and events overseas
- coordinates Australian Government physical and financial assistance for disaster relief
- maintains Australian Government response plans and arrangements for responding to domestic and international incidents.

The Crisis Coordination Centre is operated by Emergency Management Australia in the Attorney-General's Department.

Domestic response plans and arrangements: the department maintains response plans to assist the states and territories respond an emergency.

Standing Council on Police and Emergency Management: this standing council promotes a coordinated national response to law enforcement and emergency management issues.

The NEMP grants program is not easily accessed by Kimberley Aboriginal communities and organisational entities. While large-scale emergency and disaster response initiatives, especially following the extreme flood event across the Kimberley in 2011 that destroyed housing, roads and other infrastructure resulted in the rapid development of new housing at Warmun, ill-feeling was expressed throughout the community about the evacuation to Warmun after a long stay in temporary accommodation in Kununurra. It is likely that better communication of the evacuation arrangements and the progress of the rebuilding operations at Warmun might have ameliorated the discontent, sense of alienation and loss of control that the evacuees from the Warmun community suffered. A local committee led by KDC provides advice on disaster relief to the Commonwealth Department of Attorney-General. More transparency and consultation with key Aboriginal institutions in relation to the prioritisation of funded projects recommended is urged.

7.2.2 Government of Western Australia emergency management initiatives

The effectiveness of using existing planning frameworks and development programs to respond to extreme events and the long-term effects of climate change has been debated (Howitt et al. 2012; Curry 2003; Simon 2006). In our participatory research on the ground (see also Chapters 3, 4 and 6) and in our theoretical discussions (Chapter 5) the usefulness of such planning frameworks and development programs to Aboriginal people is questioned. In a setting where the development narrative is seen as failing to lift Aboriginal communities out of poverty and there is persistent underdevelopment (Howitt et al. 2012), capacity building requires a different approach. If effective adaptation strategies are to be developed, a new approach is needed that

allows Aboriginal communities to participate and actively contribute to emergency management planning frameworks. For such an approach to work, and for communities to be unburdened of their helpless-victims tag, genuine active involvement is needed from all stakeholders in preparedness, response and recovery processes.

The responsible agency in the Government of WA for hazard management is the Department of Fire and Emergency Services (DFES), formerly Fire and Emergency Services Authority of WA (FESA). This department coordinates emergency services for a range of natural disasters and emergency incidents threatening life and property. Its task is to work with the community and government to prevent, prepare for, respond to and recover from a diverse range of emergencies. Its human resources include a network of over 32,000 volunteers and 1123 career firefighters (DFES n.d.)

The State Emergency Management Committee (SEMC) is WA's peak emergency management body with the responsibility to develop strategies, organise and oversee the coordination and continuous improvement of emergency management in WA by promoting shared understanding and responsibility across whole of government and the wider community, establishing an emergency management framework based on a RM approach, promoting preparedness for emergencies to minimise their impact and accelerate recovery, and providing advice to government on any matter in relation to emergency management (Emergency Management WA 2013).

Another layer of governance is the SEMC Secretariat that is tasked with providing a range of services and administrative support to the SEMC. A three-tiered committee structure is provided for under the legislation – SEMC, District Emergency Management Committees (one for each emergency management district throughout the state), and Local Emergency Management Committees (each local government to establish a local emergency management committee with provision for local governments to combine for the purpose of emergency management, with the approval of SEMC). These committees do not have an operational response role; rather their primary function is 'emergency management planning through the establishment of the necessary plans for the effective emergency management at their respective levels (i.e. State, district and local)' (SEMC Secretariat 2013).

The DFES has a key role in ensuring that the Aboriginal communities have emergency management plans, are familiar with disaster relief plans, and to build the capacity of the Aboriginal population of the Kimberley region in these matters. The track record of the former agency, FESA, in engaging Aboriginal entities to improve these services is encouraging. In 2000, the WA Government enlisted FESA to undertake a natural hazard RM assessment of remote Aboriginal communities in coastal regions of the Pilbara and Kimberley. The project identified risks and looked at options for prevention of, preparedness for, response to and recovery from extreme events (Newman & Smith 2004). The project focused on the Aboriginal community of Bidyadanga but had limited success, as FESA reported that the training materials that had been developed were too complex and community members did not understand the complicated language used in emergency management planning (Newman & Smith 2004:11). These results confirm the findings of this research project that it is important to develop materials in local languages for effective education and capacity building, and to involve the community in their development (Chapter 6).

There is a need for whole-of-organisation approach to planning that integrates community needs within RM to reduce vulnerabilities. One strategy that has been suggested by FESA is combining Aboriginal science, or TEK, with new approaches to community-based risk planning to enable the development of a safety culture within the

community (Newman & Smith 2004). There has been much discussion on the rationale of replicating existing 'mainstream' planning frameworks and development programs to respond to extreme events and the long-term effects of climate change in Aboriginal communities (Howitt et al. 2012; Curry 2003; Simon 2006). Poverty, underdevelopment, separate development and cultural and linguistic difference combine as the key factors in limiting adaptation capacity. If effective adaptation strategies are to be developed, a new approach is needed that allows Aboriginal communities to participate and actively contribute to emergency management planning frameworks and in preparedness, response and recovery processes (see Chapter 5).

The effective partnership that existed between FESA and Kimberley Language Resource Centre (KLRC) was a positive development in the difficult institutional environment in the Kimberley region. FESA reported that it had been addressing emergency management with remote Aboriginal communities since 1993 in the area of prevention, preparedness, response and recovery. Services delivered during this time mainly focused on wet weather hazards (flood, cyclone, storm and storm surge). Especially relevant was the work of FESA's Indigenous Strategy and Policy Branch, which 'focussed delivery of emergency RM capacity building training (Safer Country) into hub communities, in preparation for the implementation of the *Emergency Management Act 2005*' (FESA & KLRC 2008:14).

FESA reported that:

Experience in the field of delivering the current version of Safer Country found that the language and culture of emergency management is complex and generally far too culturally alien to deliver in RICs [remote Indigenous communities] in its present format.

In June 2006 KLRC was approached by FESA to partner with them in the Emergency Management Arrangements Translation Project. The KLRC was asked to provide expert advice, and identify Aboriginal consultants who could assist with communication, translation and facilitation of the Emergency Management Arrangements and WA Emergency Management Guidelines. (FESA & KLRC 2008:15)

In a collaborative project conducted by FESA and the KLRC, The Indigenous Translation of Western Australian Emergency Management Guidelines and the Emergency Management Arrangements Project (FESA & KLRC 2008) was a partnership between FESA and KLRC to promote the participation of Indigenous people in emergency management decision-making by improving the accessibility and relevance of key emergency management literature. The project was designed with the intention of translating two existing documents into one or more Aboriginal languages and providing content suitable for remote Indigenous communities. However, 'As the project unfolded, it became apparent that translation of the complex written emergency management doctrine per se was not going to achieve the desired outcomes' (FESA & KLRC 2008:2). Various factors contributing to this dilemma were identified in their joint report (FESA & KLRC 2008:2):

- cultural and linguistic diversity between Indigenous peoples
- Australian Indigenous cultures are oral cultures (in the Kimberley, Aboriginal people do not rely heavily on structured written compositions as the primary means of communicating information)
- varying levels of English literacy in Indigenous communities
- relative density of emergency management literature
- complexity of the state emergency management policy and arrangements

- level of Indigenous community knowledge about the roles of key emergency management agencies
- fragmented engagement between emergency service organisations, local governments and Indigenous communities
- need for greater clarity around roles and responsibilities regarding remote Indigenous communities
- perceived relevance of emergency management to Indigenous communities.

The steps FESA could take to enhance the capacity of both emergency managers and Indigenous people were identified with the aim of building 'productive, equal partnerships to improve the safety and resilience of their own communities' (FESA & KLRC 2008:2). The report set out recommendations that addressed five broad themes – context, format, content, empowerment and respect (FESA & KLRC 2008:3):

- reframing the issues in ways that emergency management has relevance and meaning for community people
- employing a variety of interactive, participative mediums for communicating
- ensuring literature is written in plain English and reflects the needs of the community
- engaging and enabling Indigenous people to participate in emergency management decision-making
- acknowledging the cultural heritage, rights and responsibilities of Indigenous people.

Immediate positive developments from this work were also reported with the establishment of the following two projects (FESA & KLRC 2008:3):

- Remote Indigenous Communities Emergency Management Arrangements Project: in 2008 FESA and the Department of Indigenous Affairs initiated a jointly funded 12-month project to work with progress emergency management arrangements in remote Indigenous communities. The pilot project was focused on Kimberley communities in the Dampier Peninsula and Bidyadanga, and worked directly with community members, emergency service providers and local government to institute and formalise emergency management arrangements inclusive of remote Indigenous communities.
- Safer Country: FESA's own experiences delivering the Introduction to Emergency Risk Management – Safer Country training package reinforced the findings of the joint project in its relevance to Indigenous communities and in its content and format.

Clearly, poor understanding in the Aboriginal population of the institutions responsible for disaster planning and emergency responses, combined with poor communication by personnel working in the responsible agencies, creates a difficult relationship between emergency services and Aboriginal people. The general lack of understanding among government personnel about the cultural differences of Aboriginal people using emergency services continues to be an important issue to be addressed in this relationship. The report by FESA and KLRC identified examples of this misunderstanding and miscommunication (FESA & KLRC 2008:18):

It was felt the emergency services personnel lacked local and cultural knowledge and not enough information was provided to the community about the role of the emergency services once evacuation becomes necessary. For example, ignoring cultural protocols can cause upset e.g. people in avoidance relationships being seated together in a plane or other form of transport or unsympathetic treatment of elders who do not often move from their community, and who are traumatised by being evacuated to other places, especially when their return is delayed. Ensuring operational response information is provided to RICs [remote Indigenous communities] using appropriate media would assist greatly in these situations, as would more localised cross-cultural sessions for emergency services personnel.

Western Australia's emergency management arrangements designate organisations because of their legislative responsibility or specialised knowledge expertise and resources as the Hazard Management Agency (HMA) for particular hazards. FESA was not the HMA in the instance of the missing persons during the Fitzroy Floods nor is responsible for the operation of welfare centres to accommodate evacuees.

Notwithstanding the prescribed roles of respective agencies in emergency management, in view of the relative complexities of emergency management arrangements combined with a general lack of understanding of those arrangements, it is not surprising that communities will attribute responsibility for what happened to which ever agency or persons who were on the ground at the time, highly visible and perceived to be in charge at the time.

7.2.3 The Kimberley Development Commission

The KDC, established under the *Regional Development Commissions Act 1993*, is a statutory authority of the Government of WA. Its role is to promote the economic and social development in the region. At the time of writing, the commission was responsible to the Minister for Regional Development; Lands; Minister Assisting the Minister for State Development; Minister Assisting the Minister for Transport. In order to promote equitable delivery of services within the region, the commission is responsible for the coordination between relevant statutory bodies and state government agencies, identifying the infrastructure needs of the region, and encouraging the provision of that infrastructure in the region, and cooperating with other government agencies (namely, departments of the public service of the WA State and the Commonwealth, and other agencies, instrumentalities and statutory bodies of WA State and the Commonwealth; and local government authorities). It advises the Department of the Attorney-General on the prioritisation of NEMP funds, for instance. Its board membership includes two key Aboriginal community leaders (KDC n.d.).

KDC has key responsibilities in matters of emergency management and disaster relief. It coordinates government and non-government agencies to develop climate change adaptation and plans, emergency management and disaster relief plans, to identify infrastructure and other measures and to ensure that local Aboriginal agencies and organisations are involved in these processes,

7.2.4 Local government: the shires and Aboriginal communities

There are around 150 Aboriginal communities across the Kimberley. The maps that follow, of the Department of Aboriginal Affairs districts of East Kimberley and West Kimberley, indicate the distribution of these communities across the region (Figures 6 and 7). The maps reveal the concentration and density of Aboriginal communities along the coastal to the north and south of the major coastal towns of Broome and Derby in the West Kimberley district, along the waterways that flow into the Cambridge Gulf in the East Kimberley district, and along other waterways such as the Fitzroy River.

The Aboriginal communities are usually governed by community councils or associations, and funded by the Commonwealth Government and the Government of WA. The communities have small populations of less than 200 people in many cases and up to 500 people in one case. This sparse distribution of very small communities presents a significant challenge to the governmental institutions responsible for adaptation planning and emergency management in remote Indigenous communities. As it is, the shires are reluctant to take governmental responsibility for these small communities.

There are four local governments in the Kimberley – Broome, Derby-West Kimberley, Halls Creek, and Wyndham-East Kimberley. Two of these are important to consider, as our case studies are located in these shires – the Shire of Derby/West Kimberley and the Shire of Wyndham East Kimberley. The Shire of Derby-West Kimberley covers a vast area of 118,560 km² and is located more than 2,000 km north of Perth. In this shire there are numerous Aboriginal communities and the two main towns Derby and Fitzroy Crossing. Bidyadanga is located in this shire and is the home of many Karajarri people. The Shire of Wyndham East Kimberley is the local government responsible for the towns of Kununurra and Wyndham. Warmun is located in this shire, and most Gija and Miriwoong people live in this shire.

Comparing the future plans of the two shires is a study in stark difference. The Shire of Derby/West Kimberley has developed a strategic vision that encompasses the Indigenous population in the potential business and industry opportunities, and especially, 'Resolution of Indigenous social issues though land tenure, education, training and the new avenues of employment which flow from major resource projects and agricultural development of pastoral lands' (Shire of Derby 2011:5).

The Shire of Derby/West Kimberley (2011), *Plan for the Future of the District, 2011/12–2020/21*, states that the prospects for the shire are enormous with the realisation of major opportunities during the next 10–15 years (Shire of Derby 2011:5). The shire lists the following examples to illustrate prospects for its population, including Aboriginal people (Shire of Derby 2011:5):

- recognition of Derby/West Kimberley as a preferred choice for people establishing businesses and for lifestyle
- development of the untapped agriculture and forestry potential of vast rangelands, providing new income streams and employment, including, it states, for Indigenous people
- creation of infrastructure for economic development and employment
- achievement of significant and sustained community benefit arising from major resource industry projects
- realisation of a marina for locals and tourists, with locks, waterside housing, boardwalks, boat berths and a sandy beach
- population growth bringing quality and choice in community facilities and services, including education, health, housing, arts, culture, shopping and recreation.



Figure 6: Department of Aboriginal Affairs East Kimberley District (Source: DAA 2013)



Figure 7: Department of Aboriginal Affairs West Kimberley District (Source: DAA 2013)

The Shire of Wyndham East Kimberley's *Plan for the Future* (Shire of Wyndham East Kimberley n.d.), however, explicitly excludes Aboriginal institutions, communities and Aboriginal residents from its local planning process. This and another local shire planning document (Government of Western Australia Department for Planning and Infrastructure 2013) indicate a highly separatist and racialised approach to local government and planning in this shire and the exclusion of Aboriginal residents and communities and specific Aboriginal institutions from shire planning.

The Shire of Wyndham East Kimberley *Plan for the Future* document effectively asserts that the shire will extend little or no services to Aboriginal communities until native title and special Aboriginal leases are abolished – 'Council aims to advance this [service delivery] where funding for it is provided, and where Governments also normalise land tenure to ensure equity of land ownership with other Australians.' (Shire of Wyndham East Kimberley n.d.:35)

As a corollary, the shire's future planning document effectively asserts that few or no shire services will be provided to Aboriginal communities unless funding is made available by the Commonwealth Government to the Shire of Wyndham under a bilateral agreement: 'Road access to remote communities is undertaken where the State and Commonwealth Governments make funding allocations for this' and 'The State and Commonwealth Governments have committed to a Bilateral Agreement for Indigenous Affairs in Western Australia. This agreement seeks to normalise service delivery to remote communities. Council aims to advance this where funding for it is provided...' (Shire of Wyndham East Kimberley n.d.:35).

Further, the Shire's *Plan for the Future* states that (Shire of Wyndham East Kimberley n.d.:35):

There are opportunities to improve services to remote communities, however funding and the cooperation of people who live in these communities will be necessary to achieve such improvement. Like all communities in Australia, the level of services tends to be greater in larger communities than smaller ones, regardless of whether they are indigenous communities or not.

The specific intent of the shire's plans for remote communities – to deny services to Aboriginal communities unless specifically funded by the Commonwealth Government – is elaborated in the shire's strategic objective governing service delivery to remote communities, as follows (Shire of Wyndham East Kimberley n.d.:37–8):

Preservation

Council currently provides Environmental Health Services to 42 remote indigenous communities through a contract it has with the Office of Aboriginal Health (Department of Health). Services are limited to the funding provided through the contract.

Enhancement

Council provides limited other services to these communities in the course of delivering the Environmental Health Services (e.g. Ranger services, emergency planning).

Road access to remote communities is undertaken where the State and Commonwealth Governments make funding allocations for this.

Expansion

The State and Commonwealth Governments have committed to a Bilateral Agreement for Indigenous Affairs in Western Australia. This agreement seeks to normalise service delivery to remote communities. Council aims to advance this where funding for it is provided, and where Governments also normalise land tenure to ensure equity of land ownership with other Australians.

Key projects

Bilateral Agreement Implementation.

The second document – *Shire of Wyndham-East Kimberley Town Planning Scheme No. 7 Kununurra and Environs, Updated to Include AMD39 GG 4/1/13*, detailing the shire's Community Layout Plans for 14 zones in the shire – infers special separatist and racial planning provisions for 'The Settlement Zone', given little improvement in Indigenous wellbeing for the remote communities in that zone over many years. The council's objective for this zone is stated as follows – 'to improve the general health, safety and amenity of Aboriginal communities by supporting the preparation, endorsement and implementation of Community Layout Plans' (Government of Western Australia Department for Planning and Infrastructure 2013:34–5).

Regarding the preparation and endorsement of Community Layout Plans for The Settlement Zone, the document states (Government of Western Australia Department for Planning and Infrastructure 2013:34–5):

- a) Council's dealings in regard to communities in the Settlement zone shall be in accordance with Statement of Planning Policy No. 3.2 – Planning for Aboriginal Communities.
- b) Community Layout Plans may be prepared for either the whole or part of any land within the Settlement Zone. The plans should be prepared in accordance with the Guidelines for the Preparation of Community Layout Plans for Western Australian Aboriginal Communities and with any other relevant State or Commonwealth Government policy.
- c) A Community Layout Plan may provide for a mix of land uses which may include residential, community, administration, rural, and health, and small business activities for the support and benefit of the community, where these are consistent with improving the residential amenity in the locality.
- d) The Council shall not consider a layout plan, or any modification to an approved layout plan, unless the affected community has had an opportunity to comment on the contents of the plan or amendments to an approved plan.
- e) The Council shall assess the planning merits of the plan and then resolve to either approve, refuse or approve with any modification(s) that Council considers necessary.

As for the shire's development requirements (Government of Western Australia Department for Planning and Infrastructure 2013:34–5):

- a) Development in the zone is to be consistent with a Community Layout Plan endorsed by the Community, Council and Western Australian Planning Commission.
- b) Where an endorsed Community Layout Plan is not in place, development is to be in assessed using the best information available, which may include draft Community Layout Plans, 'as constructed' drawings or advice from relevant servicing agencies or organisations.
- c) Essential services and community infrastructure provided in conjunction with development of land within the zone should be consistent with the adopted Community Layout Plan.

Despite the impression that these details provided for the preparation and endorsement of 'Community Layout Plans' might give of order and progress, the top-down approach in shire planning, the general life-threatening conditions in the Aboriginal communities in 'The Settlement Zone', and the lack of Commonwealth government funds, indicate a commitment to the stated intent of a separate racial development within the Shire.

It can be reasonably assumed that the Shire of Wyndham will not involve Aboriginal institutions or Aboriginal residents of the shire in climate change adaptation, disaster planning and emergency responses unless the Commonwealth funds these as specific activities. Such a stance negates the potential for any Aboriginal involvement in planning and implementation of climate change adaptation as the shire's plans are relevant to regional populations and geography. The exclusion of one group on the basis of race from such developments by the shire should not be permitted by the Commonwealth Government, because this is an explicit breach of the *Racial Discrimination Act 1975* (Cth).

One practical example of the specific needs of the Aboriginal residents of the Wyndham Shire that requires urgent action in the context of increased extreme weather events and racial separatism in the Wyndham Shire is the construction of cyclone shelters in the many small communities across the shire. Another critical need is cyclone- and flood-resistant infrastructure in these communities.

There are many intangible issues. Aboriginal institutions need to plan in order to become more capable and resilient, and to undertake their own disaster planning and emergency responses, for the increasing extreme weather events such as cyclones and floods. They could also undertake specific programs to increase Aboriginal community awareness and understanding of climate change, potential impacts and vulnerability, and emergency responses to extreme weather events.

The demand for increased Commonwealth funding by the Wyndham Shire as the only source of funding and resources for addressing these needs is a narrow view of the capacity of the Aboriginal population to contribute to their future in the Kimberley region, a view not shared by the more inclusive Shire of Derby that explicitly acknowledges the development opportunities that the Aboriginal communities attract and can contribute to.

7.3 Emergency management, climate change adaptation, and issues of Aboriginal rights and governance

As in other jurisdictions, Aboriginal communities in the Kimberley region have a special status – they are encapsulated in local government jurisdictions, but in most cases, not served by the shire councils or local governments. Vast areas in the Kimberley are now subject to native title determinations under the Commonwealth *Native Title Act 1994*, which provides for a unique, fragile title. However, at least one shire, the Shire of Derby, refuses to recognise native title, and the shire states that it will withhold services while native title exists. Thus, these communities are in an invidious position regarding emergency management issues associated with climate change adaptation. The governmental and institutional environment of these 150 Aboriginal communities is more complex than is the case for townships. The complexity and special circumstances require attention in any future planning for climate change adaptation. Entangled in a web of government departments and agencies across federal, state and local governments, Aboriginal communities receive services from many entities in a complex Indigenous institutional array.

The Productivity Commission reports that several entities are effective in overcoming the levels of disadvantage in these Aboriginal communities as follows (Steering Committee for the Review of Government Service Provision 2011:57).

- The Indigenous Land Corporation purchases land on behalf of Indigenous organisations, to provide a range of social and cultural benefits. Its 'Land Management Program' assists with managing that land.
- The Wunan Foundation (WA), a not-for-profit Indigenous organisation in the East Kimberley, provides services aimed at improving socio-economic outcomes for Indigenous people.
- The Kimberley Indigenous Management Support Service (WA) develops the technical and management skills of Indigenous directors, managers and workers on Indigenous-owned Kimberley cattle stations.
- The Indigenous Landholder Service (WA) has successfully expanded beyond the Kimberley region and delivers extension, training and support to over 70 Indigenous managed properties across WA.
- Indigenous Business Australia's Business Development Programme, known as IBA Enterprises, directly assists Indigenous people to succeed in business, through support, mentoring and business loans.

• The Australian Indigenous Minority Supplier Council provides a direct business-to-business purchasing link between corporate Australia, government agencies and Indigenous-owned businesses.

There may be improved outcomes in the Aboriginal communities of the Kimberley region if these entities were engaged in future planning, capacity building and design of adaptation measures.

The WA State Government body with responsibility for emergency services, FESA, has grasped these challenges of capacity building and collaborated with key Indigenous bodies, such as the KLRC, to improve the overall emergency response standards and to understand the cultural and linguistic issues that require special attention. However, much more needs to be done to improve the capability and resilience of these sparsely distributed and vulnerable Aboriginal populations in the Kimberley region. One of the characteristics of such small populations with extreme disadvantages is that the leadership of the groups are under-resourced to tackle the multitude of problems they face. Preoccupied for so long over for many years with the onerous tasks of pursuing native title claims, it has not been possible for them to give attention to other matters, such as climate change adaptation issues.

Designing and implementing good governance arrangements for climate change adaptation is a new and challenging task that will require much more attention in the future than has been given in the past. This is also the case for emergency management planning and designing response mechanisms. The resilience and independence of these remote communities has been tested by existing governance arrangements and responses to emergencies, with the result that the residents of these communities are distrustful of Western ideas about governance arrangements. Poor understanding of this governmental complexity among a largely non-literate Indigenous population with extreme linguistic diversity, coupled with poor communication standards by personnel of government bodies, demands a rigorous set of principles for better performance in engaging Aboriginal people in the Kimberley region in emergency management, disaster planning and climate change adaptation planning. The collaborative work of FESA and KLRC represents an important step forward, but one which requires further work.

7.4 Institutional arrangements, native titles and governance structures

In East Kimberley, Aboriginal corporations in the Kimberley region such as the MG Corporation have been established as a result of agreements for settlement of native title and resource issues associated with Aboriginal people such as the Miriwoong people. Specific local Indigenous institutions also important for capacity building in the Kimberley are the Aboriginal community governance bodies, such as Aboriginal community councils. The governance structures of Aboriginal institutions in northwestern Australia reflect traditional ownerships and land title claims and determinations. Understanding these governance structures and how they have arisen is important in adaptation planning for climate change.

7.4.1 Miriwoong and Gajirrabeng (MG) native title

Aboriginal traditional ownership of the Ord River Basin is complex. The Ord catchment area comprises traditional estates owned by several groups, including Gija, Jaru, Miriwoong, Gajirrabeng, Balangarra and Woolah peoples. The MG peoples are the
traditional owners of estates in the northern areas of the Ord River region, while the Gija and other groups have interests in the southern and south-western areas.

In 1994 the MG peoples (using the spelling 'Miriuwung' and 'Gajerrong') filed a native title claim (the MG#1 claim) with the National Native Title Tribunal, seeking recognition of their native title rights and interests over 7653 km² of their traditional country. The MG#1 claim was referred to the Federal Court in 1995, and a determination was made in 1998, which found exclusive native title rights equivalent to ownership of the land (Ward v State of Western Australia (1998) 159 ALR 483). This determination was then subject to a Full Federal Court appeal by the WA and NT governments, which weakened some of the original findings of native title through the application of extinguishment (Western Australia v Ward (2000) 99 FCR 316). The MG people appealed the decision of the Full Federal Court to the High Court (Western Australia v Ward (2002) 213 CLR 1). The High Court remitted the case back to the Full Federal Court, recommending negotiations be entered into by the governments and the MG peoples in order to reach a native title settlement. After eight years of negotiation, an agreement was reached and a consent determination was recognised by a special sitting of the Federal Court in Kununurra on 9 December 2003 (Attorney-General of the Northern Territory v Ward (2003) 134 FCR 16). However, the next day on 10 December 2003 the WA State Government announced its intention to compulsorily acquire and extinguish native title over 65,000 ha, or 650 km², of land in the MG#1 determination area and the (then undetermined) MG#4 claim area (Guest 2009:21-2).

The Ord Final Agreement (OFA) was formally registered in 2006 as an Indigenous Land Use Agreement (ILUA) between the MG peoples and the State of WA. The primary purpose of the OFA was to settle the 'future act' implications of the expansion of Ord Stage 2 in accordance with the Native Title Act. This involved the settlement of compensation for compulsory acquisition for Ord Stage 2. Other aspects of the settlement included:

- the establishment of conservation park areas to be jointly managed between the MG people and the WA State
- a compensation package for the impacts and dispossession of traditional land
- \$100,000 was provided to KLC by the WA State Government for the establishment of MG Corporation. The MG Corporation was created to successfully manage and oversee economic and social development for MG people. It was incorporated in February 2006
- annual funding of \$1 million to the MG Corporation for the first 10 years of its operation.

Despite negotiated outcomes, a major effect of the OFA has been agricultural expansion on MG traditional land and the extinguishment of native title rights in significant areas (more than 65,000 ha).

Acknowledging the lack of public funding for PBCs, 'the Miriuwung and Gajerrong decided that the resourced MG Corporation be effectively utilised to undertake PBC work' (Guest 2009:39). Under the *Native Title Act 1993* (Cth), once native title is determined, Aboriginal groups are required to establish a PBC to manage the group's legal obligations under the Act. The composition of the MG Corporation Executive is the same as the PBCs for the MG#1 and MG#4 native title determination areas.⁶ This enables the PBCs to delegate their administrative functions to the MG Corporation, so that the PBCs effectively operate with more funding and MG Corporation meetings can

⁶The corporate structures of the MG Corporation and PBCs were reviewed and changed after they were initially incorporated, and may no longer have the same executives.

be carried out efficiently (Guest 2009:40). MG#4 was determined on 24 November 2006.

On 31 May 2011 at the Keep River National Park, Justice John Mansfield of the Federal Court gave orders for native title determinations over the remaining 32,000 km² of pastoral land, including stations in and around Keep River on the NT side of the border (Northern Land Council 2011:20). As of 2013, the native title corporation or PBC for the MG lands on the NT side of the border is yet to be established, and the delay has led to much uncertainty with regards to future roles and responsibilities of the traditional owners or native title holders.

7.4.2 Governance structures of Miriwoong institutions

As part of negotiations for the OFA, the Miriwoong and Gajirrabeng Steering Committee was established to instruct KLC (representing the MG peoples) throughout negotiations, while senior Elders or 'law bosses' for MG country retained the right to make all final decisions:

The Steering Committee was appointed and operated in accordance with traditional decision-making processes as instructed by senior Miriuwung and Gajerrong law bosses. It was comprised of a 'senior' and a 'junior' member of each *dawang* (local land owning group), where 'senior' and 'junior' were not assignations of age, but references to an individual's position in Miriuwung and Gajerrong law... (Guest 2009:30)

The MG Corporation has a decision-making process that includes a 32-member governing committee, consisting of two representatives from each of the 16 *dawang*, who together manage the MG traditional lands. This arrangement helps to ensure that the traditional rights and interests of *dawang* over their country is recognised and maintained (Hill 2011:74). In August 2008 the MG Corporation received the Highly Commended award in the category of Best Governance for an Aboriginal organisation at the National Australian Indigenous Governance Awards (Guest 2009:38–9). The limiting factor of MG Corporation for Miriwoong people is that it only has jurisdiction in WA, and the Northern Land Council administers native title and traditional owner interests for the NT. PBCs have not been set up for Miriwoong country in the NT. This creates much confusion and limitations to more appropriate approaches to governance of Miriwoong life.

A Miriwoong traditional owner, at a Keep River stakeholder meeting in September 2012, said:

It's not our fault someone drew a line through our country, why can't they make it easy for us? I'm a Miriwoong person but my country is on the NT side, so that MG (Corporation) they can't help me. We have no power on our community, no running water, no ranger program and no funding to do nothing us NT mob, but we still live here, and now with this climate change, who going to help us with that?

Understanding the complex governance structures of Aboriginal institutions is essential in adaptation planning for climate change as it will help define the roles and responsibilities of the native title group dealing with climate change matters, as well as highlight limitations. Importantly, it will allow for a CBA that is embedded within local institutions and is tailored to meet individual and community needs. For Miriwoong people, cooperation between institutions on both sides of the border will be essential.

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In September 2012 we held a stakeholder meeting in the Keep River National Park with 15 senior Miriwoong Traditional Owners, MG Corporation, Northern Land Council, local pastoralists and national park management. Participants asked that most of the discussions of this meeting be kept confidential, but all agreed that it was essential to work together to address climate change concerns and develop real opportunities for adaptation. The Miriwoong people had put forward five key concerns they said needed to be addressed if successful adaptation strategies are to be identified.

- 1. A need for joint management of Keep River National Park.
- 2. Establishment of an Aboriginal ranger program.
- 3. Development of a climate monitoring program based on traditional knowledge of the Miriwoong seasonal calendar to work with Western science.
- 4. Improved infrastructure of community outstations within the Keep River National Park.
- 5. Develop community-planning framework that takes into account the complex governance structures of Miriwoong lands.

Before the stakeholder meeting, Miriwoong people discussed climate change in relation to their own worldviews on country within the context of their daily lives, and identified the main issues. Miriwoong participants held private meetings to define the list, and we facilitated the discussion of each item in the stakeholder meeting. The outcome has been that stakeholders had a clear agenda presented to them before the meeting, which allowed them time to consult internally within their organisations and prepare before the meeting. This approach has been successful, and Miriwoong people are now independently in discussions with stakeholders to develop opportunities to address these issues.

7.4.3 Gija governance structure

Unlike the MG from the northern part of the Ord River and surrounding systems, Gija people living to the south and west have had none of their native title cases determined in the areas claimed under the Native Title Act. However, like the MG, the Gija lands are subject to complex state government legislation and land tenures, including pastoral leases, mining leases, excisions and a World Heritage listed national park (the listing is for 'natural values' and not 'cultural values'). A number of native title claims over parts of Gija land have been lodged through KLC, but these are still pending. While KLC is the representative body governing Gija native title issues, several other organisations assist groups of Gija people with governance issues on varying levels. Because they do not have native title, and the large land area is managed accordingly by a several organisations, no overarching body exists to deal with climate change issues faced by Gija people.

The Warmun community, where the largest number of Gija people live, is governed by a community council. Gija traditional lands include the southern part of the Argyle Diamond lease, while the northern part of the lease is the traditional land of the Miriwoong people. A number of Warmun community members are beneficiaries of the Argyle Diamond agreement. The diamond mine lease area is the subject of an ILUA that resulted in the establishment of the Gerlganyem and Kirlgayi trusts to manage the native title payments and other benefits that accrue to the Miriwoong and Gija beneficiaries of this agreement. These trusts assist some Gija people who live in small communities – for example, Joowoorlinyji (Bow River) and Rugun (Crocodile Hole) – near the mine area with day-to-day management.

There are two other mining companies operating in Gija country. The Savannah Nickel Mine, about 50 km south of Warmun, and the Kimberley Metals Group, which operates the Ridges Iron Ore Project, located to the north of the Argyle Diamond lease area and mines iron ore, which is transported by road train to a holding stockpile at Wyndham Port, before being transferred by barge to waiting ships in deeper water. The Gija and Miriwoong peoples are parties to an agreement permitting land access and settling the 'future act' and other native title interests in the lease area. The KLC assisted the native title groups to negotiate agreements with both mining companies, but now both agreements are managed by trust committees set up as part of the negotiations. KLC assists when it is requested by these committees. KLC has also assisted the Aboriginal traditional owners to establish a ranger program in association with the Violet Valley and Norton Bore communities south-west of Warmun. In workshop discussions, participants suggested that the KLC Gija ranger program could undertake climate change monitoring based on traditional knowledge systems and also engage in mitigation activities through a managed carbon-burning program.

Most of the World Heritage listed Purnululu (Bungle Bungle) National Park is in Gija country. The Purnululu Association administration, which deals with the Gija part of the park, has for a long time been based at the small community of Wurerrenginy, at Frog Hollow, 37 km south of Warmun. The association runs the independent Purnululu Association School, and deals with land issues on behalf of members. Gija people resident at Imintji who are connected with the Lansdowne and Tableland stations areas have their land issues administered from Derby. Without any unified body or native title determinations – there are a number of Gija native title claims – climate change governance issues in the several parts of Gija country make large-scale planning for climate change adaptation difficult.

The lack of native title determinations in relation to Gija traditional land estates poses a barrier to adaptation, but opportunities still exist to build pathways to adaptation planning in the future. Organisations pursuing land title claims can work collaboratively and embed adaptation planning within existing structures and community groups, such as the WAC.

7.5 Bidyadanga case study: challenges in a remote community

The Bidyadanga Aboriginal community is located about 200 km south of Broome and 600 km north of Port Headland on the edge of the Pilbara region. The community is located on the coastal dune system that forms the northern edge of Eighty Mile Beach in the La Grange aquifer water planning area. Karajarri people are the native title holders of the land in which Bidyadanga community is located. Their country stretches from the west Kimberley coast, almost 200 km east into the Great Sandy Desert (Figure 8). Several areas of cultural and natural significance have been identified by the traditional Aboriginal owners, and their sensitivity demands special consideration in any future planning and responses in relation to climate adaptation. Three sites are Ramsar-listed wetland zones: the Eighty Mile Beach wetland system (including the Anna Plains wetland system); the Mandora Marsh wetland system, and; the Roebuck Bay wetland system. (Government of Western Australia, Department of West

The significance of the Mandora Marsh wetland system has been identified by traditional owners and highlighted in an assessment conducted by the then Department of Conservation and Land Management in 1999. It found that Mandora Marsh contains an unusually rich and diverse number of wetland types of both saline and freshwater origin. Extending about 50 km inland and surrounded by desert, the area supports the most-inland mangrove community in Australia. Raised peat bogs and mound springs are also of considerable scientific interest. In addition, the area contains populations of threatened plants and animals including a species of bush tobacco, *Nicotiana hetherantha*, and the bilby, *Macrotis lagotis*. Several new species of flora and fauna have also been discovered at Mandora Marsh.

An investigation into the marsh's cultural values (Yu 2000) specified the particular significance it represented to the traditional owners. The department has set strong rules to protect Mandora Marsh in collaboration with the traditional owners.

Today many Karajarri people live in the community of Bidyadanga, formerly known as the La Grange Catholic Mission. Bidyadanga is the largest Aboriginal community in WA, with a population of about 500 residents (Department for Planning and Infrastructure 2008). The Bidyadanga community is made up of Aboriginal people from six different language groups, including Karajarri, Mangala, Juwaliny, Yawuru, Yulparija and Nyangumarta. These groups were all moved onto Karajarri lands in the first half of the twentieth century, and after the establishment of the La Grange Catholic Mission in 1955 (McKelson & Dodd 2007). The Karajarri language (*muwarr*) is part of the Pama-Nyungan language family (Bagshaw 2003). There are three variations of Karajarri: *Nangu, Najanaja* and *Nawurtu*. Karajarri is recognised as a highly endangered language.



Figure 8: The traditional lands of Karajarri people (Reproduced with the kind permission of the National Native Title Tribunal, 2012 Map Series)

The remoteness of the community makes it one of Australia's most vulnerable communities to the impacts of climate change and extreme events, especially tropical cyclones. The community has long lived with the impacts of natural disasters, but residents have expressed concern about their capacity to respond to any increased risk. The Karajarri people have been the focus of many studies investigating risk, vulnerability and development of planning frameworks.

7.5.1 Native title and current governance structure for Karajarri people

In 1979 the lease for the Catholic mission was transferred to the Bidyadanga Aboriginal Community La Grange Inc., or the Bidyadanga Community Council, as the Aboriginal community's representative body (Weir 2011). The community council receives funding from the WA State Government to deliver community services. The community council is a representative forum elected on behalf of community members. Its constitution mandates equal representation from all five major tribal groups.

The Karajarri people's native title rights and interests were recognised in two native title consent determinations, Karajarri People (Area A) and Karajarri People (Area B), made in February 2002 and September 2004 (Nangkiriny v Western Australia (2002) 117 FCR 6; Nangkiriny v Western Australia [2004] FCA 1156). Both these determinations arose from claims to native title made in 1996, 1997 and 1999, which were later combined in 2000 and successfully negotiated. The 2002 Karajarri native title consent determination (Area A) covered 24,725 km² of the remote Kimberley region, and recognised Karajarri people as holders of exclusive native title rights and interests to 'possess, occupy, use and enjoy' their land 'to the exclusion of all others' (Nangkiriny v Western Australia (2002) 117 FCR 6). The 2004 consent determination (Area B) related to the pastoral stations Nita Downs Station, Shamrock Station, part of Anna Plains Station, and the De Grey Stock Route, as well as various other small areas of land (Weir 2011). The determination recognised Karajarri people's non-exclusive native title interests, including the right to enter and remain on land, camp, take flora, fauna, natural resources and water, engage in ritual and ceremony, and maintain and protect sites of significance (Nangkiriny v Western Australia [2004] FCA 1156 at [5]). These non-exclusive native title rights were recognised over the community living area of Bidvadanga because the area was an Aboriginal Reserve and could be claimed under section 47 of the Native Title Act.

In 1998 Karajarri established the KTLA as their PBC. Following the determination of Karajarri native title, the KTLA became a community council (registered native title body corporate; RNTBC) under the Native Title Act, Division 6. As an RNTBC, the KTLA's primary role is to protect and manage native title for the Karajarri people and to serve as a legal entity through which parties may conduct business with Karajarri over their native title land (Attorney-General's Department Steering Committee 2006:6). However, the KTLA's secondary responsibilities within the Karajarri community are much broader. It is also responsible for and manages a wide variety of programs, runs businesses and is the main contact point for all planning matters regarding land (ranging from water allocation planning to agricultural development and mining). Some of the larger programs currently being undertaken by the KTLA are:

- the Karajarri 'Working on Country' ranger program
- Indigenous Protected Area planning
- water management planning
- negotiating ILUAs
- managing outstation community living areas
- managing the Karajarri Cattle Company.

The KTLA has mainly operated without funding after the native title determination. As a result many members work on a voluntary basis, and there was no KTLA office in Bidyadanga until after the settlement of the Bidyadanga Initial Works Land Use Agreement between the KTLA, Bidyadanga Community Council and the State of WA in 2010 (Weir 2011; Edgar 2011), which means that:

Without administrative support, KTLA committee members are regularly placed in the uncomfortable position of making decisions without all the relevant information. Without support staff, the board is responsible for both making decisions and implementing them. *(Weir 2011:20)*

The challenges of native title governance have strained the relationship between Karajarri people and the Bidyadanga Community Council (Edgar 2011). For example, the community council Chair is no longer held by a Karajarri representative, and Karajarri people living on outstations beyond Bidyadanga have had their council voting rights removed (Weir 2011). This is made more complicated as Bidyadanga falls within the Broome Shire area, which has responsibility for overarching town planning.

In 2008 the community council initiated negotiations with the KTLA and the State of WA for an ILUA regarding the upgrade of infrastructure in Bidyadanga, including new housing for community residents (Edgar 2011). The agreement was formalised in 2010. As the first formal agreement between the community council and Karajarri PBC:

[it] is envisaged that the ILUA will set a precedent within Bidyadanga and for the State and other stakeholders by ensuring that Traditional Owners are provided prominent and formal positions in negotiations over the use of, and access to, their land. (Edgar 2011)

The complex governance structure and multi-level planning makes it essential that all levels of government and community are involved in emergency management planning. At present, conversations are restricted to the council level and many community members are not aware of emergency preparedness and response procedures, making many sectors of the community vulnerable to the impact of extreme weather events and the long-term impacts of climate change.

7.5.2 The impact of tropical cyclones

The coastline of WA between Port Hedland and Broome is one of the most cycloneprone areas in the world. Bidyadanga Aboriginal community is particularly vulnerable to the impacts of severe tropical cyclones. Since 1909 about 38 cyclones (Figure 9) have crossed the coast within 100 km of Bidyadanga and have had direct or indirect impacts on the community (BOM 2013a). The frequency of severe tropical cyclones and the remoteness of the community put it at a greater risk, with the community becoming completely inaccessible during these events. The cyclone season runs from November to April. The major impacts of cyclones to the region are strong winds, flooding rains and storm surges. Severe tropical Cyclone Rosita in 2000 crossed the coast just to the north of Bidyadanga and caused widespread damage to a neighbouring caravan park and Eco Beach tourist resort. Storm surges were reported to have penetrated 2.5 km inland, causing extensive damage to pastoral properties and extensive loss of livestock (BOM 2000). The community residents were evacuated to Broome, community infrastructure suffered only superficial damage, and residents were able to return to their homes within days. This was one of five evacuations between 2000 and 2004 (Newman & Smith 2004).



Figure 9: Tropical cyclones crossing within 100 km of Bidyadanga in northwestern Australia, 1909 to 2006 (Source: BOM 2013a)

Tropical cyclones have had a significant impact on the community over many years, and two of the four highest rainfall events on record in WA have been recorded at Bidyadanga. In January 1964 Cyclone Bessie caused widespread damage to Bidyadanga with 616 mm of rain in 72 hours. Cyclone Sally in December 1971 delivered 532 mm of rain in 24 hours and isolated the community for more than a week. Historical records report that a tropical cyclone in 1887 off the coast of Eighty Mile Beach destroyed a pearling fleet and killed 140 people (BOM 2013b). Despite the impact of tropical cyclones on the community and the level of vulnerability faced by residents, emergency management planning with community members is limited.

7.5.3 Perceptions of risk

As with the Miriwoong and Gija peoples, Karajarri perceptions of risk from extreme events and climate change in general are influenced by their worldviews and cultural practices. There are many differences between the perceptions of Karajarri residents at Bidyadanga and residents at Warmun and in the Keep River district. This can be attributed to levels of education and English proficiency. In general, workshop participants understood the more complex language of climate change adaptation. Participants were able to relate causes of climate change with global warming phenomena and understood cause and effect on local and global scales. One Aboriginal participant remarked:

... like for that sea level... is it because of in the other side of the world with the ice melting to fill up that water.

People commented that they have been very aware of the impacts of climate change, and had observed that the phenology of plants and animals was changing locally. There was a sense that their TEK and cultural rules told them that there would be consequences if they did not 'look after country the right way':

Well it's no surprise to us, black people... around the world, Indigenous people around the world have been telling people, 'Don't go, don't cut this down' or 'don't dig this up'.

There was considerable concern expressed about the impacts of tropical cyclones on the community and about a sense of complacency. It was suggested that, as people had been living with cyclones their whole lives, the preparedness of the community for an extreme event was low. There were many indicators for the onset of a tropical cyclone, some learnt as part of the tradition of TEK and some learnt by observation, and familiar with these, people believed that they would just simply 'go to Broome' and they would 'be alright'.

Most people interviewed in focus groups and larger group workshops were unaware of how to prepare homes for a tropical cyclone. One participant commented:

I'd just shut the door and get in my car.

The residents appear to be quite resilient, not to say nonchalant, faced with the threat of tropical cyclones and do not necessarily see themselves as vulnerable to the impacts. In a KTLA meeting, directors felt that this was because there had not been a direct impact on the community in many years. One participant commented:

We need to change the mindset of the whole community.

Bidyadanga is one of the most vulnerable Aboriginal communities to extreme events and future impacts of climate change. Before conclusions can be drawn on community perceptions and attitudes to severe weather events and climate change at Bidyadanga, more in-depth research needs to be undertaken with community members.⁷

7.5.4 Roles and responsibilities of Aboriginal organisations

Local government and community councils provide limited municipal services to communities, and most often resources are stretched to capacity in the provision of even basic services. More complex issues such as emergency planning are not seen as a priority. Inadequate infrastructure remains one of the biggest issues facing the Bidyadanga community. Many questions were raised by participants, including who has responsibility for providing services such as upgrading of housing to meet cyclone standards and provision of an emergency evacuation or shelter within the community.

The relationship between residential groups and native title holders sometimes can become tense when community infrastructure proposals are discussed. No one organisation has responsibility for native title matters. A PBC or the Native Title Representative Body, in this case the KLC, could be approached to become involved in resolving and managing the native title issues. Such bodies can be effective if involved early in the process of design and commissioning of infrastructure and related projects. These complex issues are not the focus of this study, but nevertheless need to be acknowledged.

One example of how these complexities can affect adaptation occurred during the WA Government's pilot emergency management planning program in Bidyadanga. FESA emergency service officers worked with the Bidyadanga community to try to establish a

^{7.} This research project had only limited contact and engagement with the wider Bidyadanga community.

Community Development Employment Project to train local people as emergency response personnel. This project did not succeed, but workshop participants in our study provided additional insights as to the complexities that historically have led to the failure of successive projects to deliver results. They suggested that FESA did not engage with the wider community to assure higher levels of community engagement and success. According to one participant:

It should be taken from a whole community perspective, rather than just the traditional owners... Bidyadanga [is] made up of different language groups. KTLA can't just do this, the community council needs to be more active on the ground...

This highlights complexities of governance structures within Aboriginal communities and how this can affect adaptation planning. There needs to be a more inclusive approach to emergency management planning. Comprehensive representation of linguistic and native title groups, as well as residents of communities, needs to be more effective in the consultation and planning process. The numerous examples of dissatisfaction with inadequate representation of the diverse community interests reported to us offer insights as to how lessons learned can be applied to climate change adaptation planning in the future. The KTLA for many years has been trying to address these issues (Weir 2011). Progress is slowly being made to educate agencies, but the capacity of the KTLA to engage in these processes is limited, especially given their ongoing participation in many community activities, such as our climate change adaptation workshops (Figure 10). Adaptation planning frameworks need to be developed that look at the multi-layered governance structures and understand the traditional and historical roles and responsibilities of each group. The lack of understanding by Aboriginal and non-Aboriginal organisations is not only a significant barrier to emergency management planning but also a potential barrier to adaptation.



Figure 10: Karajarri Traditional Owners at a stakeholders' workshop for collaborative planning in the La Grange Basin (Photograph: Sonia Leonard)

7.5.5 Integrating risk assessments to development planning of Karajarri lands

The La Grange area has been dominated by pastoralism since white settlement. Senior people can remember sheep farming, and the evidence of this period remains in old sheep-shearing sheds and other infrastructure. More recently cattle farming on pastoral leases has dominated the area. This land use is perceived to co-exist relatively well with native title rights and interests (Edgar 2011). Although some detrimental impacts of cattle occur, access issues are relatively well understood, land is fenced minimally and the landform remains intact (Weir 2011).

The impacts of extreme weather events are well understood by Karajarri residents of Bidyadanga, but how climate change affects the frequency and intensity of these events and how they affect current and future development in the La Grange area appear to be less understood. In workshops KTLA participants expressed concerns that Aboriginal people have about future agricultural development in the area and the impacts of climate change and extreme events. However, TEK and seasonal calendar knowledge did not play the important role it assumed in the other two case-study areas. One reason for the lesser interest in using a seasonal calendar approach to planning may be that the focus of the attention of the Karajarri people in past years has been on water rights, impacts on groundwater and underground water, saltwater incursion and water quality issues. This does not imply a lack of knowledge of seasonal phenology of flora and fauna, but rather a higher prioritisation of pressing water quality and management issues (Government of Western Australia Department of Water 2010).

Although the participants expressed interest in documenting and investigating their seasonal calendar for desert areas in the future, their major concerns identified were:

- increased water consumption versus decreased aquifer recharge and the effect on freshwater spring systems and biodiversity sustained by them
- agricultural expansion, land clearing and potential salinity arising from the shifting saltwater interface
- further salt water intrusion to the freshwater interface from sea-level rise and storm surges, and its effect on community water supply in coastal areas
- damage to cultural heritage sites along the coast from storm surge and sealevel rise
- access to traditional food sources with changing phenology of flora and fauna
- economic viability of pastoral diversification and current stocking rates under the increased risk of tropical cyclones and storm surges
- that all new buildings in the community and surrounding outstations should be built to severe tropical cyclone ratings.

There is a desire for the KTLA to use its position as a native title holder and for residents to lead development planning in Bidyadanga to avoid simply reacting to extreme events and impacts of climate change as they occur. It was considered essential that climate change adaptation and risk of extreme events be identified and factored into any future planning. Considerable discussion was given to appropriate location of development and the use of ground water.

The issues facing Karajarri people are similar to those elsewhere in northern Australia. As one workshop participant said:

It is important to keep abreast of information coming from other areas, such as research and experiences, so that we can be aware of and prepared for what may happen in the La Grange area. Partnerships with other Aboriginal groups across the north of Australia, but also in other places in WA, were seen as an important method in building capacity of both the KTLA and Bidyadanga Community Council to respond to extreme events. Despite current efforts by FESA and other government organisations, the current planning framework is failing to secure adequate capacity of the community to respond to both short- and long-term impacts of climate change.

We started those conversations for a cyclone shelter years ago, through that ILUA... that basketball court was going to double as a cyclone shelter but look it still got no roof... we are not prepared for a big cyclone here.

7.6 Warmun flood, 2011: messages for the future

On the 12 March 2011 the remote Aboriginal community of Warmun in the East Kimberley was devastated by an extreme flash flood event. Unusually heavy rainfall in the 24-hour period resulted in 310 mm of rain being recorded at Warmun. Without warning at about 2 pm community members reported a sudden rapid rise of Turkey Creek, with a flash flood engulfing the community. Water levels exceeded roofs of houses within 20–30 min and the WA Department of Water estimated flood levels reached 5.1 m above the bridge deck crossing Turkey Creek in the middle of the community. There was no time for people to move personal belongings to higher ground. Community members self-evacuated and congregated at the roadhouse on higher ground, aided by directions from young Aboriginal members of the community. About 224 Aboriginal people were immediately affected and displaced by the flood. There were 42 houses totally destroyed and an additional 20 homes were deemed unliveable without major repairs. Most residents lost all of their personal possessions.

Emergency managers had difficulty coordinating the immediate response to the extreme event, and there was limited understanding within the community on the emergency procedures. After the initial evacuation to the roadhouse, the community was confused about what to do next. The community was isolated for two days with limited supplies and shelter. The event had severely damaged roads in both directions, leaving roads impassable, and information flowed slowly between community and state emergency managers. The community was eventually evacuated to Kununurra by helicopters on 14 March and housed in a temporary workmen's camp for about four months. The WA Government declared the community a natural disaster zone about one week after the flood event (Figure 11).



Figure 11: The declaration of Warmun as a Natural Disaster Area (Photograph: Sonia Leonard)

The sign can still be seen at the gates of the Warmun Community as of March 2013.

7.6.1 Recovery process: rebuilding the community

Several significant issues have emerged in the management of response and recovery for the Warmun flood event. There were communication difficulties due to language barriers and misunderstanding of the cultural protocols of relocating an entire community outside their traditional lands. The socio-cultural implications of overcrowding in long-term evacuation centres and the level of services required to support people's day-to-day needs, as well as the psychological impact of the event, were also problematic. The lack of insurance and other precautionary measures meant that emergency managers and governments needed to provide a different level of recovery assistance to the community than to other sectors of society. Additionally the adaptive capacity of the community to recover was limited by a lack of engagement in the planning and development of emergency management procedures.

The Warmun flood event shows the sheer enormity of reconstruction and recovery required to adequately respond to the needs of an Aboriginal community after a devastating extreme event. It highlights the importance of developing detailed culturally appropriate emergency management plans, so as to build the adaptive capacity of Aboriginal people to respond to a possible increase in extreme events due to climate change.

7.6.2 Enhancing adaptive capacity and community resilience

Community resilience is built by working with the local knowledge of people living in the community. In workshops with both Warmun and Bidyadanga communities it became clear that their historic, cultural and spiritual connection to their land provides a realistic insight to disaster preparedness. In Warmun many interviewees recalled TEK indicators within the landscape that told them that the big flood was coming. According to one participant:

Fire fly all over the place the days before the flood, never seen so many before, that tells us something strange was coming. [Another] sign was the centipede, them knew it was going to rain lots, they came up out of the ground and moved away from the river.

The TEK of Warmun residents helped to identify that an event was pending, but they did not predict the magnitude of the event. However, TEK is still an important element to be considered in disaster preparedness. TEK indicators can help people understand pending events, and when integrated with contemporary BOM warning systems, communities can respond accordingly.

KTLA has challenges in its capacity to handle climate emergencies. This concern affects the organisation's ability to respond to external demands and to lead from within. Support for PBCs is also an ongoing issue. One participant remarked:

A big educational sort of awareness process we need to also go through... to understand them risk of climate change...

7.6.3 Using social networking in disaster preparedness

With the growing popularity of social media networking within Aboriginal communities. and access to mobile phones and tablet devices on the increase, the role of social networks is a key consideration in disaster preparedness and warning systems. Software applications could be designed in local languages and Aboriginal Kriol to provide basic preparedness information and links to useful contacts. Alerts could be sent directly through the applications in the event of a pending cyclone or flood. It was suggested by a workshop participant that a simple cost-effective first step could be for FESA in WA to set up Facebook pages for Aboriginal communities. These could serve as a message board for weather warnings and cyclone alerts. As most of the younger community members have smart phones - and as we observed increasingly older people in the communities are embracing this technology – that can be set up to push Facebook notifications, these alerts could be delivered into the community in real time. As young people received these messages, word would spread quickly through the community. Additionally this interface could be used for targeted educational campaigns, and FESA could advise and remind people on their household preparations in what they need to do as a tropical cyclone or other natural hazards approach. Other possible communication platforms are Twitter and utilising local radio stations.

Most importantly these strategies take advantage of existing social networks in these communities. These communities are highly connected socially, with everyone knowing everyone or being family, which is a real strength in communities and emergency services responding to disasters. In the 2011 flood, it was the younger natural leaders within the Warmun community that took charge and spread the warning quickly and efficiently. This serves as an example of the need for emergency manager to build on these human assets to strengthen community capacity to respond to natural hazards and more extreme events.

7.6.4 Responding to disasters within Aboriginal communities

The Warmun flood experience in 2011 highlights the need for cultural expertise to assist a community in the recovery process from an extreme event. The lack of communication from government agencies in charge of the Warmun recovery process, which community people reported, could have been addressed to some degree if local

Aboriginal people had been trained to assist in the response efforts. Cultural and language barriers are commonly overlooked by non-Indigenous emergency managers, and there is a presumption that people understand emergency processes. In response to the Queensland floods in 2011, the Red Cross developed a training program to establish Aboriginal liaison officers to deliver assistance to other Aboriginal people in post-event recovery (Isaac 2012). The program is an initiative of the Flagship Disaster Preparedness Project – working with Aboriginal communities to harness their traditional knowledge to improve community resilience to future disasters. The training involves having Aboriginal people from the local community trained to coordinate and understand the cultural needs of Aboriginal people at evacuation centres and offering door-to-door assistance on their relocation back into the community. The Red Cross has found that people feel more comfortable talking with someone who can relate to their own cultural background.

Aboriginal community members themselves are best placed to identify the vulnerable sectors of the community, and can draw on its strengths to help in disaster preparedness, response and recovery. In the case example of the Warmun flood, community members had no choice but to take charge of the initial evacuation out of floodwaters, and natural leaders from within the community stepped forward and took on the role of emergency managers.

We knew where people were and who needed help... that's why nobody died, we just got everyone real quick.

Emergency management plans that are developed by and with Aboriginal communities will be more effective in empowering communities to build adaptive capacity and will improve the success of the recovery process. Empowering communities can potentially save lives in these remote Aboriginal communities, as it may take days for emergency managers to provide assistance. The top-down approach of emergency management response in WA has resulted in communities feeling disempowered in the recovery process. The Kiwirrkurra floods of early 2000 and March 2001, which forced the evacuation of its small population, and then the Warmun flood provide important lessons on why Aboriginal communities should not be treated as victims, rather as empowered resourceful community members. In a workshop in Warmun, one participant commented how being evacuated out of Warmun, and not being involved in the recovery process, was disempowering to the whole community:

We used to be independent, our old people used to camp out here after big floods and they were fine. It was good enough for us before, this is making us dependent [not being involved in recovery process] not independent, [it's] no good for us, disempowering to the community, not treat us like a race of people. Should have left all the able body people to help with the clean-up and reconstruction.

Local government and community councils provide limited municipal services to communities, and most often resources are stretched to capacity providing basic services, and more complex issues such as emergency planning are not seen as a priority. When events like the Warmun flood occur, emergency services are not trained or prepared to deal with the complex social, cultural and logistical issues that arise in a remote Aboriginal community. Had adequate emergency management planning been undertaken before this event, clear procedures would have been established, so that Aboriginal people would be engaged in the emergency and recovery process.

7.7 Summary

Although emergency management procedures for recovery and reconstruction after extreme natural disasters are considered to be well developed within Australia, responding to the immediate needs of remote Aboriginal communities presents numerous complexities that pose challenges for local emergency managers, governments and communities. The inaccessibility of remote locations, barriers to the delivery of services and scarce resources all pose logistical challenges. Emergency managers also need to consider appropriate cultural engagement, heritage protection, and recognition of native title rights and obligations. In recent years a number of extreme flood events have affected remote Aboriginal communities in WA. These events present opportunities for emergency managers and community stakeholders to learn from the experiences and to develop adaptive emergency management plans for remote Aboriginal communities. Climate change predictions indicate that extreme events may become more severe in the future, so understanding the vulnerability and adaptive capacity of Aboriginal communities to respond is fundamental to community resilience.

Northern Australia has a history of governments and emergency services treating Aboriginal communities as powerless victims in responding to the impact of natural hazards. This has disempowered these communities and prevented them from being actively involved in the recovery process. This practice reduces capacity and increases the vulnerability of these communities. The establishment of the Remote Indigenous Communities Advisory Committee (2007) has significantly helped to address the need for greater Aboriginal involvement in emergency response to natural disasters in Australia.

Arising from Aboriginal experience in land title negotiations over recent years, the adaptation planning process, including emergency management, needs to develop a strong negotiation position for traditional owners in engaging with government agencies and others on issues of climate change. Ultimately, any adaptation planning process will be seen as successful when Aboriginal communities have the skills and confidence to discuss and negotiate on climate issues and to respond to climate change in a comprehensive and coordinated manner.

8. CONCLUSIONS AND PRIORITIES

The results, findings and discussions of this study highlight the need for a multidisciplinary approach to design and implement adaptation responses for Aboriginal communities in northern Australia. The geographic vulnerability of these communities cannot be mitigated; they are culturally connected to their traditional lands and usually will not and cannot be moved or relocated. The future sustainability and economic success of the region require an immediate response to the impacts of extreme climate variability and climate change. Factors that promote adaptive capacity, build community resilience and promote future growth need to be considered. Governments need to work in collaboration with Aboriginal institutions and individuals to understand the complexities of Aboriginal life, and they need to consider the worldviews and cultural identities of Kimberley Aboriginal people in developing adaptation pathways. Responses to the short- and long-term impacts of climate change need to work within existing institutional structures (both Indigenous and mainstream) to prioritise adaptation actions.

8.1 Responding to extreme events

Northern Australia has a history of treating Aboriginal communities as powerless victims in responding to the impact of natural hazards. This has disempowered these communities and prevented them from being actively involved in the recovery process. This practice reduces capacity and increases the vulnerability of these communities. Although emergency management procedures for recovery and reconstruction after the impact of extreme natural disasters are considered to be well developed within Australia, responding to the immediate needs of a remote Aboriginal community presents complexities and poses challenges for local emergency managers. The inaccessibility of remote locations, barriers to the delivery of services and scarce resources all pose logistical challenges. The Warmun flood event serves as such an example. Such events present opportunities to learn from the experiences and develop adaptive emergency management plans for remote Aboriginal communities. Climate change predictions indicate that extreme events may become more severe in the future, so understanding the vulnerability and adaptive capacity of Aboriginal communities to respond is fundamental to community resilience. Extreme events are tangible risks and are potentially the first real impacts of climate change that many Aboriginal communities in the Kimberley will face. The results of this project recommend consideration of following priorities:

- emergency managers need to consider appropriate cultural engagement, heritage protection and recognition of native title rights and obligations
- a whole-of-organisation approach to planning that integrates community needs within RM to reduce vulnerabilities
- the integration of Aboriginal science, or TEK, with new approaches to community-based risk planning
- the development of procedures that engage Aboriginal people in the recovery process
- the development of Aboriginal emergency management personnel to coordinate disaster responses in remote communities.

8.2 Priorities in developing adaptive planning frameworks

This report has examined lessons from adaptation planning frameworks that could be used to inform improved Indigenous adaptation planning in northern Australia. The

three approaches of risk management (RM), integrated development (ID), and community-based adaptation (CBA) were found to be useful models for planning. Tensions between these models are likely to be resolved through implementation and in consultation with community partners and initiating agencies. Our participatory research and experience working with Aboriginal communities in the region suggest that community-based approaches to adaptation planning are effective and beneficial to their broader aspirations, which in turn will assist in achieving positive outcomes for those vulnerable, remote communities facing climate change.

The following priorities (of equal merit) are proposed to improve Indigenous adaptation planning in the Kimberley region. They are linked to the generic adaptive planning sequence adopted in all of the three approaches examined. In the initiation stage, key preparatory steps include establishing appropriate governance arrangements and building community support through engagement protocols. Planning activity focuses on mechanisms to ensure adaptation responds to community-defined conceptions of risk and vulnerability through the integration of multiple knowledges of climate and change. Implementation emphasises an aspirational approach that delivers tangible community outcomes that improve wellbeing and quality of life while enhancing resilience to a broad range of potential and probable climate futures. Finally, monitoring activities emphasise the need for community to maximise control of data and information gathering to ensure full access to the information necessary to maintain ownership over the adaptation process.

The use of linguists, translators and interpreters for effective communication and research that accurately reflects Indigenous values

Linguists, translators and interpreters were critical to the successful conduct of workshops, consultations and interviews involving Aboriginal people for whom English is not the first language during this research project. Successful adaptation planning and implementation in northern Aboriginal communities will depend on the quality and effectiveness of communication, and the use of language workers will be an important strategy for engaging with Aboriginal people in these communities.

Participatory planning processes that incorporate Indigenous traditions and customs

Because the future success of adaptation planning depends on the successful engagement between Aboriginal communities and stakeholders to develop bottom-up responses to climate change, such engagement should be informed by successful participatory planning processes and have regard for the traditions and customs of Indigenous people in the conduct of the research. The value of field visits with traditional owners to their estates and workshops and interviews conducted with Aboriginal people on their country cannot be overemphasised.

The importance of stakeholders, collaborations and partnerships

One priority identified in our introductory workshops by traditional owners was the need to discuss climate change adaptation with their stakeholders. Identified stakeholders for each community differed depending on community priorities, geographic location and governance structure. This priority was emphasised because of the desire for collaboration and partnerships with agencies and institutions that can offer support and advice in planning, developing adaptation tools and implementing plans.

The need to address identified research needs and gaps

The absence of local level, empirical studies of Australian Aboriginal and Torres Strait Islander peoples' experiences of both slow and fast onset climate events is a significant knowledge gap that presents a major barrier to the development and implementation of inclusive, efficient and effective adaptation plans and policies. There is limited research on the relationship between exposure to variable climate conditions and adaptive capacity in the Australian context, and how exposure influences perceptions of risk. Research into traditional Aboriginal ecological knowledge, and particular climate and weather knowledge, is critical to the task of integrating Aboriginal knowledge with scientific knowledge to develop adaptation strategies. Further research funding to address these identified research needs and gaps is necessary to ensure that adaptation responses, including capacity building measures, in Australian Indigenous communities are informed by rigorous research.

The capacity of disaster management agencies

In recent years extreme events have tested response capabilities of institutions and agencies with responsibility to provide support to remote communities. Increases in extreme events are expected to continue to affect remote Aboriginal communities and infrastructure. Further investment in the capacity of disaster management agencies and emergency services is necessary to increase knowledge of the cultural diversity, practices and traditions of local Aboriginal groups and to strengthen their engagement and build their capacity to be involved in response and recovery programs. The role that social networks, mobile telephones and social media can play in disaster preparedness and warning systems should be considered. Training and other measures to ensure that Aboriginal people are involved in emergency management, including warning systems, post-event recovery programs and disaster management planning, are urgently needed.

REFERENCES

- Adger, WN 2003, 'Social capital, collective action, and adaptation to climate change', *Economic geography*, vol. 79, no. 4, pp. 387–404.
- Adger, WN, Agrawala, S, Mirza, MMQ, Conde, C, O'Brien, K, Pulhin, J, Pulwarty, R, Smit, B & Takahashi, K 2007, 'Assessment of adaptation practices, options, constraints and capacity', in ML Parry, OF Canziani, PJ van der Linden & CE Hanson (eds), *Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, pp. 717–43.
- Adger, W, Kelly, P & Ninh, N 2001, *Living with Environmental Change: Social Resilience, Adaptation and Vulnerability in Vietnam*, London: Routledge.
- Adger, WN, Lorenzoni, I & O'Brien, KL 2009, Adapting to Climate Change: Thresholds, Values, Governance, Cambridge University Press.
- Adger, WN, Paavola, J, Mace, MJ & Huq, S (eds) 2006, *Fairness in Adaptation to Climate Change*, The MIT Press, Cambridge.
- Altman, J, Jordan, K, Kerins, S, Buchanan, G, Biddle, N, Ens, E & May, K 2009,
 'Indigenous interests in land & water', in G Stone (ed.), *Northern Australia Land* and Water Science Review 2009, CSIRO, Canberra, pp. 1–56.
- Anderson, I, Crengle, S, Leialoha Kamaka, M, Chen, T-H, Palafox, N & Jackson-Pulver, L 2007, 'Indigenous health in Australia, New Zealand, and the Pacific', *The Lancet*, vol. 367, no. 9524, pp. 1775–85.
- Attorney-General's Department n.d.a, *Emergency Management*, viewed 30 May 2013, www.ag.gov.au/EmergencyManagement/Pages/default.aspx.
- Attorney-General's Department n.d.b, *National Emergency Management Projects*, viewed 30 May 2013, <a href="https://www.ag.gov.au/EmergencyManagement/Pages/NationalEmergencyMag
- Attorney-General's Department n.d.c, *Crisis Coordination Centre*, viewed 30 May 2013, <www.ag.gov.au/EmergencyManagement/Pages/CrisisCoordinationCentre.aspx >.
- Attorney-General's Department Steering Committee 2006, *Structures and Processes of Prescribed Bodies Corporate*, Canberra.
- Aussie Bee n.d. 'A new name for our Trigona stingless bees: Tetragonula', viewed 22 May 2013, <www.aussiebee.com.au/tetragonula-namechange.html>.
- Bagshaw, G 2003, 'The Karajarri claim: A case-study in native title anthropology', *Oceania*, no. 53.
- Baumwoll, J 2008, 'The value of Indigenous knowledge for disaster risk reduction: A unique assessment Tool for reducing community vulnerability to natural disasters', Webster University.

- Berkes, F, Colding, J & Folke, C 2000, 'Rediscovery of traditional ecological knowledge as adaptive management', *Ecological Applications*, vol. 10, no. 5, pp. 1251–62.
- Biddle, N 2009, *Ranking Regions: Revisiting an Index of Relative Indigenous Socioeconomic Outcomes*, Centre for Aboriginal Economic Policy Research, ANU.
- BOM (Bureau of Meteorology) 2000, *Tropical Cyclones John, Steve and Rosita: Tropical Cyclone Season 1999–2000*, Commonwealth of Australia, Canberra, viewed 1 January 2013, <www.bom.gov.au/announcements/sevwx/watcs99-00.pdf>.
- BOM 2013a, *Tropical Cyclones 1906 to 2006*, Commonwealth of Australia, Canberra, viewed 1 January 2013, <www.bom.gov.au/cgi-bin/silo/cyclones>.
- BOM 2013b, *Tropical Cyclones Affecting Broome*, Commonwealth of Australia, Canberra, viewed 1 January 2013, <www.bom.gov.au/cyclone/history/wa/broome.shtml>.
- Bowman, DM 1998, 'The impact of Aboriginal landscape burning on the Australian biota', *New Phytologist*, vol. 140, no. 3, pp. 385–410.
- Braaf, RR 1999, 'Improving impact assessment methods: Climate change and the health of indigenous Australians', *Global Environmental Change*, vol. 9, no. 2, pp. 95–104.
- Bradley, J 1995, 'Fire: Emotion and politics: A Yanyuwa case study', *Country in Flames: Biodiversity Series, Paper Number 3,* DEST Biodiversity Unit, Canberra, Australia, pp. 25–31.
- Burgess, CP, Johnston, FH, Berry, HL, McDonnell, J, Yibarbuk, D, Gunabarra, C, Mileran, A & Bailie, RS 2009, 'Healthy country, healthy people: The relationship between Indigenous health status and "caring for country", *Medical Journal of Australia*, vol. 190, no. 10, pp. 567–72.
- Burton, I, Huq, S, Lim, B, Pilifosova, O & Schipper, EL 2002, 'From impacts assessment to adaptation priorities: The shaping of adaptation policy', *Climate Policy*, vol. 2, no. 2, pp. 145–59.
- Byg, A & Salick, J 2009, 'Local perspectives on a global phenomenon climate change in Eastern Tibetan villages', *Global Environmental Change*, vol. 19, no. 2, pp. 156–66.
- Caldecott, J 1996, Designing Conservation Projects, Cambridge University Press.
- Carter, TR, Parry, M, Harasawa, H & Nishioka, S 1994, *IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations*, Department of Geography, University College, London.
- Cash, DW, Clark, WC, Alcock, F, Dickson, NM, Eckley, N, Guston, DH, Jäger, J & Mitchell, RB 2003, 'Knowledge systems for sustainable development', *Proceedings of the National Academy of Sciences*, vol. 100, no. 14, pp. 8086–91.
- Chambers, R 1997, *Whose Reality Counts?: Putting the First Last*, Intermediate Technology Publications Ltd.
- Chishakwe, N, Murray, L, Chambwera, M 2012, Building climate change adaptation on community experiences: Lessons from community-based natural resource

management in southern Africa, International Institute for Environment and Development, London.

- Clement, C 1988, *Pre-settlement Intrusion into the East Kimberley*, East Kimberley Working Paper no. 24, East Kimberley Impact Assessment Project, Canberra.
- Coulthard, S 2009, 'Adaptation and conflict within fisheries: Insights for living with climate change', in WN Adger, I Lorenzoni & KL O'Brien (eds), *Adapting to Climate Change: Thresholds, Values, Governance*, Cambridge University Press, Cambridge, pp. 255–68.
- Crate, SA 2008, 'Gone the bull of winter?', *Current Anthropology*, vol. 49, no. 4, pp. 569–95.
- Cruikshank, J 2001, 'Glaciers and climate change: Perspectives from oral tradition', *Arctic*, pp. 377–93.
- CSIRO (Commonwealth Scientific and Industrial Research Organisation) 2009, Water in the Kimberley Region of the Timor Sea Drainage Division: A Report to the Australian Government from the CSIRO Northern Australian Sustainable Yields Project, CSIRO, Canberra.
- CSIRO (Commonwealth Scientific and Industrial Research Organisation) 2012, *State of the Climate 2012 Report*, CSIRO, Canberra, viewed 1 January 2013, www.csiro.au/Outcomes/Climate/Understanding/State-of-the-Climate-2012.aspx.
- Curry, GN 2003, 'Moving beyond postdevelopment: Facilitating Indigenous alternatives for "development", *Economic Geography*, vol. 79, no. 4, pp. 405–23.
- DAA (Department of Aboriginal Affairs) 2013, *Kimberley Region: Aboriginal Communities*, State Maps, Government of Western Australia Perth, viewed 1 January 2013, <www.daa.wa.gov.au/Documents/Maps/Maps May 2013/KimberleyComs_DAA.pdf>.
- DAF (Department of Agriculture and Food) 2010, *Climate Change and Impact on WA Agriculture*, Government of Western Australia, viewed 1 January 2013, <www.agric.wa.gov.au/objtwr/imported_assets/content/lwe/cli/fn_cc_impact_wa_ agriculture.pdf>.
- Davis, J, Langton, M, Smith, N & Steffensen, V 2003, *Indigenous Fire Management Issues in the Laura Basin – Practices and Aspirations: Report to the National Reserves System Program, Environment Australia, Canberra*, Balkanu Cape York Development Corporation.
- Department for Planning and Infrastructure 2008, *Bidyadanga Community Layout Plan No. 2*, Government of Western Australia, Perth, viewed 1 January 2013, <www.planning.wa.gov.au/dop_pub_pdf/bidyadanga_background_report.pdf>.
- Department of Climate Change 2007, *National Climate Change Adaptation Framework*, Commonwealth of Australia, Canberra, viewed 1 January 2013, <www.climatechange.gov.au/government/initiatives/~/media/government/initiative s/nccaf/national_climate_change_adaption_framework.pdf>.
- Department of Climate Change and Energy Efficiency 2010, Adapting to Climate Change in Australia: An Australian Government Position Paper, Commonwealth of Australia, Canberra, viewed 1 January 2013,

<www.climatechange.gov.au/~/media/publications/adaptation/gov-adapt-climatechange-position-paper.pdf>.

- DFES (Department of Fire and Emergency Services) n.d., *The Department of Fire and Emergency Services*, viewed 31 May 2013, </www.dfes.wa.gov.au/pages/default.aspx>.
- Doohan, KE 2007, "Making things come good": Aborigines and miners at Argyle', PhD thesis, Macquarie University.
- Douglas, P 2004. 'Healthy Rivers and Indigenous Interests', *Indigenous Law Bulletin*, vol. 5, no. 29, p. 12.
- Edgar, J 2011, 'Indigenous Land Use Agreement Building relationships between Karajarri traditional owners, the Bidyadanga Aboriginal Community La Grange Inc. and the Government of Western Australia', *Australian Aboriginal Studies*, vol. 2011, no. 2.
- Ellemor, H 2005, 'Reconsidering emergency management and Indigenous communities in Australia', *Global Environmental Change Part B: Environmental Hazards*, vol. 6, no. 1, pp. 1–7.
- Emergency Management Australia 2007, *Keeping our mob safe : a national emergency management strategy for remote Indigenous communities*, Emergency Management Australia, Dickson, A.C.T, viewed 30 May 2013, <http://www.em.gov.au/Documents/RICAC_KeepingOurMobSafe_July2007.pdf>
- Emergency Management WA 2013, *State Emergency Management Committee Secretariat*, viewed 31 May 2013, <www.semc.wa.gov.au/Emergency%20Management%20WA/Pages/default.aspx >.
- Ensor, J & Berger, R 2009, 'Community-based adaptation and culture in theory and practice', in W Adgar, I Lorenzoni & KL O'Brien (eds), *Adapting to Climate Change Thresholds, Values, Governance*, Cambridge University Press, Cambridge UK, pp. 227–39.
- Fankhauser, S, Smith, JB & Tol, RS 1999, 'Weathering climate change: Some simple rules to guide adaptation decisions', *Ecological Economics*, vol. 30, no. 1, pp. 67– 78.
- FESA (Fire and Emergency Services Authority of Western Australia) & KLRC (Kimberley Language Resource Centre) 2008, Indigenous Translation of Western Australian Emergency Management Guidelines and the Emergency Management Arrangements, viewed 1 March 2013, <www.dfes.wa.gov.au/publications/IndigenousRsearch/FESA-Translation-Project-Consultancy-Report.pdf>.
- Ford, J & Martinez, D 2000, 'Traditional ecological knowledge, ecosystem science, and environmental management', *Ecological Applications*, vol. 10, no. 5, pp. 1249–50.
- Ford, JD, Pearce, T, Duerden, F, Furgal, C & Smit, B 2010, 'Climate change policy responses for Canada's Inuit population: The importance of and opportunities for adaptation', *Global Environmental Change*, vol. 20, no. 1, pp. 177–91.
- Franks, P & Blomley, T 2004, 'Fitting ICD into a project framework: A CARE perspective', in TO McShane & MP Wells (eds), *Getting Biodiversity Projects to*

Work: Towards Better Conservation and Development, Columbia University Press, New York, USA, pp. 177–91.

- Fussell, HM 2007, 'Adaptation planning for climate change: Concepts, assessment approaches, and key lessons', *Sustainability Science*, vol. 2, no. 2, pp. 265–75.
- Gardner, J, Dowd, A-M, Mason, C & Ashworth, P 2009, *A Framework for Stakeholder Engagement on Climate Adaptation: Climate Adaptation National Research Flagship Working Paper Number* #3, National Research Flagship Climate Adaptation CSIRO.
- Government of Western Australia Department for Planning and Infrastructure 2013, *Shire Of Wyndham-East Kimberley Town Planning Scheme No. 7 Kununurra And Environs: Updated to Include AMD 39 GG 4/1/13*, viewed 30 May 2013, <http://online.planning.wa.gov.au/LPS/data/Local%20Planning%20Schemes/Wyn dham-East%20Kimberley%20-%20Sbiro%20ef%20(Scheme%207)/Scheme%20Toxt.pdf>

%20Shire%20of%20(Scheme%207)/Scheme%20Text.pdf>.

- Government of Western Australia, Department of Water 2011, *Kimberley Regional Water Plan 2010–2030: Strategic Directions and Actions, Draft for Public Comment*, Government of Western Australia, Perth, viewed 1 January 2013, <www.water.wa.gov.au/PublicationStore/first/95832.pdf>.
- Government of Western Australia Department of Water 2010, *La Grange Groundwater Allocation Plan February 2010 – Water Resource Allocation and Planning Series Report 25*, viewed 1 January 2013, <www.water.wa.gov.au/PublicationStore/first/82626.pdf>.
- Green, D 2007, 'Culture and climate change: Impacts for Indigenous Australians', *Just Policy: A Journal of Australian Social Policy*, no. 46, p. 18.
- Green, D, Billy, J & Tapim, A 2010, 'Indigenous Australians' knowledge of weather and climate', *Climatic Change*, vol. 100, no. 2, pp. 337–54.
- Green, D, Jackson, S & Morrison, J 2009, *Risks from Climate Change to Indigenous Communities in the Tropical North of Australia*, Department of Climate Change, Commonwealth of Australia.
- Guest, K 2009, *The Promise of Comprehensive Native Title Settlements: The Burrup, Mg-Ord and Wimmera Agreements*, AIATSIS, Canberra, viewed 1 January 2013, <www.aiatsis.gov.au/research/docs/dp/DP27.pdf>.
- Guston, DH 2001, 'Boundary organizations in environmental policy and science: An introduction', *Science, Technology, & Human Values*, vol. 26, no. 4, pp. 399–408.
- Hallam, S 1975, *Fire and Hearth : A Study of Aboriginal Usage and European* Usurpation in South-western Australia, Prehistory and Material Culture Series No. 8, Australian Institute of Aboriginal Studies, Canberra.
- Harmon, D 2001, 'On the meaning and moral imperative of diversity', in L Maffi (ed.), On Biocultural Diversity: Linking Language, Knowledge and the Environment, Smithsonian Institution Press, Washington DC, pp. 53–70.
- Hay, J & Mimura, N 2006, 'Supporting climate change vulnerability and adaptation assessments in the Asia-Pacific region: An example of sustainability science', *Sustainability Science*, vol. 1, no. 1, pp. 23–35.

- Haynes, CD 1985, 'The pattern and ecology of munwag: Traditional Aboriginal fire regimes in north-central Arnhemland [Northern Territory].[Conference paper]', in M Ridpath & L Corbett (eds), *Proceedings of the Ecological Society of Australia*, Darwin Institute of Technology, Canberra, vol. 13, pp. 203–14.
- Head, L 1989, 'Prehistoric Aboriginal impacts on Australian vegetation: An assessment of the evidence', *Australian Geographer*, vol. 20, no. 1, pp. 37–46.
- Hennessy, K, Fitzharris, B, Bates, B, Harvey, N, Howden, S, Hughes, L, Salinger, J & Warrick, R 2007, 'Australia and New Zealand', in ML Parry, OF Canziani, JP Palutikof, PJ van der Linden & C Hanson (eds), Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK, pp. 507–40.
- Hewitt, K 2007, 'Preventable disasters: Addressing social vulnerability, institutional risk, and civil ethics', *Geographisches Rundscahu: International Edition*, vol. 3, no. 1, pp. 43–52.
- Heyd, T & Brooks, N 2009, 'Exploring cultural dimensions of adaptation to climate change', in WN Adger, I Lorenzoni & K O'Brien (eds), Adapting to Climate Change: Thresholds, Values, Governance, Cambridge University Press, Cambridge, UK, pp. 269–82.
- Hill, R 2011, 'Towards equity in Indigenous Co-Management of Protected Areas: Cultural planning by Miriuwung–Gajerrong People in the Kimberley, Western Australia', *Geographical Research*, vol. 49, no. 1, pp. 72–85.
- Howell, P 2003, Indigenous Early Warning Indicators of Cyclones: Potential Application in Coastal Bangladesh, Working Papers in Disaster Studies and Management 6, Benfield Greig Hazard Research Centre, University College, London.
- Howitt, R, Havnen, O & Veland, S 2012, 'Natural and unnatural disasters: Responding with respect to Indigenous rights and knowledges', *Geographical Research*, vol. 50, no. 1, pp. 47–59.
- Howitt, R & Suchet, S 2004, 'Rethinking the building blocks: Management and Indigenous epistemologies', paper presented to Processes for Cross-Cultural Engagement – Remote Regions/Northern Development session of the Western Regional Science Association Meeting, Wailea Marriot Resort, Maui, 26–29 February 2004, viewed 1 March 2013, <www.es.mg.edu.au/rhowitt/MAU_009A.htm>.
- Hunt, J & Smith, DE 2006, *Building Indigenous Community Governance in Australia: Preliminary Research Findings*, Working paper 31/2006, Centre for Aboriginal Economic Policy Research, The Australian National University, Canberra, viewed 31 May 2013, http://caepr.anu.edu.au/Publications/WP/2006WP31.php.
- Hunter, N & Leonard, S 2010, 'Indigenous weather knowledge and biotemporal indicators of climate change', paper presented to International Climate Change Adaptation Conference: Climate Adaptation Futures, Gold Coast, Qld, 29 June.
- Huntington, HP, Trainor, SF, Natcher, DC, Huntington, O, DeWilde, L & Chapin III, FS 2006, 'The significance of context in community-based research: Understanding discussions about wildfire in Huslia, Alaska', *Ecology and Society*, vol. 11, no. 1, p. 40.

- Huq, S & Reid, H 2007, 'Community-based adaptation: A vital approach to the threat climate change poses to the poor', *International Institute for Environment and Development (IIED): Briefing Paper,* IIED, London.
- IAPP (International Association for Public Participation) 2003, *IAPP Core Values IAP2*, Thornton, USA, viewed 1 March 2013, <www.iap2.org/associations/4748/files/CoreValues.pdf>
- Isaac, K 2012, *Cultural Knowledge and Expertise Is the Key To Recovery*, viewed 14 May 2012, <www.ifrcmedia.org/blog/cultural-knowledge-and-expertise-is-the-keyto-recovery/>.
- Jacob, C, McDaniels, T & Hinch, S 2010, 'Indigenous culture and adaptation to climate change: Sockeye salmon and the St'át'imc people', *Mitigation and Adaptation Strategies for Global Change*, vol. 15, no. 8, pp. 859–76.
- Jennings, S & Magrath, J 2009, *What Happened to the Seasons?*, Oxfam GB, London, viewed 1 December 2012, <www.oxfam.org.au/wp-content/uploads/2012/02/oaus-whathappenedtoseasons-0110.pdf>.
- Jones, R 1969, 'Fire-stick farming', Australian Natural History, September, pp. 224–8.
- Jones, RN 2001, 'An environmental risk assessment/management framework for climate change impact assessments', *Natural Hazards*, vol. 23, no. 2–3, pp. 197–230.
- Jones, RN & Preston, BL 2010, 'Adaptation and risk management', *Wiley Interdisciplinary Reviews: Climate Change*, vol. 2, no. 2, pp. 296–308.
- Kapsch, M-L, Eicken, H & Robards, M 2010, 'Sea ice distribution and ice use by indigenous walrus hunters on St. Lawrence Island, Alaska', in I Krupnik, C Aporta, S Gearheard, L Kielsen Holm & G Laidler (eds), SIKU: Knowing Our Ice, Springer, Berlin, pp. 115–44.
- KDC (Kimberley Development Commission) 2011, *Kimberley: A Region in Profile*, West Australian Government, Perth.
- KDC (Kimberley Development Commission) 2012, 2011 ABS Census of Population and Housing: A Kimberley Perspective, Western Australian Government, Perth.
- KDC (Kimberley Development Commission) n.d., *Welcome to the Kimberley*, viewed 31 May 2013, <www.kdc.wa.gov.au/>.
- Langton, M, Ma Rhea, Z, Ayre, M & Pope, J 2003, *Composite Report on the Status and Trends Regarding the Knowledge, Innovations and Practices of Indigenous and Local Communities Relevant to the Conservation and Sustainable Use of Biodiversity*, Convention on Biological Diversity, Montreal, 8-12 December 2003.
- Langton, M, Parsons, M, Leonard, S, Auty, K, Bell, D, Burgess, P, Edwards, S, Howitt, R, Jackson, S, McGrath, V & Morrison, J 2012, *National Climate Change Adaptation Research Plan: Indigenous Communities*, National Climate Change Adaptation Research Facility, Gold Coast, Qld, viewed 14 March 2013, <www.nccarf.edu.au/sites/default/files/attached_files_publications/11.027 NCCARF NARP INDIG Websize_0.pdf>.
- Latz, PK & Green, J 1995, *Bushfires & Bushtucker: Aboriginal Plant Use in Central Australia*, IAD Press, Alice Springs, NT.

- Leonard, S, Parsons, M, Olawsky, K & Kofod, F 2013, 'The role of culture and traditional knowledge in climate change adaptation: Insights from East Kimberley, Australia', *Global Environmental Change*, vol. 23, pp. 623–32.
- Lewis, H 1989, 'Ecological and technological knowledge of fire: Aborigines versus park rangers in northern Australia', *American Anthropologist*, vol. 91, no. 4, pp. 940–61.
- Lewis, J 1999, *Development in Disaster-prone Places: Studies of Vulnerability*, Intermediate Technology, London.
- Lim, B & Spanger-Siegfried, E 2004, Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies, and Measures, United Nations Development Programme, New York, viewed 1 February 2013, <www.preventionweb.net/files/7995_APF.pdf>.
- McGregor, WB 2004, *The Languages of the Kimberley*, Routledge Curzon, London, New York.
- McKelson, K & Dodd, T 2007, *Nganarna Nyangumarta Karajarrimili Ngurranga: We Nyangumarta in the Country of the Karajarri*, Wangka Maya Pilbara Aboriginal Language Centre, South Hedland, WA.
- Mackenzie, J 2008, 'Water planning in the Gulf of Carpentaria', *Collaborative Water Planning: Retrospective Case Studies*, vol. 4.1, Land & Water Australia, TRaCK, Nathan, Qld.
- Mackenzie, J 2012, *Facilitators' Guide to Indigenous Water Planning*, Tropical Rivers and Coastal Knowledge (TRaCK), North Australian Land and Sea Management Alliance (NAILSMA), Department of Sustainablility, Environment, Water Population and Communities, Canberra.
- Maffi, L 1998, 'Language: A resource for nature', *Nature and Resources*, vol. 34, no. 4, pp. 12–21.
- Masini, RJ, Sim, CB, Simpson, CJ, McKenzie, NL, Start, AN, Burbridge, AA, Kenneally, K & Burrows, N 2009, *Protecting the Kimberley: A Synthesis of Scientific Knowledge to Support Conservation Management in the Kimberley Region of Western Australia*, Department of Environment and Conservation, Perth, WA.
- Mercer, J, Kelman, I, Suchet-Pearson, S & Lloyd, K 2009, 'Integrating indigenous and scientific knowledge bases for disaster risk reduction in Papua New Guinea', *Geografiska Annaler: Series B, Human Geography*, vol. 91, no. 2, pp. 157–83.
- Metcalf, V & Robards, M 2008, 'Sustaining a healthy human–walrus relationship in a dynamic environment: Challenges for comanagement', *Ecological Applications*, vol. 18, no. sp2, pp. S148–S156.
- Mirima Council 2012, *Miriwoong Seasonal Calendar*, Mirima Council, viewed 1 February 2013, <www.mirima.org.au/calendar/>.

MLDRIN (Murray Lower Darling River Indigenous Nations) 2003, Report to the Murray Darling Basin Commission: Indigenous Response to the Living Murray Initiative, MLDRIN, Canberra, viewed 31 May 2013, <http://thelivingmurray2.mdbc.gov.au/__data/page/1522/Indigenous_Report.pdf>.

Moore, G 2001, 'Culture and communication in Aboriginal land management in NSW: A Koori perspective', in E Young, J Davies & RM Baker (eds), *Working on Country:*

Contemporary Indigenous Management of Australia's Lands and Coastal Regions, Oxford University Press, South Melbourne.

Moore, M 2001, The Ethics of Nationalism, Oxford University Press, Oxford.

- Moser, SC & Ekstrom, JA 2010, 'A framework to diagnose barriers to climate change adaptation', *Proceedings of the National Academy of Sciences*, vol. 107, no. 51, pp. 22026–31.
- National Native Title Tribunal 2012, *Kimberley Native Title Applications and Determination Area Map, as per the Federal Court 30th September 2012,* <www.nntt.gov.au/Mediation-and-agreement-making-services/Documents/Quarterly Maps/WA_Kimberley_NTDA_schedule.pdf>.
- NCU (National Copyright Unit) 2012. Indigenous Cultural and Intellectual Property Rights. Available online at: http://smartcopying.edu.au/scw/go/pid/820
- Nelson, DR, Adger, WN & Brown, K 2007, 'Adaptation to environmental change: Contributions of a resilience framework', *Annual Review of Environmental Resources*, vol. 32, pp. 395–419.
- Newman, M & Smith, SA 2004, 'Integration of emergency risk management into West Australian Indigenous communities', *Australian Journal of Emergency Management*, vol. 19, no. 1.
- Newry, D & Palmer, K 2003, "Whose language is it anyway?" Rights to restrict access to endangered languages: A north-east Kimberley example', in *Maintaining the Links: Language, Identity and the Land: Proceedings of the Seventh Foundation for Endangered Languages Conference*, Broome, WA, pp. 101–06.
- Nicholson, PH 1981, 'Fire and the Australian Aborigine–an enigma', in AM Gill, RH Groves & IR Noble (eds), *Fire and the Australian Biota. Australian Academy of Science, Canberra*, pp. 55-76.
- Northern Land Council 2011, Northern Land Council Annual Report 2010–2011: Our Land, Our Sea, Our Life, Northern Land Council, Darwin, viewed 18 March 2103, <www.nlc.org.au/files/various/NLC4340_2010-11_AR_web.pdf>.
- O'Brien, K 2009, 'Do values subjectively define the limits to climate change adaptation', in W Adgar, I Lorenzoni & KL O'Brien (eds), *Adapting to Climate Change: Thresholds, Values, Governance*, Cambridge University Press, Cambridge, pp. 164–80.
- O'Brien, KL, Eriksen, S, Schjolden, A & Nygaard, L 2009, *What's In a Word? Conflicting Interpretations of Vulnerability in Climate Change Research*, Center for International Climate and Environmental Research, Oslo.
- O'Brien, K, Hayward, B & Berkes, F 2009, 'Rethinking social contracts: Building resilience in a changing climate', *Ecology and Society*, vol. 14, no. 2, p. 12.
- O'Connor, M & Prober, S 2010, *A Calendar of Ngadju Seasonal Knowledge*, Centre for Environment and Life Sciences, CSIRO.
- O'Connor, S 1992, *The Timing and Nature of Prehistoric Island Use in Northern Australia, Archaeology in Oceania,* 27, pp. 49–60.
- O'Connor, S 1999, *30,00* Years of Aboriginal Occupation in the Kimberley, Northwest Australia. Terra Australis 14, Archaeology and Natural History and Centre for
- 126 Indigenous climate change adaptation in the Kimberley region

Archaeological Research Publications, Research School of Pacific and Asian Studies, Australian National University, Canberra.

- O'Connor, S 2011, *Lifeways of the First Australians*, ANU School of Culture, History & Language, viewed 31 May 2013, http://chl.anu.edu.au/disciplines/archaeology/current_projects/project_details.ph p?searchterm=kimberleyCaves>.
- O'Connor, S and Veth, P 2000, 'The world's first mariners: Savannah dwellers in an island continent', in S O'Connor and P Veth (eds), *East of Wallace's Line: Studies of Past and Present Maritime Societies in the Indo-Pacific Region,* Modern Quaternary Research in Southeast Asia 16, AA Balkema, Rotterdam, pp. 99– 137.
- Oliver, T, Langton, M & Kofod, F 2002, *Blood on the Spinifex*, Ian Potter Museum of Art, The University of Melbourne.
- Palmer, D, Watson, J, Watson, A, Ljubic, P, Wallace-Smith, H & Johnson, M 2006, "Going back to country with bosses": The Yiriman Project, youth participation and walking along with Elders', *Children Youth and Environments*, vol. 16, no. 2, pp. 317–37.
- Palmer, K & Williams, N 1990, 'Aboriginal relationships to land in the Southern Blatchford Escarpment Area of the East Kimberley', in R Dixon & M Dillon (eds), Aborigines and Diamond Mining: The Politics of Resource Development in the East Kimberley, UWA Press, Nedlands, WA, pp. 5–28.
- Parry, ML, Canziani, OF, Palutikof, J, van der Linden, PJ & Hanson, CE 2007, *Climate Change 2007: Impacts, Adaptation and Vulnerability: Working Group I Contribution to the Fourth Assessment Report of the IPCC*, vol. 4, Cambridge University Press.
- Pearce, T, Wright, H, Notaina, R, Kudlak, A, Smit, B, Ford, J & Furgal, C 2011, 'Transmission of environmental knowledge and land skills among Inuit men in Ulukhaktok, Northwest Territories, Canada', *Human Ecology*, vol. 39, no. 3, pp. 271–88.
- Petheram, L, Zander, K, Campbell, B, High, C & Stacey, N 2010, "Strange changes": Indigenous perspectives of climate change and adaptation in NE Arnhem Land (Australia)', *Global Environmental Change*, vol. 20, no. 4, pp. 681–92.
- Posey, DA & Dutfield, G 1996, *Traditional Resource Rights: International Instruments for Protection and Compensation for Indigenous Peoples and Local Communities*, IUCN The World Conservation Union, Gland, Switzerland and Cambridge, UK.
- Preston, BL, Westaway, RM & Yuen, EJ 2011, 'Climate adaptation planning in practice: An evaluation of adaptation plans from three developed nations', *Mitigation and Adaptation Strategies for Global Change*, vol. 16, no. 4, pp. 407–38.
- Prober, SM, O'Connor, MH & Walsh, FJ 2011, 'Australian Aboriginal peoples' seasonal knowledge: A potential basis for shared understanding in environmental management', *Ecology and Society*, vol. 16, no. 2, p. 12.
- Pursche, K 2004, Aboriginal Management and Planning for Country: Respecting and Sharing Traditional Knowledge: Summary Report on Subprogram 5 of the Ord-Bonaparte Program, Land & Water Australia, Canberra.

Putnis, A, Josif, P & Woodward, E 2007, *Healthy Country, Healthy People: Supporting Indigenous Engagement in the Sustainable Management of Northern Territory Land and Seas: A Strategic Framework*, Darwin: CSIRO.

Pyne, SJ & Cronon, W 1991, Burning Bush: A Fire History of Australia, Holt, New York.

- Reid, H, Berger, R, Cannon, T, Huq, S & Milligan, A 2009, 'Community-based adaptation to climate change: An overview', in H Reid, R Berger, T Cannon, M Alam & A Milligan (eds), *Participatory Learning and Action 60: Community-based Adaptation*, Internal Institute for Environment and Development, London.
- Remote Indigenous Communities Advisory Committee 2007, *Keeping Our Mob Safe: A National Emergency Management Strategy for Remote Indigenous Communities*, Australian Government, Canberra.
- Rose, DB 1996, *Nourishing Terrains: Australian Aboriginal Views of Landscape and Wilderness*, Australian Heritage Commission, Canberra.
- Ross, H 1990, 'Community social impact assessment: A framework for indigenous peoples', *Environmental Impact Assessment Review*, vol. 10, no. 1, pp. 185–93.
- Russell-Smith, J, Craig, R, Gill, A, Smith, R & Williams, J 2002, *Australian Fire Regimes: Contemporary Patterns (April 1998–March 2000) and Changes Since European Settlement*, State of the Environment Second Technical Paper Series no. 2, Department of the Environment and Heritage, Canberra.
- Russell-Smith, J, Lucas, D, Gapindi, M, Gunbunuka, B, Kapirigi, N, Namingum, G, Lucas, K, Giuliani, P & Chaloupka, G 1997, 'Aboriginal resource utilization and fire management practice in western Arnhem Land, monsoonal northern Australia: Notes for prehistory, lessons for the future', *Human Ecology*, vol. 25, no. 2, pp. 159–95.
- Russell-Smith, J, Yates, C, Edwards, A, Allan, GE, Cook, GD, Cooke, P, Craig, R, Heath, B & Smith, R 2003, 'Contemporary fire regimes of northern Australia, 1997–2001: Change since Aboriginal occupancy, challenges for sustainable management', *International Journal of Wildland Fire*, vol. 12, no. 4, pp. 283–97.
- Sayer, J & Wells, MP 2004, 'The pathology of projects', in TO McShane & MP Wells (eds), *Getting Biodiversity Projects to Work: Towards Better Conservation and Development*, Colombia University Press, New York, pp. 35–48.
- Sekine, H, Fukuhara, K, Uraguchi, A, Knee Tan, C, Nagai, M & Okada, Y 2009, *The Effectiveness of Community-based Adaptation (CBA) to Climate Change: From the Viewpoint of Social Capital and Indigenous Knowledge*, GEIC Working Paper Series.
- SEMC (State Emergency Management Committee) Secretariat 2013, *Emergency Management in Western Australia*, viewed 31 May 2013, <www.semc.wa.gov.au/Pages/home.aspx>.
- Shaw, B 1986, *Countrymen: The Life Histories of Four Aboriginal Men as Told to Bruce Shaw*, Australian Institute of Aboriginal Studies, Canberra.
- Shire of Derby (West Kimberley) 2011, *Plan for the Future of the District 2011/12 2020/21*, viewed 30 May 2013, http://upload.sdwk.wa.gov.au/data/yourcouncil/councildocuments/PlanForTheFuture.pdf>.

- Shire of Wyndham East Kimberley n.d. *Plan for the Future 2008–2010, Extended to June 30 2013*, viewed 30 May 2013, </www.swek.wa.gov.au/publications/documents/planforthefuture2013>.
- Simon, D 2006, *Fifty Key Thinkers on Development*, Taylor & Francis, New York.
- Sinnamon, V & Mango, P 2010, 'Climate change on the Northern Carpentaria Plains', paper presented to International Climate Change Conference: Climate Adaptation Futures, Gold Coast, Qld, 29 June 2010.
- Smyth, DM 2011, *Guidelines for Country-based Planning*, Department of Environment and Resource Management, Cairns, Artherton, Qld.
- Smyth, D, Szabo, S & George, M 2004, *Case Studies in Indigenous Engagement in Natural Resource Management in Australia*, Department of the Environment and Heritage, Canberra.
- Spence, A, Poortinga, W, Butler, C & Pidgeon, NF 2011, 'Perceptions of climate change and willingness to save energy related to flood experience', *Nature Climate Change*, vol. 1, no. 1, pp. 46–9.
- Standards Australia and Standards New Zealand 2009, *Risk management Principles and Guidelines AS/NZS ISO 31000:2009*, Standards Australia, Sydney, Australia & Wellington, NZ, viewed 1 April 2013, http://sherq.org/31000.pdf>.
- Stanton, J 1992, 'JP Thomson oration: The neglected lands: Recent changes in the ecosystem of Cape York Peninsula and the challenge of their management', *Queensland Geographical Journal*, vol. 7, pp. 1–18.
- Stavenhagen, R 1998, 'Cultural rights: A social science perspective', in H Niec (ed.), *Cultural Rights and Wrongs*, UNESCO, Paris, pp. 1–20.
- Steering Committee for the Review of Government Service Provision 2011, *Overcoming Indigenous Disadvantage: Key Indicators 2011*, Productivity Commission, Canberra, viewed 30 May 2013, <www.pc.gov.au/__data/assets/pdf_file/0010/111610/key-indicators-2011overview-booklet.pdf>.
- Sutton, PJ 1995, 'Country: Aboriginal boundaries and land ownership in Australia', *Aboriginal History*, vol. 3, pp. 174–86.
- Tan, P L, Jackson, S, Oliver, P, Mackenzie, J, Proctor, W, Ayre, M 2008, Collaborative Water Planning: Context and Practice Literature Review, Land & Water Australia, TRaCK, Nathan, Qld.
- Taylor, R 2003, 'An Indigenous perspective on evaluations in the inter-cultural context: How far can one throw a Moree boomerang?', *Evaluation Journal of Australasia*, vol. 3, no. 2, pp. 44–52.
- Thomas, DS & Twyman, C 2005, 'Equity and justice in climate change adaptation amongst natural-resource-dependent societies', *Global Environmental Change*, vol. 15, no. 2, pp. 115–24.
- Thomson, DF & Peterson, N 2005, *Donald Thomson in Arnhem Land*, compiled and introduced by Nicolas Peterson, Miegunyah Press, Carlton, Vic.

Tindale, N 1974, *Aboriginal Tribes of Australia: Their Terrain, Environmental Controls, Distribution, Limits and Proper Names*, University of California Press, Berkeley.

- Tompkins, EL, Few, R & Brown, K 2008, 'Scenario-based stakeholder engagement: Incorporating stakeholders preferences into coastal planning for climate change', *Journal of Environmental Management*, vol. 88, no. 4, pp. 1580–92.
- Tornado and Storm Research Organisation n.d., Severe Storm Definitions & Whirlwind Classification, accessed 30 May 2013, <www.torro.org.uk/site/classify_info.php>.
- Toussaint, S 2008, 'Kimberley Friction: Complex attachments to water-places in northern Australia', *Oceania*, vol. 78, no. 1, pp. 46–61.
- Turner, N & Clifton, H 2009, "It's so different today": Climate change and indigenous lifeways in British Columbia, Canada', *Global Environmental Change*, vol. 19, no. 2, pp. 180–90.
- UNESCO 2007, Indigenous Knowledge and Changing Environments: Biological and Cultural Diversities in Transition, Local Indigenous Knowledge Systems Program, UNESCO, Cairns, Qld.
- United Nations General Assembly 2007, *United Nations Declaration on the Rights of Indigenous Peoples*, viewed 10 March 2013, </www.unhcr.org/refworld/docid/471355a82.html>.
- Veland, S, Howitt, R & Dominey-Howes, D 2010, 'Invisible institutions in emergencies: Evacuating the remote Indigenous community of Warruwi, Northern Territory Australia, from Cyclone Monica', *Environmental Hazards*, vol. 9, no. 2, pp. 197– 214.
- Vogel, C, Moser, SC, Kasperson, RE & Dabelko, GD 2007, 'Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships', *Global Environmental Change*, vol. 17, no. 3, pp. 349–64.
- Walsh, F & Mitchell, P 2002, *P*lanning for Country: Cross-cultural Approaches to Decision-making on Aboriginal Lands, Jukurrpa Books, Alice Springs, NT.
- Ward, N, Reys, S, Davies, J & Roots, J 2003, Scoping Study on Aboriginal Involvement in Natural Resource Management Decision Making and the Integration of Aboriginal Cultural Heritage Considerations into Relevant Murray–Darling Commission Programs, Murray-Darling Basin Commission, Canberra, viewed 1 March 2013,
 http://live.greeningaustralia.org.au/nativevegetation/pages/pdf/Authors
- Webb, R & Beh, J 2013, Leading Adaptation Practices and Support Strategies for Australia: An International and Australian Review of Products and Tools, National Climate Change Adaptation Research Facility, Gold Coast, Qld, viewed 1 January 2013,

<www.nccarf.edu.au/sites/default/files/attached_files_publications/Webb-2013-Leading-adaptation-practices-web.pdf>.

- Weir, JK 2011, *Karajarri: A West Kimberley Experience in Managing Native Title*, AIATSIS Research Discussion Paper 30, AIATSIS, Canberra, viewed 1 March 2013, <http://aiatsis.gov.au/ntru/documents/WeirDiscussionPaper30.pdf>
- Wende, R, Nanson, G & Price, D 1997, 'Aeolian and fluvial evidence for Late Quaternary environmental change in the east Kimberley of Western Australia', *Australian Journal of Earth Sciences*, vol. 44, no. 4, pp. 519–26.

- Whitehead, PJ, Bowman, D, Preece, N, Fraser, F & Cooke, P 2003, 'Customary use of fire by Indigenous peoples in northern Australia: Its contemporary role in savanna management', *International Journal of Wildland Fire*, vol. 12, no. 4, pp. 415–25.
- Williams, N & Kirkby, I 1989, Summary of Findings and Recommendations, Ethnography of the East Kimberley, Work in Progress: Location and Status of Aboriginal Communities, East Kimberley Impact Assessment Project.
- Willows, R, Reynard, N, Meadowcroft, I & Connell, R 2003, *Climate Adaptation: Risk, Uncertainty and Decision-making*, UKCIP Technical Report, UK Climate Impacts Programme, Oxford, UK.
- Wisner, B, Blaikie, P, Cannon, T & Davis, I 2004, *At Risk: Natural Hazards, People's Vulnerability and Disasters*, 2nd edn, Routledge, London.
- Wolf, J 2011, 'Climate change adaptation as a social process', in JD Ford & L Berrang-Ford (eds), *Climate Change Adaptation in Developed Nations*, Springer, New York, pp. 21–32.
- Wolf, J & Moser, SC 2011, 'Individual understandings, perceptions, and engagement with climate change: Insights from in-depth studies across the world', *Wiley Interdisciplinary Reviews: Climate Change*, vol. 2, no. 4, pp. 547–69.
- Woodward, EL 2010, 'Creating the Ngan'gi Seasons calendar: Reflections on engaging Indigenous knowledge authorities in research', *Learning Communities: International Journal of Learning in Social Contexts*, pp. 125–37.
- Yibarbuk, DM 1998, 'Notes on traditional use of fire on upper Cadell River', in M Langton (ed.), *Burning Questions: Emerging Environmental Issues for Indigenous Peoples in Northern Australia*, Centre for Indigenous Natural Cultural Resource Management, Northern Territory University, Darwin, pp. 1–6.
- Yu, S 2000, Ngapa Kunangkul: Living Water, Report on the Aboriginal Cultural Values of Groundwater in the La Grange Sub-Basin, prepared for the Centre for Anthropological Research at The University of Western Australia, for the Water and Rivers Commission, Perth.



